

# Local Hazard Mitigation Planning Workbook



---

*A workbook to assist local communities in developing  
a multi-hazard mitigation plan.*

# Workbook Table of Contents

PLEASE READ THIS FIRST! .....	3
IDENTIFY HAZARDS AND RISKS.....	13
DEFINE GOALS AND OBJECTIVES .....	41
IDENTIFY ALTERNATIVES FOR SOLVING PROBLEMS.....	43
SELECT EVALUATION CRITERIA.....	57
SELECT FEASIBLE MITIGATION STRATEGIES .....	58
PREPARE A DRAFT PLAN.....	59
PREPARE FINAL PLAN .....	62
IMPLEMENT PLAN .....	63
MONITOR AND PERIODICALLY REVISE PLAN.....	66
APPENDIX A - SAMPLE PLAN.....	68
APPENDIX B - DETAILED TECHNIQUES FOR A HAZARD ANALYSIS (OPTIONAL) .....	123
APPENDIX C - PLANNING REQUIREMENTS FOR FLOOD MITIGATION ASSISTANCE (FMA) .....	128
APPENDIX D - INTEGRATING HAZARD MITIGATION INTO COMMUNITY COMPREHENSIVE PLANNING.....	137



# Please Read This First!

## Purpose of this Workbook

- Assist local officials, planners, zoning administrators and consultants in developing local multi-hazard mitigation plans. Since hazard mitigation is inherently a local government function, and since virtually all communities in Michigan are vulnerable to multiple hazards, it is especially important that local jurisdictions undertake and sustain a **multi-hazard mitigation planning effort within their community**.
- Provide a comprehensive process to develop and implement a successful community-wide, on-going multi-hazard mitigation planning program. This applies not only to counties and those municipalities that have their own emergency management program, but also to townships, villages and special purpose districts as well.
- While it is recognized that many communities will plan simply to “qualify” for various project funding sources, there are certainly many other benefits to be derived from a pro-active mitigation planning effort, not the least of which are **protection of the public health and safety, preservation of essential services, prevention of property damage, and preservation of the local economic base**.
- This workbook is not a “cookbook”. It focuses on the **process** of developing local hazard mitigation plans. Since each community is unique in its geographic, social, and economic makeup, a fill-in-the-blank document simply would not work as well as a document that focuses on the plan development process.

## “Why should my community develop a hazard mitigation plan?”

Here is an outline of reasons for creating a local hazard mitigation plan:

To save lives and protect property

To preserve and protect an area’s environment and economy.

To preserve and maintain an area’s quality of life

To provide information to citizens, businesses, and officials (including future emergency managers), for

- Planning
- Economic development
- Project development decisions
- Emergency management awareness and assistance

Political and legal concerns:

- Keeping the infrastructure and economy running as smoothly as possible
- Reducing liability
- Building partnerships and community support
- Saving money

Local control issues:

Project ideas come from thoughtful local input and community consensus, not relatively quick post-disaster decisions by state or federal analysts

Project implementation and funding:

Funding is more likely for projects that

- Are part of an effective plan
- Demonstrate community involvement and support
- Use partnerships

The following real life situations illustrate why it is important for communities to address hazard mitigation planning:

- The Street Department extends or improves streets into the floodplain, while the Planning and Zoning Department is discouraging development there.
- The Public Works Department straightens ditches and lines them with concrete to make them more efficient, while the Parks Department or neighborhood groups are promoting greenways and natural vegetative approaches to bank stabilization.

- The Economic Development Authority is actively promoting development of a new riverfront residential and commercial development in the floodplain, while the Parks Department and Planning and Zoning Department are working “behind the scenes” on the development of a community riverfront park in the same location that would facilitate the establishment of a canoeing and kayaking livery.
- The City Council opts not to participate in the National Flood Insurance Program because it is deemed to be “anti-development,” even though the Emergency Manager warns that many residents and businesses are vulnerable to flooding and will not be covered for any flood-related losses unless the community joins the program.
- The Planning Commission approves the development of high-density residential housing immediately adjacent to a plant that manufactures and stores a poisonous and highly toxic compound used in heavy industrial operations. The Fire Department is aware of this situation, but does not feel it is in a position to advise against the perceived wishes of the community.
- The County Board of Commissioners approves a new large residential development in a rural, woodland area, even though adequate fire protection service is not readily available from the volunteer fire departments in the surrounding areas.
- A community beautification program results in the planting of several hundred new trees in public places throughout the city. However, it is later determined that the species of tree planted is highly susceptible to ice, snow and wind damage, and therefore may contribute to future disaster debris problems.

A good community hazard mitigation planning effort could have addressed most (if not all) of these problems so that, if nothing else, the involved parties would have been aware of the potential ramifications associated with their actions. Obviously, that does not guarantee that the actions taken would contribute to a lessening of community hazard vulnerability. However, the planning effort would have increased the likelihood that all involved parties would have been aware of (and hopefully sensitive to) each other’s position as illustrated in the above example situations. (If that kind of cooperation and coordinated decision-making could be achieved on a wide scale at the local level, it would be a huge step forward in reducing hazard vulnerability within the State of Michigan).

Planning can help build that level of coordination and cooperation within a community. The objective of hazard mitigation planning is to produce an environment that results in the coordination of activities that will not only reduce a community’s level of hazard vulnerability, but also meet other community needs as well. In fact, one of the true benefits of mitigation planning is that vulnerability reduction can be achieved, in conjunction with other community goals and objectives, at little or no additional cost to the community. This “multi-objective” approach (which is certainly not unique to hazard mitigation planning) can greatly increase the likelihood of success and sustainability of the hazard mitigation planning effort within the community.

Mitigation opportunities are available both prior to and following disasters. While the post-disaster period presents a ready window for achieving mitigation objectives, pre-disaster mitigation planning assures that:

- Opportunities are not lost in the hasty effort to rebuild and recover from the disaster. There are fewer constraints on time and resources to develop a hazard mitigation plan prior to a disaster. After a disaster, the demands on systems and people are far greater.
- Public involvement occurs prior to a disaster, alleviating controversial issues that often arise after a disaster.
- A community can capitalize on mitigation opportunities after a disaster, rather than missing them while developing the required plan.
- The Hazard Mitigation Grant Program, which is used to fund mitigation measures identified within the plan, can be used in a more timely manner as eligible activities are already identified.
- An existing mitigation plan may only need to be updated to address the current disaster situation to satisfy FEMA requirements.

## **“Why plan for multiple hazards?”**

This workbook is designed to assist local jurisdictions in developing a simple multi-hazard mitigation plan for their community. It is important for communities to plan for all types of hazards to which they are vulnerable - especially since hazards do not neatly follow jurisdictional or funding lines. It is simply not good public policy to plan for mitigating only a single hazard, when in reality all Michigan communities are vulnerable to a multiplicity of hazards. For that reason, mitigation planning is best approached from a comprehensive, multi-hazard perspective. This workbook supports that effort by providing information, guidance and a sample planning format that can address a variety of common hazards in Michigan. The planning format is very similar to that used in the development of the Michigan Hazard Mitigation Plan, which outlines and guides state-level hazard mitigation efforts.

## **“What are the planning options?”**

By using this workbook, a community can develop a “stand-alone” mitigation plan, or it can opt to integrate the resulting mitigation planning strategies into the larger community Comprehensive (Master, General Development, Land Use, etc.) Plan that is in place in most counties and many local municipalities. Both planning options can result in an effective reduction in community vulnerability, if properly developed and diligently implemented. However, integrating mitigation concepts and strategies into the Comprehensive Plan will, in the long run, result in a greater and more permanent “institutionalization” of hazard mitigation concepts into the community’s development processes, practices and pattern. Comprehensive Plans address many aspects of the community’s physical, social and economic environment. As a result, the opportunities for effectuating desirable change and improvement to the community’s development pattern and community support systems is greatly enhanced. In other words, mitigation can “touch” (influence) every future decision made in these important areas. In addition, since development control and guidance mechanisms such as zoning and capital improvements planning are predicated, to some degree, by the community’s intended or desired development pattern (as articulated in the Comprehensive Plan), mitigation strategies, concepts and initiatives stand a much greater chance of being considered for implementation if they are part of the larger community Comprehensive Plan. For that reason, it is recommended that hazard mitigation planning be undertaken as an integral component of the community’s overall comprehensive planning efforts. However, this workbook will support whichever planning method a community chooses.

## **“What about public involvement?”**

Since hazard mitigation benefits the entire community, it pays to get as many citizens as possible involved in planning, designing and implementing hazard mitigation strategies. Public involvement builds support and insures a strong constituency base or future mitigation activities.

The value of public involvement lies in sharing responsibility with those who will strongly influence the success or failure of the mitigation effort. Involving a broad cross-section of interested individuals and organizations is a way of collecting good ideas and suggestions and ensuring that the community will view hazard mitigation as relevant to their needs. Furthermore, strength in numbers will increase the chances for lasting accomplishments.

### Understand Your Public

Take some time to lay out a plan for urging local citizens to participate in the process. To effectively use people’s time, skills and available resources, ask these questions:

#### **Who is the public?**

Identify the interest groups who should be involved in the mitigation effort. Landowners, conservation groups, civic clubs, youth groups and schools? Which agencies should be involved? Are there groups outside the community who may have an interest? Once you identify these groups, ask them to help identify others not included.

#### **What do you want from the public?**

Do you need technical expertise or information? Public opinions or attitudes about the community’s level of hazard risk? How many volunteers? When, and for how long?

**What will you give to the public?**

Will you give them a real voice in the developing and implementing the plan? Will they have the power to advise and make suggestions? What responsibilities and duties will you ask them to perform? Will participation be open to all people or are there criteria?

**How much do you want to involve the public?**

Are there particular roles for participants, such as advisory, decision-making, review, approval? How much power will these participants have? How much public involvement is right? How will you balance the roles of professionals versus the public?

**When is public involvement appropriate or most effective?**

At what stages or during what events will public involvement be most effective? Any elections, festivals or holidays which tie in with a meeting or the release of a report?

### Choose Your Techniques

Computer professionals have a term for the usefulness of poor, incomplete or inaccurate information: "G.I.G.O"--- "Garbage In, Garbage Out." The most well-intentioned community efforts can be needlessly hampered or derailed by the lack of complete, relevant and timely information. Just remember, the type of information you receive is no more important than who you receive it from.

Review the techniques discussed below, decide what combination most appropriately fits your effort and implement those techniques with a well-planned education and consensus building strategy to maximize results.

**Advisory Committees:**

An excellent way to involve citizens in the mitigation plan development and implementation processes. Membership should be broad-based, including people directly affected and those with a more general interest. You can use either an open-ended or selective appointment process, but make sure all meetings are public and well announced.

The primary functions of an advisory committee are:

- To provide direction to professionals by assisting in decision-making.
- To inform the general public about progress being made.
- To lend their skills to the effort, whether it is technical expertise, political support, financial assistance, etc.

Do not try to avoid controversy when appointing the members. A wide range of interests, expertise and viewpoints is essential for a credible and effective committee. Involve opponents early in the process to address their concerns, demonstrate your good faith, and invite them to be partners rather than opponents.

**Meetings:**

Like the colonial town hall meetings from which the ideals of American democracy evolved, meetings will be a rallying point and a central focus for the guts of your mitigation planning effort. Meetings are a simple and effective way to get people together and they serve a variety of purposes, including:

- Conveying information
- Reporting results
- Demonstrating causes and views
- Helping people to make decisions
- Sharing and developing ideas

Meetings take many forms. Public hearings, workshops, forums and committee meetings all have different purposes and formats. Small, informal meetings are good for collecting "qualitative" information such as opinions, attitudes and complaints. A large workshop or nominal group session is useful for identifying specific goals and issues and exploring in depth the possible actions to address them. By developing a simple agenda, with clear goals and objectives, your meeting will be much more fruitful and effective.

**Surveys:**

Very effective tools. Not only do you collect valuable information, but you establish rapport and foster involvement among citizens. And surveys can be customized to extract varying levels of data from a wide assortment of publics: property owners, environmentalists, property rights advocates, and recreation boosters. Best of all, you can reach people who never show up for meetings, but are willing to fill out a form.

To design an effective survey form, follow these guidelines:

- A representative, unbiased sample (community-wide or a particular group) is needed for credible results. Tax rolls are a reliable address source. People directly affected by various hazards will have the most interest in the survey.
- Keep the questions clear, understandable and free of jargon or technical language. Write the questions in a conversational, neighborly fashion and be sure to avoid leading or suggestive language.
- Pre-test your questions to satisfy the above criteria. Revise them if necessary.
- Design your survey for easy tabulation and analysis. Access to a computer is important. Access to someone who can analyze the data is even more important.
- Ask survey respondents if they would like a copy of the results, summarized in a brief fact sheet report. The questionnaire could also help develop a mailing list for a newsletter or other important communications. Remember, a survey is only representative of the community or group if it is a true random sample. If this is not possible, the information can still be useful and informative and an excellent way to keep people involved and connected to the project.

**Personal Interviews:**

In some circumstances, a personal interview is much more effective than a telephone or mail questionnaire. You have the opportunity to ask more intuitive follow-up questions, customize the interview to each subject's personality, go into more detail on specific issues, provide more information and do a more effective job of "selling" the plan to skeptical interviewees. The down side is the time and staff needed to do personal interviews. You may want to concentrate on community leaders and other authorities.

**Mass Media:**

A major mitigation planning effort will be a big story in most communities, so the reporters will likely seek out those involved for facts, quotes and pictures. But it still pays to be proactive when dealing with the media. If not, they may first call when someone complains about a proposed initiative, feeds them false or misleading information and plants the first seeds of doubt as to the usefulness or wisdom of developing the plan in the first place.

Get your side of the story to the media first: give them the facts, the benefits of doing the plan, a list of prominent supporters, examples of other successful mitigation initiatives and who they can contact for information on them, how it will be financed, who's involved and what their roles are, and a list of reasons why the community should support the effort.

Get acquainted with the "beat" reporters who cover the environment, local government, business/financial news and real estate. Keep in regular contact with them, offering information, story ideas, photo opportunities, etc. Provide news releases for important events and meetings. You may be misquoted or incorrect information may be published. Don't blame the reporter and don't clam up for fear of being misquoted again. Provide the correct information and keep the lines of communication open.

**Newsletters:**

A newsletter can serve many purposes: providing detailed information about the current status of the planning effort, laying out proposals for future initiatives, building support, providing a citizen's forum, providing articles about mitigation efforts in other communities, etc.

Keep technical information and jargon to a minimum; your goal is to build rapport with people in the community. Write in a conversational, informal style, much as you would for a church or civic club newsletter. Use plenty of photos, illustrations, cartoon, white space and other graphic enhancements. Above all, keep it short and to the point; people have many other reading options. Your goal is to get them to spend just a few minutes reading your newsletter.

## Checklist: Public Involvement Techniques

- Meetings
- Advisory committees
- Surveys
- Letters to the editor
- Newsletters
- School program
- Interviews
- Media coverage
- Public service announcement
- Posters and flyers
- Stationery

### Writing a News Release

A good news release should give the most important information about your effort in short, readable sentences. Emphasize the benefits to the community and the affected residents. Don't be afraid to advocate for the planning effort or drop names; well-known civic leaders and public officials who support the effort are good bets for getting coverage.

- Keep the release under two pages—one is better.
- Put contact name, address and phone number in the upper left-hand corner.
- Place "For Immediate Release" or date of future release in upper right above headline.
- Type double space with side margins and end each page with a complete paragraph.
- Include your own headline to get the editor's attention and provide your own emphasis.
- Design a release letterhead to attract attention. Your news will have competition on the editor's desk.

### **Organization of the Workbook**

Although this workbook is organized as a "flexible framework" to fit the needs of different communities, a recommended, systematic planning process has been outlined. In summary, a hazard mitigation plan is a written explanation of how a community will reduce or eliminate harm caused by hazards. Hazard mitigation plans propose specific actions a community will use to reduce harm from hazards. Proposed actions are based on good information and community involvement. Creating a plan therefore involves a research process, and a political process. These processes involve many overlapping steps, and this workbook will summarize each of the steps that make up the overall planning process.

The research process will be called HAZARD ANALYSIS and will:

- Identify persons, property, and important features in an area
- Identify hazards affecting an area
- Identify the extent of risk to vulnerable areas from identified hazards

The political process will be called MITIGATION PLANNING and will

- Identify goals and objectives for Emergency Management Programs
- Suggest strategies to achieve mitigation goals and objectives
- Evaluate strategies using locally chosen criteria
- Select feasible strategies based on evaluation criteria
- Propose specific action steps that will achieve desired objectives
- Prepare the plan
- Implement the plan
- Monitor the plan

Several appendices are included to provide detailed information and examples. A suggested plan format is outlined in Appendix A. Appendix B contains detailed techniques for a local hazard analysis. Appendix C contains information on planning for the Flood Mitigation Assistance Program. Appendix D discusses how to integrate hazard mitigation planning and community comprehensive planning.

Here are the steps which this instructional booklet recommends to create a functional hazard mitigation plan for your community.

- STEP 1: Identify hazards and risks
- STEP 1a: Develop a community profile
- STEP 1b: Identify hazards that affect the community
- STEP 1c: Estimate risks from hazards
- STEP 1d: Assess vulnerabilities and establish mitigation priorities based on them
- STEP 2: Define community goals and objectives
- STEP 3: Identify alternatives for solving problems
- STEP 4: Select criteria to evaluate alternatives
- STEP 5: Select feasible mitigation strategies
- STEP 6: Prepare a draft plan and get community feedback
- STEP 7: Revise draft plan and adopt a final plan
- STEP 8: Implement the adopted hazard mitigation plan
- STEP 9: Monitor plan implementation and effectiveness, and periodically revise plan

Each of these steps has a separate section describing it in this booklet. In many cases, there are tasks that help to accomplish more than one of these steps at a time. As one step is completed, it is common that part of the work needed to accomplish the next step will already have been accomplished. Breaking the entire mitigation planning process into steps like this has merely been done to make the process easier to learn about and complete.

**Questions?? Comments??**

**Don't hesitate to call us!**



If you need further information, consultation, or wish to offer comments, please contact the Michigan State Police, Emergency Management Division at (517) 336-6198.

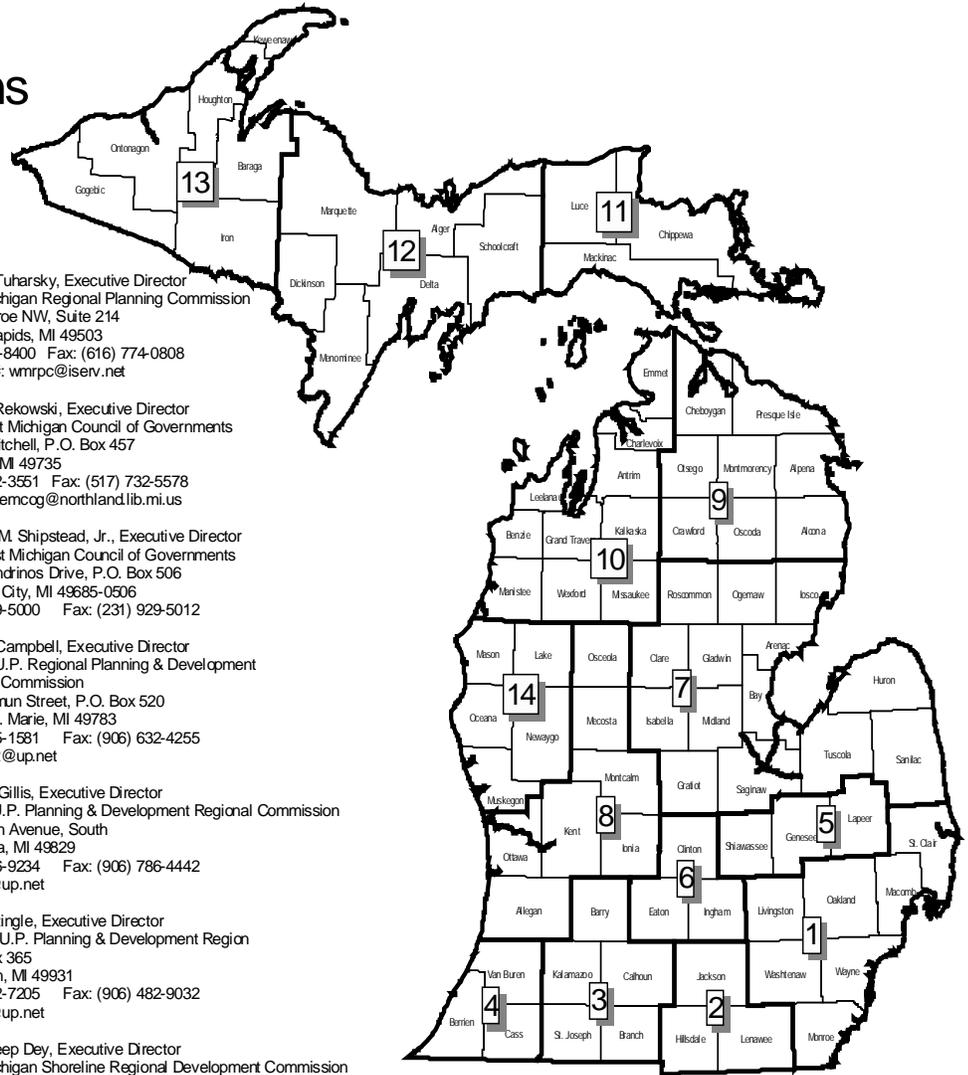


## ADDITIONAL PLANNING RESOURCES

Below is some contact information for the State's Regional Planning Offices. These organizations can be of great assistance in providing data, local contact information, and technical assistance with planning. For communities with the desire and ability to contract out for planning services, these organizations may be able to provide valuable planning services. (See also Appendix D, on integrating hazard mitigation planning into community comprehensive planning.)

### State Planning and Development Regions

1. Paul Tait, Executive Director  
Southeast Michigan Council of Governments  
660 Plaza Drive, Suite 1900  
Detroit, MI 48226  
(313)961-4266 Fax: (313)961-4869  
E-MAIL #: [tait@semcog.org](mailto:tait@semcog.org)
2. Charles Reisdorf, Executive Director  
Region 2 Planning Commission  
Jackson County Tower Building  
120 W. Michigan Avenue  
Jackson, MI 49201  
(517)788-4426 Fax: (517)788-4635  
[creisdorf@region2planning.com](mailto:creisdorf@region2planning.com)
3. Rand Bowman, Executive Director  
Southcentral Michigan Planning Council  
P.O. Box 2137  
Portage, MI 49081-2137  
(616)323-0045 Fax: (616) 323-1544  
[smpc@net-link.net](mailto:smpc@net-link.net)
4. Judy Lammers, Executive Director  
Southwestern Michigan Commission  
185 E. Main Street, Suite 701  
Benton Harbor, MI 49022-4440  
(616) 925-1137 Fax: (616) 925-0288  
[swmicomm@cquinc.net](mailto:swmicomm@cquinc.net)
5. Chapin W. Cook, Fiscal Officer  
Genesee Planning Commission  
1101 Beach Street, Suite 223  
Flint, MI 48502  
(810) 257-3010 Fax: (810) 257-3185  
[gcpcadmin@attmail.com](mailto:gcpcadmin@attmail.com)
6. Jon Coleman, Executive Director  
Tri-County Regional Planning Commission  
913 W. Holmes Road, Suite 201  
Lansing, MI 48502  
(517) 393-0342 Fax: (517) 393-4424  
E-MAIL #: [TCRPC@acd.net](mailto:TCRPC@acd.net)
7. Sue Fortune, Executive Director  
East Central Michigan Planning & Development  
Region  
3535 State Street  
Saginaw, MI 48602-3261  
(517) 752-0100 Fax: (517) 752-1180
8. Joyce Tuharsky, Executive Director  
West Michigan Regional Planning Commission  
820 Monroe NW, Suite 214  
Grand Rapids, MI 49503  
(616)774-8400 Fax: (616) 774-0808  
E-MAIL #: [wmrpc@iserv.net](mailto:wmrpc@iserv.net)
9. Diane Rekowski, Executive Director  
Northeast Michigan Council of Governments  
121 E. Mitchell, P.O. Box 457  
Gaylord, MI 49735  
(517) 732-3551 Fax: (517) 732-5578  
[e-mail#:nemcog@northlandlib.mi.us](mailto:e-mail#:nemcog@northlandlib.mi.us)
10. Alton M. Shipstead, Jr., Executive Director  
Northwest Michigan Council of Governments  
2700 Dendros Drive, P.O. Box 506  
Traverse City, MI 49685-0506  
(231) 929-5000 Fax: (231) 929-5012
11. John Campbell, Executive Director  
Eastern U.P. Regional Planning & Development  
Regional Commission  
524 Ashmun Street, P.O. Box 520  
Sault Ste. Marie, MI 49783  
(906) 635-1581 Fax: (906) 632-4255  
[eurpdc2@up.net](mailto:eurpdc2@up.net)
12. Dave Gillis, Executive Director  
Central U.P. Planning & Development Regional Commission  
2415 14th Avenue, South  
Escanaba, MI 49829  
(906) 786-9234 Fax: (906) 786-4442  
[cuppad@up.net](mailto:cuppad@up.net)
13. Jim Stingle, Executive Director  
Western U.P. Planning & Development Region  
P. O. Box 365  
Houghton, MI 49931  
(906) 482-7205 Fax: (906) 482-9032  
[wupdr@up.net](mailto:wupdr@up.net)
14. Sandeep Dey, Executive Director  
West Michigan Shoreline Regional Development Commission  
137 Muskegon Mall, P.O. Box 387  
Muskegon, MI 49443-0387  
(616) 722-7878 Fax: (616) 722-9362  
E-MAIL #: [sdey@wmsrdc.org](mailto:sdey@wmsrdc.org)



Produced By: Tri-County Regional Planning Commission

## Acknowledgements

This workbook contains a combination of new and previously developed material. Much guidance, and the sample plan format, was taken from EMD Publication 905, *Hazard Mitigation Grant Program (HMGP) Applicant Workbook*. That document was first published in 1992 to provide guidance to state agencies and local governments on how to plan for, apply for and manage HMGP funds subsequent to a presidential disaster declaration. Post-disaster mitigation planning within the declared area is required as a condition of receiving Federal disaster assistance funds. Because of that requirement, and because it is good public policy to reduce the impacts and costs of disasters and emergencies through a coordinated planning effort, planning guidance was included in the EMD 905 document. That document, and the planning guidance contained within, has been updated annually.

A considerable amount of information has also been derived from two FEMA publications: - DAP 12, *Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments*, (1992 edition); and *The National Flood Insurance Program/Community Rating System Example Plans*, (July 1996 edition). Both documents contain a wealth of mitigation planning guidance, some of which was summarized and included in this document. Users of this guidance document may also wish to review the two FEMA publications for additional background information on hazard mitigation planning concepts, techniques and formats.

The Illinois Emergency Management Agency's *Model Hazard Mitigation Plan Workbook* (August 1996 edition) and the Wisconsin Department of Natural Resource's *Community Flood Mitigation Planning Guidebook* (November 1995 edition) also provided background information and format guidance that were edited for use in this document.

The original edition of this workbook (dated March 1999) included references to the amendment to EMD Publication 201, titled *Hazard Analysis Guidance Tool for Michigan Communities*. For this newly-revised version, such references have been replaced with re-edited versions of the pertinent material from that document. This was done to place the most important planning materials into this single book and make the guidance materials easier to use. The revised version of this book also includes newly-researched information that originally appeared in the instructional materials for EMD's course entitled "Plan Writing Workshop."

Finally, several elements of the plan format used in the *Michigan Hazard Mitigation Plan* were included in the sample plan format in this document. That is important because it will help to promote consistency between the State's hazard mitigation plan (which addresses statewide mitigation issues) and local hazard mitigation plans (which address jurisdiction or region-specific issues).

Special thanks must also go to the Michigan Department of Environmental Quality, Land and Water Management Division for their assistance in reviewing the draft document. Their comments and suggestions helped to produce a document that is concise, readable and easy to use.

# The Hazard Mitigation Planning Process

---



**Step 1: Identify hazards and risks**

Includes four sub-steps:

- a. The Community Profile
- b. Hazard Identification
- c. Risk Assessment
- d. Vulnerability Assessment

**Step 2: Define goals and objectives**

**Step 3: Identify alternatives for solving problems**

**Step 4: Select evaluation criteria**

**Step 5: Select feasible mitigation strategies**

**Step 6: Prepare a draft plan**

**Step 7: Prepare final plan**

**Step 8: Implement plan**

**Step 9: Monitor and periodically revise plan**

# Step 1

## Identify Hazards and Risks

---

### Overview:

---

---

This chapter focuses on the beginning stage of the hazard mitigation planning process. Your community has recognized that it is potentially vulnerable to a wide range of hazards and now needs to identify precisely what its problems are. This involves creating a hazard analysis.

### “Is a hazard analysis necessary?”

Yes—the hazard analysis will help you to understand what your community's problems are and which ones most urgently need to be addressed by mitigation actions. Even if you feel you know these things already, your knowledge should be written into a document that others can learn from.

The hazard analysis is the foundation upon which all emergency planning efforts in the community are built. In fact, preparing a good hazard analysis and community profile is the first step that the community's emergency planning team should take in building an effective emergency management program. A hazard analysis provides an understanding of the potential threats facing the community. By pinpointing the location, extent and magnitude of past disasters or emergency situations, and by examining knowledge of new or emerging risks, it is possible to determine the probability of such events occurring and the vulnerability of people and property. By viewing this information along with relevant land use, economic, and demographic information from a well prepared “community profile,” Emergency Managers can make assumptions about those segments of the community that might be impacted by various types of incidents. This, in turn, allows them to set priorities and goals for resource allocation and response, recovery, and mitigation activities prior to an incident occurring. Collectively, these decisions are the cornerstone of the community's emergency management program, and should guide all decisions pertaining to community emergency management activities.

In other words, by putting into written form the collected information that you and others in your community have about local hazards, you will help spread an awareness of what needs to be done, and why. This information will shape the rest of the planning process. As others read the hazard analysis, many of them will agree that actions should be undertaken, and some of them will be motivated to promote local hazard awareness, lobby for political support, find funding sources for mitigation projects and programs, or even get personally involved in mitigation activities.

### Suggested steps for developing a community hazard analysis.

The process of creating a good hazard analysis will be broken down into four substeps in this workbook. These will be called (a) the community profile, (b) hazard identification, (c) risk assessment, and (d) vulnerability assessment, and all fall under "step 1" of the overall mitigation planning process. Separate sections (numbered as steps 1a through 1d) are now included in this workbook to more clearly describe each of the hazard analysis substeps.

#### Where are we now?



**Step 1: Identify hazards and risks**

**Step 2: Define goals and objectives**

**Step 3: Identify alternatives for solving problems**

**Step 4: Select evaluation criteria**

**Step 5: Select feasible mitigation strategies**

**Step 6: Prepare a draft plan**

**Step 7: Prepare final plan**

**Step 8: Implement plan**

**Step 9: Monitor and periodically revise plan**

### **Step 1a – Community Profile**

The first substep - the development of a **community profile** - is accomplished by identifying (and mapping, where appropriate) information that is relevant to hazard mitigation, such as the community's present land use and development patterns, geography and climate, transportation network, demographic information, key industries, the major organizations active in the community, the locations and nature of important community facilities, and other information that is relevant to the community's safety and smooth functioning.

### **Step 1b – Hazard Identification**

The second substep involves the **identification** of those hazards to which the community is susceptible. To do this, the community should review the Michigan Hazard Analysis (EMD Publication 103) and investigate local information sources to determine if the community has experienced (or may be susceptible to) specific hazards. The Michigan Hazard Analysis provides a good start in the investigation, but it has a broad, statewide perspective. Local information sources are critically important because they provide information on those events that may not have been widespread or severe enough to be listed in the Michigan Hazard Analysis, but nonetheless had a significant impact on the community. Communities can also add those locally-specific hazards not described in the Michigan Hazard Analysis. In this substep, experienced emergency managers can share their knowledge of local hazards so as to benefit others who do not have this knowledge.

### **Step 1c – Risk Assessment**

The third substep, **Risk Assessment**, involves the examination of the community's hazards using measures that evaluate such factors as exposure, frequency of events, scope of impact, etc. Through this evaluation process, hazards are identified in detail and a community's overall risk from those hazards is assessed and mapped. Considering hazard-specific "worst-case" disaster scenarios may help to determine what critical issues the community may face—life safety, public health, loss of critical functions, economic impacts, and short/long term recovery issues.

### **Step 1d – Vulnerability Assessment**

The fourth substep is the determination of the community's **vulnerability** to the hazards that were identified and assessed in steps 1b and 1c. Since a good community profile has mapped out the locations of the community's people and important facilities, and a good risk assessment has mapped out its hazards, a **vulnerability assessment** can ensue by comparing areas where the hazards overlap with people and important facilities.

REMINDER: These "substeps" are described for instructional purposes, to make it easier for you to understand and complete the essential elements of a good hazard analysis. As you will see in your own research process, there are many areas where one step overlaps with another—this is a normal part of the analysis and there should be no concern that the analysis will be weakened if some information seems to be collected in a different order than what is suggested here. It is common that new information, once taken into account in the full hazard analysis, will cause some of your initial research to be revised. The result will be a useful and valid analysis that has adapted itself to changing conditions and new information.

(Note: To meet various FEMA funding eligibility requirements for flood mitigation assistance, the analysis should also include:

1. A description of the extent of flood depth and damage potential.
2. An estimate of the types and number of structures at risk.
3. The fair market value of the structures at risk, if available.
4. An additional map or overlay of repetitive loss properties and some discussion of potential mitigation activities for these structures.

See Appendix C for further information on FEMA requirements for flood mitigation planning.)

*Once completed, the hazard analysis should be provided to local officials for review and feedback. A copy should also be provided to the Michigan State Police Emergency Management Division to support its planning, funding, and mitigation efforts throughout the state.*

## STEP 1a: THE COMMUNITY PROFILE

The community profile should be able to introduce your community to strangers who may be completely unfamiliar with it. These may include:

- Emergency workers from FEMA or the State
- New residents (or new local officials)
- New businesses considering whether to move into the community

The Community Profile section of the hazard analysis will give summary information on general features of the community, plus specific information that is pertinent to emergency management. Much of this information may have already been prepared by other community agencies, such as the planning department, chamber of commerce, economic development authority, aging office, community college or university, school district, etc. In many cases, it may only be necessary to find existing documents or web sites and use those portions of them that relate to emergency management in your community profile. Finding it is the key, and doing so will not only help complete the job faster, but also generate support and “buy-in” for the end product from those agencies assisting in the information gathering.

All these can be used to get information:

- People
- Books
- Documents
- Plans
- Maps
- Studies
- Internet
- Planning Offices (Local, County, and Regional)
- County Agencies (Road Commissioners, Drain Commissioners)
- Watershed Councils
- LEPCs
- NFIP flood maps (FIRMs)
- Studies by the U. S. Army Corps of Engineers

The following list should be reviewed as a memory aid or "idea list" for the types of information that may be useful to include in the community profile section:

---

### Historical Overview

- Year of establishment/incorporation
- “Reason for being” (i.e., why was community established?)
- Notable historical events (i.e. what has shaped the area? Why has it grown or changed over time?)
- Notable community citizens, businesses, organizations, economic activities
- Other information that gives a sense of the nature of the community

### Geography and Climate

- Physical location of community in State of Michigan (including its proximity to surrounding major cities, regions, etc.)
- A map of communities in the county or sectors in the city, with information on each jurisdictions office locations and contact persons
- Background information on landforms, soils, forest cover, environmentally-sensitive areas, and other geographical features
- Overview of weather patterns, to include average monthly temperatures, precipitation (rain and snowfall), winds (directions and speeds), and major climatic influences (i.e., Great Lakes)
- Other information that gives a sense of the geographical/climatic conditions of the community

### Land Use Patterns

- Major land uses in the community (present)
- Anticipated/planned major land uses (future)
- Known hazardous areas in community – brownfields, blight, pollution, floodplains, etc.
- General development pattern (i.e., along major transportation links/nodes, “sprawl”, clustered around geographic feature such as a lake, etc.)
- General types/condition of housing stock (including trailers, manufactured home parks)

- Other special residential conditions or considerations (sheltering areas, dormitories, prisons, health or psychiatric institutions, group quarters, areas with homeless persons, etc.), including isolated populations (rural without cars, phones, etc.) and areas with special needs populations (non-English speaking, poor, disabled, elderly communities).
- Types of public infrastructure, its general condition and capacity (sewer, water, power, roads, etc.)
- Areas of major land use conflict (i.e., heavy industrial adjacent to high-density residential)
- Current or proposed historic districts within the community
- Current mitigation efforts to lessen the community's vulnerability to hazards (inc. warning systems)
- Other information that gives a sense of the land use patterns (present and future) of the community

#### Transportation Network

- Interstate highways, state trunklines, major local connectors serving community
- General condition of roads, bridges, and other elements of the transportation infrastructure
- Freight rail lines, airports, marine ports, passenger rail service, bus services, public transit located in or serving the community
- Handicapper-accessible transportation available in community.
- Other information that gives a sense of the transportation network in place in the community (capacity for mass evacuation, traffic counts, high-accident intersections, etc.)

#### Population Characteristics

- Patterns and trends of population growth and migration
- Total current and future projected population of the community and surrounding region
- Age/sex/racial breakdown of the population
- Percent of population that is non-English speaking
- Special-needs populations within community (elderly, children, disabled, etc.)
- Seasonal population fluctuations (campgrounds, resorts, etc.)
- Other information that gives a sense of the population characteristics of the community

#### Economic Characteristics

- Total current and projected future economic activity with the community
- Major employers/employment sectors within the community (and region, if appropriate)
- Percent of population unemployed, on public assistance, and/or in poverty
- Identification of areas with blight, concentrated poverty, renaissance zones, or empowerment zones.
- Community tax revenue and sources (i.e., business tax, sales tax, property tax, income tax, etc.)
- Median household income in different areas
- Other information that gives a sense of the economic characteristics of the community

#### Key Community Facilities/Organizations

- Description of major community services provided (i.e., police, fire, EMS, hospitals, public works, planning/zoning, health, waste management, water/sewer, schools, etc.), and the locations from which those services operate
- Description of electric, gas, telephone and other critical utility services provided (i.e., service areas, capacity, population served, etc.)
- Description of key private and/or private-non-profit organizations operating in the community (i.e., Red Cross, Salvation Army and other active churches, United Way, Senior Services, recreation centers, community foundations, etc.), and the locations from which those organizations operate
- Description and locations of institutions of higher learning (colleges, universities, major trade schools, academies, etc.), and their impact on the community
- Other information that gives a sense of the key facilities and organizations (public, private, and private-non-profit) operating in the community

#### Other Information?

- Major activities or events that occur on a regular basis (i.e., festivals, entertainment shows, demonstrations or other gatherings, business/trade events, etc.) that could in some way impact the community's vulnerability to hazards
- Patterns and trends of serious crime/civil disturbance within the community
- Historical "trends" in the community (i.e., strong environmental orientation, strong support of historic preservation, etc.) that could, in some way, impact community vulnerability to hazards
- Etc.

Community profile information should be recorded on a map or maps to show where the community's people, property, and other resources are located. In substep 1c of the hazard analysis, a map of a community's hazards will be made, and a comparison of where hazards seem to overlap with people and property on the community profile map will suggest areas of vulnerability (substep 1d), where mitigation measures may need to be focused and prioritized.

### Where to Find Information for Community Profiles

The internet contains many web sites that are extremely useful information sources. If your jurisdiction is a county, <http://www.miaco.org/counties.html> provides information on each county in Michigan, and links to web pages produced by the counties. Detailed information with which to create a hazard analysis can sometimes be found a county's web page, or more generally, can be obtained at <http://medc.michigan.org/miinfo/places/> and <http://www.state.mi.us/dmb/mic/>. Information that needs to be found for sectors within a county, or individual municipalities can be researched at the Michigan Municipal League at <http://www.mml.org/>, the Michigan Townships Association at <http://www.mta-townships.org/>, the U.S. Census Bureau at <http://factfinder.census.gov/servlet/BasicFactsServlet> and <http://venus.census.gov/cdrom/lookup>. Those whose communities are located in Southeastern Michigan can benefit from the Southeast Michigan Council of Governments (SEMCOG) web site at <http://www.semco.org/index.html>. Specific economic information for counties can be found by using County Business Patterns data available at <http://www.census.gov/epcd/cbp/view/cbpview.html>. Other information may be available at <http://www.fedstats.gov/>.

Most of this information can also be found at research libraries throughout the state. Information should not merely be copied blindly – that would merely overload your analysis and make the resulting document harder for readers to understand and use. Instead, focus on information that is pertinent to emergency management in some way, and include it in your document in an organized manner with some explanation of how it is useful. Local sources of information (local directories, phone book listings, local officials, etc.) are very important to ensure that your document is customized and useful on the local level.

Much vital information about the locations of schools, fire departments, other critical facilities, government offices, warning sirens, and so on, can only be obtained through these local sources. Contact with local officials, local or regional planning offices, Local Emergency Planning Committees (LEPCs), conservation groups, chambers of commerce, among many others, will often reveal that much needed information has already been researched and is present in existing documents. Information on land use, traffic, people, businesses, and the environment is most easily obtained if local, county, or regional planners (or their documents) can be found. In some cases, historic structures may be identified as being at risk, and local historic preservation bodies can be gained as partners for the hazard mitigation process. For registered historic sites in Michigan, refer to <http://www.sos.state.mi.us/history/preserve/michsite/index.html>.

Many people may feel that producing and using maps in the analysis will be too difficult, if their office does not have capacity for or familiarity in using Geographic Information Systems or other map-producing software. No such requirement is intended here. A simple photocopied map with hand-drawn markings on it can serve quite well for hazard analysis purposes, so long as locations are identified accurately on it. In many cases, however, excellent and useful maps can be found or produced on internet sites. In some cases, these sites will produce customized maps that identify hazard-specific areas of concern in your community. The Project Impact site is one useful site for this, at <http://www.esri.com/hazards/makemap.html>. Other useful mapping sites are at:

The Department of Transportation: <http://www.mdot.state.mi.us/maps/trafficmaps/>

The Census Bureau: <http://tiger.census.gov/cgi-bin/mapbrowse-tbl>

Topozone (highly recommended!): <http://www.topozone.com>

U.S. Geological Survey: <http://mapping.usgs.gov>

For those who do have GIS capabilities available to them (in their office or through coordination with another office), there are many excellent resources available at the MDEQ web site at [http://www.deq.state.mi.us/lwm/water\\_mgmt/gis/](http://www.deq.state.mi.us/lwm/water_mgmt/gis/). Those in Southeast Michigan can also find information at the SEMCOG web site at <http://www.semco.org/index.html>. Maps needed to interpret census data can be found at the American Factfinder page at <http://factfinder.census.gov/servlet/BasicFactsServlet>.

### Analyzing Large or Diverse Areas Using Sectoring

Some communities may wish to consider “sectoring” in their hazard analysis process. Sectoring involves dividing the community into sub-parts for the purpose of developing a more detailed, targeted hazard analysis. Sectors can be developed around existing geo-political boundaries (i.e., by township, around natural geographic features such as rivers, etc.), or they may be artificially-created (i.e., dividing the community into halves or quadrants). Sectoring may be needed for very large areas in which maps and studies of the entire area will not provide enough detail to allow an analysis. Sectoring is also beneficial when there are differences in hazard threats in different parts of a community. For example, if a small portion of a community is particularly vulnerable to riverine flooding, it makes sense to analyze that particular part of the community in greater detail, separately from the rest. Also, if day vs. night populations are radically different in parts of a community (i.e., a downtown area that is heavily populated during working hours, but lightly populated at night), it may make sense to sector that particular area and include analyses for both day and night situations in your document.

### Use of Pre-Formatted Worksheets for Hazard Analysis

You may find it easier to begin a hazard analysis by filling in a pre-formatted outline about the features in your community and/or sectors within your community. The worksheets on the following pages are provided as an example of a format you can use to develop a profile of your community, and one or more sectors within it. As an example, it is designed to be convenient to use, but is much less detailed and comprehensive than you may need to assess your community. Use it as a starting point, and feel free to revise it by adding new information or removing some, so as to better describe your community. The bullet-style lists on previous pages in this section should be used to provide more ideas about the kind of information that it may be important to add to your community profile. The final goal is to identify all of your communities important infrastructure and facilities, and to note where people and property are located so that you will be able to assess what hazards they may be vulnerable to in a later part of the hazard analysis. (Notice that many elements of the community profile overlap with substep 2, Hazard Identification, because some important features of a community are themselves potential hazards. This means you already have a head start on completing the remaining substeps in the hazard analysis.)



**After reviewing the community profile worksheet example on the following 7 pages, please turn to page 26 to continue reading about the hazard analysis process.**

## Community Profile Worksheet Example – pg. 1

*Record the following information for the community or sector:*

**1. Major geographic features:**

a. **For example:** Grand River and Maple Valley Creek

b. \_\_\_\_\_

c. \_\_\_\_\_

d. \_\_\_\_\_

**2. Population concentrations:**

a. group homes:

**For example:** Evergreen Senior Center, 131 Evergreen Street (750 residents)

b. large apartment buildings:

c. schools:

d. large office buildings:

e. hospitals:

f. other (describe):

## Community Profile Worksheet Example – pg. 2

*Record the following information for the community or sector:*

### 3. Population shifts:

a. daily:  
**For example:** downtown day (7AM – 6PM) – 15,000 people  
downtown night (after 6PM) – 1,250 people

b. weekly:

c. seasonal:

### 4. Essential public and private facilities:

a. police precincts:  
**For example:** 32<sup>nd</sup> Precinct, 1400 Maple Drive  
33<sup>rd</sup> Precinct, 854 West Oak Street

b. fire stations:

c. public works yards:

d. pumping stations:

## Community Profile Worksheet Example – pg. 3

*Record the following information for the community or sector:*

e. community shelters:

f. community medical facilities:

g. other (describe - i.e., government building, record center, etc.):

### **5. Essential public and private resources:**

a. major construction companies:

**For example:** Ace Construction, 2224 East River Road

b. major warehouses:

c. equipment rental facilities:

d. other (describe):

## Community Profile Worksheet Example – pg. 4

Record the following information for the community or sector:

### 6. Known potential hazards:

(Note: If any of the following hazards exist within the area, list the locations and describe.)

a. floodplain/flood-prone areas:

**For example:** Maple Valley Mobile Home Park, 1342 Maple Valley Way  
(295 structures, 922 residents)

b. shoreline flooding and erosion areas:

c. hazardous material sites:

d. hazardous material transportation routes:

1) highways:

2) rail:

3) waterways:

4) pipelines:

## Community Profile Worksheet Example – pg. 5

Record the following information for the community or sector:

**6. Known potential hazards (continued):**

(Note: If any of the following hazards exist within the area, list the locations and describe.)

e. airports:

f. scrap tire warehousing operations:

g. dams:

h. oil and natural gas extraction, storage, and transportation facilities:

i. correctional facilities:

j. urban/wildland interface areas:

## Community Profile Worksheet Example – pg. 6

*Record the following information for the community or sector:*

k. commercial nuclear power plants:

l. underground mines or mine areas (active or abandoned):

m. marine passenger ferry service facilities/passenger rail service facilities:

n. major military base or other active military facility:

o. stadium, racetrack, amusement park, or other large crowd assembly area:

p. other (describe):

## Community Profile Worksheet Example – pg. 7

Record the following information for the community or sector:

### 7. Socio-economic profile of sector:

- a. total population (day): \_\_\_\_\_
- b. total population (night): \_\_\_\_\_
- c. peak population (seasonal): **For example:** summer – 52,000; winter – 28,000 \_\_\_\_\_
- d. percent over 65: \_\_\_\_\_
- e. percent under 18: \_\_\_\_\_
- f. percent below poverty level: \_\_\_\_\_
- g. estimated property insurance coverage: \_\_\_\_\_
- h. estimated flood insurance coverage: \_\_\_\_\_
- i. percent that are homeowners: \_\_\_\_\_

### 8. Warning siren coverage:

- a. siren locations:  
**For example:** Meadowbrook Elementary School; 32<sup>nd</sup> Precinct Police Station

- b. percent of population covered by warning siren:  
**For example:** Day (7AM-6PM): 68%; Night (after 6PM): 52%

(Note: Attach warning siren location/coverage map if available.)

## STEP 1b: HAZARD IDENTIFICATION

### Overview of the Hazards Identification Process

An introduction to the hazards faced by Michigan communities can be obtained in the Michigan Hazard Analysis (EMD Publication 103). That document can be consulted as a first step in the hazards identification process. It is a comprehensive study of the various types of natural, technological, and human-related disasters and emergencies that have confronted the State of Michigan, or have the potential to occur. It provides an overview of the State's vulnerability to various hazards. From that document, it is possible to generally identify possible community hazards and gather information about the community's potential exposure and vulnerability to those hazards.

While that document provides an excellent starting point, it is certainly not all-encompassing. Because the Michigan Hazard Analysis examines hazards from a *statewide* perspective, it focuses on those hazards that have the potential to cause the greatest amount of damage and impact. It does not always examine those "smaller," more localized events that may have occurred (or have the potential to occur) in a single community or even a portion of a community. Such events are critically important to the communities in which they impact, but they may not be of sufficient size or magnitude to warrant being included in the larger statewide document. That being the case, localized sources of information should also be tapped to more accurately determine the nature and scope of a community's hazards. Research can be conducted through local statistics, records, libraries, historical organizations, newspapers, broadcast media, chambers of commerce, insurance companies, private citizens, and other appropriate community entities. These sources should be able to provide more comprehensive insight and information about past disaster events and local hazard areas to determine where (and how frequently) your community is affected.

Be sure to customize the information for local hazard mitigation uses. Avoid repetitive and unnecessary information, but use text, tables, maps as appropriate. Sometimes, there will be gaps in the document that you may need to fill in with your own knowledge or research. Local Emergency Managers should include in their hazard analysis the information they know about their community's capabilities, preparedness, and response to the different sorts of hazards which it may experience. Special political or social conditions that may affect a community's vulnerability can also be explained in the hazard analysis. For example, special events or seasonal population shifts may cause increases and decreases in the number of people needing protection, warning, evacuation, or services during an emergency. Such shifts may require different plans and responses to address these differing levels of need. Shortcomings in a community's capabilities should also be identified as part of an analysis, such as needs for extra equipment, coordination, or training for personnel.

There are numerous internet sites that can provide information on the many hazards that might affect your community. A list of identified hazards in Michigan appears on the following pages, with a brief description of each hazard followed by one or two web sites that can provide more information. Some description like the ones provided below should appear for each hazard in your hazard analysis, so that readers who know nothing about emergency management can be introduced to these threats and better understand the analysis that follows. If your community has identified hazards that are not listed below, it is important that these new hazards be identified and described in your hazard analysis.

A copy of EMD-PUB 103, Michigan Hazard Analysis, can be viewed and downloaded from the State Police Emergency Management Division's web site at

[http://www.msp.state.mi.us/division/emd/Hazann2000/Hazard\\_Analysis\\_2000\\_index.htm](http://www.msp.state.mi.us/division/emd/Hazann2000/Hazard_Analysis_2000_index.htm) .

You can also go directly to the Division's web site at <http://www.mspeemd.org> and look under the heading "Newsletters and Publications" to find the document.

NOTE: Again, there is some overlap here between step 1b (Hazard Identification) and step 1c (Risk Assessment). In the course of identifying which hazards have occurred and could occur in your community, you will already begin to gain a sense of the frequency with which these hazards could cause a problem, the intensity with which they appear, and so on. Don't worry about making a neat division between these substeps of the hazard analysis. In fact, your document will probably be easier to read if, after a community profile (from step 1a), each hazard is identified in its own section, with a definition and introduction that would lead neatly into an assessment of risk and an assessment of the community's vulnerability to this hazard (produced from steps 1b, 1c, and 1d, following).

## Known Hazards in Michigan

### ***Civil Disturbances:***

A public demonstration or gathering (such as a sports event), or a prison uprising, that results in a disruption of essential functions, rioting, looting, arson or other unlawful behavior. Large-scale civil disturbances rarely occur, but when they do they are usually an offshoot or result of one or more of the following events: 1) labor disputes where there is a high degree of animosity between the two dissenting parties; 2) high profile/controversial judicial proceedings; 3) the implementation of controversial laws or other governmental actions; 4) resource shortages caused by a catastrophic event; 5) disagreements between special interest groups over a particular issue or cause; or 6) a perceived unjust death or injury to a person held in high esteem or regard by a particular segment of society. Areas subject to civil disturbances may encompass large portions of a community. Types of facilities that may be subject to or adversely impacted by civil disturbances may include government buildings, military bases, nuclear power plants, universities, businesses, and critical service facilities such as police and fire stations.

Prison uprisings are normally the result of perceived injustice by inmates regarding facility rules, operating procedures and living conditions, or insurrections started by rival groups or gangs within the facility. Civil disturbances (including prison uprisings) often require the involvement of multiple community agencies in responding to and recovering from the incident.

For a list of prison locations and descriptions, see <http://www.state.mi.us/mdoc/cfa/menu.html> .

### ***Drought:***

A prolonged period with no rain, particularly during the planting and growing seasons in agricultural areas. Drought can also adversely affect urban areas - particularly those dependent on reservoirs for their water. Decreased water levels due to insufficient rain can lead to restriction of water uses and amounts. It is difficult to predict or forecast when a drought will begin, and how long it will last. Increased pumping of groundwater and surface irrigation in drought periods can result in land subsidence problems in some areas of the country. Virtually all areas of the country are subject to impact from drought - whether it be reduced agricultural outputs, reduced water supply, land subsidence, power outages caused by excessive energy use, increase in wildfires, reduced marine navigation capabilities, etc. The most vulnerable regions of the country for drought are the arid southwest and the Great Plains.

Drought information can be found at <http://enso.unl.edu/monitor/monitor.html> and <http://water.usgs.gov/dwc/> .

### ***Earthquakes:***

A sudden motion or trembling in the earth caused by an abrupt release of slowly accumulating strain which results in ground shaking, surface faulting, or ground failures. Most areas of the United States are subject to earthquakes (including parts of Michigan), and they occur literally thousands of times per year. Most earthquake occurrences result in little or no damage. However, when moderate or severe earthquakes occur, the results can be devastating in terms of loss of life, property and essential services. One of the most dangerous characteristics of earthquakes is their ability to cause severe and sudden loss. Within 1 to 2 minutes, an earthquake can devastate an area through ground shaking, surface fault ruptures, and ground failures. Most deaths and injuries are not directly caused by the earthquake itself, but rather indirectly through the collapse of structures.

Earthquakes are measured by their magnitude and intensity. Magnitude is a measure of the amount of energy released at the epicenter or origin of the event. The Richter Magnitude Scale is commonly used to determine earthquake magnitude. An earthquake of 5.0 is a moderate event, 6.0 characterizes a strong event, 7.0 is a major earthquake, and 8.0 is a catastrophic earthquake. Earthquake intensity is the measure of damage done at a given location. In the U.S., the most commonly used intensity scale is the Modified Mercalli Intensity Scale, which describes 12 increasing levels of intensity ranging from imperceptible to catastrophic.

Earthquake mapping information can be found at <http://www.esri.com/hazards/makemap.html> and <http://geohazards.cr.usgs.gov/eq/> .

Also of interest is [http://neic.usgs.gov/neis/states/michigan/michigan\\_history.html](http://neic.usgs.gov/neis/states/michigan/michigan_history.html) .

### ***Extreme Temperatures:***

Prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions such as high humidity, lack of rain (drought), high winds, etc. Extreme temperatures - whether it be extreme heat or extreme cold - share a commonality in that they both primarily affect the most vulnerable segments of society such as the

elderly, children, impoverished individuals, and people in poor health. The major threats of extreme heat are heatstroke (a major medical emergency), and heat exhaustion. Extreme heat is a more serious problem in urban areas, where the combined effects of high temperature and high humidity are more intense. The major threats of extreme cold are hypothermia (also a major medical emergency) and frostbite. Michigan is subject to both temperature extremes.

A useful site is at <http://weather.noaa.gov/fax/miscella.shtml#mprecip> .

### ***Fire Hazards:***

#### ***A. Scrap Tire Fires:***

Any instance of uncontrolled burning at a scrap tire storage or recycling site. Each year in the U.S., an estimated 250 million vehicle tires have to be disposed of. Michigan alone generates 7.5-9 million scrap tires annually. Many of these scrap tires end up in disposal sites (legal or illegal), some of which may have several hundred thousand tires. Michigan currently has more than 24 million scrap tires at disposal sites scattered across the state. Tire disposal sites can be fire hazards due to the large quantity of “fuel” onsite, coupled with the fact that the shape of a tire allows air to flow into the interior of a tire pile, rendering standard fire fighting practices nearly useless. Flowing burning oil released by the burning tires spreads the fire to adjacent areas. Some scrap tire fires have burned for months, creating acrid smoke and an oily residue which can leach into the soil, creating long-term environmental problems. Scrap tire fires differ from conventional fires in several respects: 1) even relatively small scrap tire fires can require significant resources to control and extinguish; 2) the costs of fire management are often far beyond that which local government can absorb; 3) the environmental consequences of a major tire fire can be significant; and 4) the extreme heat from the fire converts a standard passenger vehicle tire into about two gallons of oily residue, which can then leach into the soil or migrate to streams.

For registered storage locations, see [http://www.deq.state.mi.us/wmd/stp/ST\\_I&G.htm](http://www.deq.state.mi.us/wmd/stp/ST_I&G.htm) . Information on storage violations is at <http://www.deq.state.mi.us/ead/tasect/wv/stv.html> .

#### ***B. Structural Fires:***

Any instance of uncontrolled burning which results in structural damage to residential, commercial, industrial, institutional, or other properties in developed areas. In terms of average annual loss of life and property, structural fires - often referred to as the “universal hazard” because they occur in virtually every community - are by far the biggest hazard facing most communities in Michigan and across the country. Each year in the U.S., fires result in approximately 5,000 deaths and 300,000 injuries requiring medical treatment. According to some sources, structural fires cause more loss of life and property damage than all types of natural disasters combined. Particularly devastating are large urban conflagrations, in which multiple structures are damaged or destroyed. Not surprisingly, Michigan’s structural fire experience mirrors the national figures. The State Fire Marshal estimates that a structural fire occurs in Michigan approximately every 24 minutes.

Safety information appears at

[http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/fire\\_safety\\_information.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/fire_safety_information.html)

#### ***C. Wildfires:***

An uncontrolled fire in grass or brushlands, or forested areas. The most immediate dangers from wildfires are the destruction of homes and timber, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area. Long-term effects can be numerous and include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities. Forests cover approximately one-half of Michigan’s total land base. As a result, much of the state is vulnerable to wildfire. In addition, development in and around forests and grasslands is increasing rapidly, making public safety a primary consideration in wildfire mitigation and suppression efforts.

Information for mapping and risk assessment is at [http://www.fs.fed.us/land/wfas/map\\_list.htm](http://www.fs.fed.us/land/wfas/map_list.htm) .

For mitigation strategies and information of all kinds on the subject, see the FIREWISE communities web site at [http://www.firewise.org/www/active\\_win.htm](http://www.firewise.org/www/active_win.htm) .

### ***Flooding Hazards:***

#### ***A. Dam Failures:***

The collapse or failure of an impoundment resulting in downstream flooding. Dam failures can result in loss of life and extensive property or natural resource damage for miles downstream from the dam. Failure of a dam does not only occur during flood events, which may cause overtopping of a dam. Failure can also result from poor operation, lack of maintenance and repair, and vandalism. Such failures can be catastrophic because they occur unexpectedly, with no time for evacuation. Michigan has experienced over 260 dam failures in its history.

The worst recorded dam failure in U.S. history occurred in Johnstown, Pennsylvania, in 1889. More than 2,200 people were killed when a dam upstream from Johnstown failed, sending a huge wall of water downstream which completely inundated the town.

To locate dams and obtain information for risk assessment, see the impressive site at <http://crunch.tec.army.mil/nid/webpages/nid.cfm>.

**B. Riverine and Urban Flooding:**

Riverine flooding is defined as the periodic occurrence of overbank flows of rivers and streams resulting in partial or complete inundation of the adjacent floodplain. Riverine floods are generally caused by prolonged, intense rainfall, snowmelt, ice jams, dam failures, or any combination of these factors. Such overbank flows are natural events that may occur on a regular basis. Riverine floods occur on river systems whose tributaries may drain large geographic areas and encompass many independent river basins. Floods on large river systems may continue for several days. Many areas of Michigan are subject to riverine flooding.

Flash flooding differs from riverine flooding in extent and duration. Flash floods are brief, heavy flows on small streams or in normally dry creeks. Flash floods are normally the result of locally-intense thunderstorms resulting in significant rainfall. Flash floods are typically characterized by high velocity water, often carrying large amounts of debris.

Urban flooding involves the overflow of storm sewer systems and is usually caused by inadequate drainage following heavy rainfall or rapid snowmelt.

For mapping, see <http://esri.com/hazards/makemap.html>. For current conditions, see <http://www.nws.noaa.gov/oh/hic/current/streamflow.shtml>.

NOTE: Hazard analyses and mitigation plans designed to meet planning requirements for the Flood Mitigation Assistance program must meet specific requirements. These will be detailed in a later section – see Appendix C.

**C. Shoreline Flooding/Erosion:**

Flooding and erosion along Michigan's 3,200 mile long Great Lakes shoreline is typically caused by high Great Lakes water levels, storm surges, or high winds. Shoreline flooding and erosion are natural processes that occur at normal and even low Great Lakes water levels. During periods of high water, however, flooding and erosion are more frequent and serious, causing damage to homes, businesses, roads, water distribution and wastewater treatment facilities, and other structures in coastal communities. Windstorms and differences in barometric pressure can temporarily tilt the surface of a lake up at one end as much as 8 feet. This phenomenon is called a storm surge and can drive lake water inland over large areas.

For mapping, see <http://esri.com/hazards/makemap.html>. For current conditions, see <http://www.nws.noaa.gov/oh/hic/current/streamflow.shtml>.

***Hazardous Material Incidents:***

**A. Fixed Site:**

An uncontrolled release of hazardous materials from a fixed site, capable of posing a risk to health, safety, property and the environment. Hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other community facilities. Hazardous materials are materials or substances which, because of their chemical, physical, or biological nature, pose a potential threat to life, health, property and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases.

Hazardous materials are highly regulated by the government to reduce risk to the general public, property and the environment. Despite precautions taken to ensure careful handling during the manufacture, transport, storage, use and disposal of these materials, accidental releases are bound to occur. Areas at most risk are within a 1-5 mile radius of identified hazardous material sites. Many communities have detailed plans and procedures in place for responding to incidents at these sites, but releases can still cause severe harm to people, property and the environment if proper mitigative action is not taken in a timely manner.

The world's deadliest hazardous material incident occurred on December 4, 1984 in Bhopal, India. A cloud of methyl isocyanate gas, an extremely toxic chemical, escaped from a Union Carbide chemical plant, killing 2,500 people and injuring tens of thousands more. This incident triggered historical Federal legislation intended to minimize such disasters from occurring in the United States.

The following sites provide information on LEPCs, types of hazardous materials, Superfund sites, and identifies locations of major industrial users of hazardous materials:

<http://www.epa.gov/swercepp/ehs/ehsalph.html>

<http://www.deq.state.mi.us/ead/sara/sara3.html>

[http://www.epa.gov/enviro/html/cerclis/cerclis\\_query.html](http://www.epa.gov/enviro/html/cerclis/cerclis_query.html)

<http://www.atsdr.cdc.gov/hazdat.html>

<http://gis.cdc.gov/>

For industrial accident information, see <http://www.osha.gov/oshstate/index.html> .

#### B. Transportation Incidents:

An uncontrolled release of hazardous materials during transport, capable of posing a risk to health, safety, property or the environment. All modes of transportation - highway, railroad, seaway, airway, and pipeline - are carrying thousands of hazardous material shipments on a daily basis through local communities. A transportation accident involving any one of those hazardous material shipments could cause a local emergency affecting many people. The U.S. Department of Transportation regulates the transportation and shipping of over 18,000 different materials. Areas most at risk are within a 1-5 mile radius of a major transportation route along which hazardous material shipments move. All areas in Michigan are potentially vulnerable to a hazardous material transportation incident, although the heavily urbanized and industrialized areas in southern Michigan are particularly vulnerable due to the highly-concentrated population, the large number of transportation routes that criss-cross the area, and the large number of hazardous material shipments that occur on a daily basis.

See <http://www.epa.gov/swercepp/ehs/ehsalph.html> .

#### ***Infrastructure Failures:***

A failure of critical public or private utility infrastructure resulting in a temporary loss of essential functions and/or services. Such interruptions could last for periods of a few minutes to several days or more. Public and private utility infrastructure provides essential life supporting services such as electric power, heating and air conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of these independent, yet inter-related systems fails due to disaster or other cause - even for a short period of time - it can have devastating consequences. For example, when power is lost during periods of extreme heat or cold, people can literally die in their homes. When the water or wastewater treatment systems in a community are inoperable, serious public health problems arise that must be addressed immediately to prevent outbreaks of disease. When storm drainage systems fail due to damage or an overload of capacity, serious flooding can occur. All of these situations can lead to disastrous public health and safety consequences if immediate mitigative steps are not taken. Typically, it is the most vulnerable segments of society - the elderly, children, ill or frail individuals, etc., that are most heavily impacted by an infrastructure failure. If the failure involves more than one system, or is large enough in scope and magnitude, whole communities and even regions can be negatively impacted.

#### ***Nuclear Attack:***

Any hostile attack against the United States, using nuclear weapons, which results in destruction of military and/or civilian targets. All areas of the United States are conceivably subject to the threat of nuclear attack. However, the strategic importance of military bases, population centers and certain types of industries place these areas at greater risk than others. The nature of the nuclear attack threat against the U.S. has changed dramatically with the end of the "Cold War" and the conversion of previous adversaries to more democratic forms of government. Even so, the threat still exists for a nuclear attack against this country. Despite the dismantling of thousands of nuclear warheads aimed at U.S. targets, there still exists in the world a large number of nuclear weapons capable of destroying multiple locations simultaneously. In addition, controls on nuclear weapons and weapons components are sporadic at best in the former Soviet Union, and the number of countries capable of developing nuclear weapons continues to grow despite the ratification of an international nuclear non-proliferation treaty. It seems highly plausible that the threat of nuclear attack will continue to be a hazard in this country for some time in the future.

At this point, attack planning guidance prepared by the Federal government in the late 1980s still provides the best basis for a population protection strategy for Michigan. That guidance has identified 25 potential target areas in Michigan, and 4 in Ohio and Indiana that would impact Michigan communities, classified as follows: 1) commercial power plants; 2) chemical facilities; 3) counterforce military installations; 4) other military bases; 5) military support industries; 6) refineries; and 7) political targets. For each of these target areas, detailed plans have been developed for evacuating and

sheltering the impacted population, protecting critical resources, and resuming vital governmental functions in the post-attack environment.

For information on the nuclear threat, see <http://www.acq.osd.mil/bmdo/bmdolink/html/threat.html> .

### ***Nuclear Power Plant Accidents:***

An actual or potential release of radioactive material at a commercial nuclear power plant or other nuclear facility, in sufficient quantity to constitute a threat to the health and safety of the off-site population. Such an occurrence, though not probable, could affect the short and long-term health and safety of the public living near the nuclear power plant, and cause long-term environmental contamination around the plant. As a result, the construction and operation of nuclear power plants are closely monitored and regulated by the Federal government. Communities with a nuclear power plant must develop detailed plans for responding to and recovering from such an incident, focusing on the 10 mile Emergency Planning Zone (EPZ) around the plant, and a 50 mile Secondary EPZ that exists to prevent the introduction of radioactive contamination into the food chain. Michigan has 3 active and 1 in-active commercial nuclear power plants, in addition to 4 small nuclear testing/research facilities located at 3 state universities and within the City of Midland.

For plant locations, information, and response plans, see <http://www.nrc.gov/AEOD/pib/disclaimer.html> .

### ***Oil and Gas Well Accidents:***

An uncontrolled release of oil or gas from wells, or its poisonous by-product, hydrogen sulfide (see the section on Petroleum and Natural Gas Pipeline Accidents for more information).

Oil and gas are produced from fields in over 60 counties in the Lower Peninsula. Over 40,000 wells have been drilled in these counties. Of that total, approximately one-half (20,000) have produced oil or gas. Over 1.1 billion barrels of crude oil and 3.6 trillion cubic feet of gas have been withdrawn from these wells.

For identification and risk assessment of oil & gas wells, a list can be downloaded from the MDEQ site at <http://www.deq.state.mi.us/gsd/WellLoc/Index.html> . The locations of sites for which permits were given are described using rectangular land descriptions. For wells that appear to be situated near populated, developed, or highly-traveled areas, information can be requested from MDEQ about whether the wells actually exist, and whether hydrogen sulfide may exist in them. Requests should refer to the specific permit number obtained from the web list. Some permitted sites have never actually had wells dug or drilled. Others have been filled in ("plugged") and no longer pose any threat.

### ***Petroleum and Natural Gas Pipeline Accidents:***

An uncontrolled release of petroleum or natural gas, or the poisonous by-product hydrogen sulfide, from a pipeline. As a major petroleum and natural gas consumer in the United States, vast quantities of petroleum and natural gas are transported through and stored in Michigan. Though often overlooked as a threat because much of the petroleum and gas infrastructure in the state is located underground, petroleum and gas pipelines can leak, erupt or explode, causing property damage, environmental contamination, injuries and loss of life. In addition to these hazards, there is also a danger of hydrogen sulfide release. Hydrogen sulfide is an extremely poisonous gas that is also explosive when mixed with air temperatures of 500 degrees or above. In addition to pipelines, these dangers can be found around oil and gas wells, pipeline terminals, storage facilities, and transportation facilities where the gas or oil has a high sulfur content.

Unfortunately, no comprehensive source of information about pipeline locations has yet been found on the internet by our staff. However, a map of approximate locations of major pipelines appears in our Michigan Hazard Analysis document at [http://www.msp.state.mi.us/division/emd/Hazann2000/Hazard\\_Analysis\\_2000\\_index.htm](http://www.msp.state.mi.us/division/emd/Hazann2000/Hazard_Analysis_2000_index.htm)

### ***Public Health Emergencies:***

A widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public. Public health emergencies can take many forms: 1) disease epidemics; 2) large-scale incidents of food or water contamination; 3) extended periods without adequate water and sewer services; 4) harmful exposure to chemical, radiological or biological agents; or 5) large-scale infestations of disease-carrying insects or rodents. Public health emergencies can occur as primary events by themselves, or they may be secondary events another disaster or emergency, such as a flood, tornado, or hazardous material incident. The common characteristic of most public health emergencies is that they adversely impact, or have the potential to adversely impact, a large number of people. Public health emergencies can be statewide, regional, or localized in scope and magnitude. For information and mapping, see <http://www.deq.state.mi.us/intrest.html> and <http://gis.cdc.gov/> .

### ***Sabotage/Terrorism:***

An intentional, unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political, social, or religious objectives. Sabotage/terrorism can take many forms or have many vehicles for delivery, including: 1) bombings; 2) assassinations; 3) organized extortion; 4) use of nuclear, chemical and biological weapons; 5) information warfare; 6) ethnic/religious/gender intimidation (hate crimes); 7) state and local militia groups that advocate overthrow of the U.S. Government; 8) eco-extremism, designed to destroy or disrupt specific research or resource-related activities; and 9) widespread and organized narcotics smuggling and distribution organizations. Because sabotage/terrorism objectives are so widely varied, so to are the potential targets of such actions. Virtually any public facility or infrastructure, or place of public assembly, can be considered a potential target. In addition, certain types of businesses engaged in controversial activities are also potential targets, as are large computer systems operated by government agencies, banks, financial institutions, large businesses, health care facilities, and colleges/universities.

One of the first acts of domestic sabotage/terrorism ever carried out occurred in Michigan on May 18, 1927, in Bath. A disgruntled taxpayer and farmer detonated 1,000 pounds of explosives under the newly constructed Bath Consolidated School, killing 38 students and 3 teachers and injuring 58 others. The perpetrator then blew himself up, along with the school superintendent. As tragic as that event was, it could have been worse were it not for the fact that half of the explosives failed to detonate as planned, which certainly would have killed many more students and teachers.

See <http://www.nlectc.org/ccfp/> and <http://www.fbi.gov:80/library/terror/terroris.htm> .

### ***Subsidence:***

Depressions, cracks, and sinkholes in the ground surface, which can threaten people and property. Subsidence depressions, which normally occur over many days to a few years, may damage structures with low strain tolerances, such as dams, nuclear reactors, and utility infrastructure. The sudden collapse of the ground surface to form sinkholes poses an immediate threat to life and property. Such ground movements may continue for several days, weeks, months or even years, until the walls stabilize. The population most at risk would be in areas where industrial or residential development has occurred above active or abandoned mines where underground cavities are present near the surface, as well as areas where an extensive amount of groundwater has been withdrawn.

See <http://www.osmre.gov/aml/inven/zintroin.htm> .

### ***Thunderstorm Hazards:***

#### **A. Hail:**

A condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth. Hail is a product of the strong thunderstorms that frequently move across the state. As one of these thunderstorms passes over, hail usually falls near the center of the storm, along with the heaviest rain. Sometimes, however, strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, causing an unexpected hazard at places that otherwise might not appear threatened. Hailstones range in size from a pea to a golf ball, but hailstones larger than baseballs have occurred in the most severe thunderstorms. Hail is formed when strong updrafts within the storm carry water droplets above the freezing level, where they remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. They finally fall to the ground, battering crops, denting autos, and injuring wildlife and people. Large hail is a characteristic of severe thunderstorms, and it often precedes the occurrence of a tornado.

See <http://www.esri.com/hazards/makemap.html> .

#### **B. Lightning:**

The discharge of electricity from within a thunderstorm. Although lightning is often perceived as a minor hazard, it damages many structures and kills and injures more people in the U.S. per year, on average, than tornadoes or hurricanes. Many lightning deaths and injuries could be avoided if people would have more respect for the threat that lightning presents. Michigan ranks second in the nation in both lightning-related deaths and lightning-related injuries.

See <http://www.esri.com/hazards/makemap.html> .

#### **C. Severe Winds (Windstorms):**

According to the National Weather Service, winds 58 miles per hour or greater are classified as a windstorm. Windstorms are a fairly common occurrence in many areas in Michigan. Along the Great Lakes shoreline, strong winds occur with

regularity, and gusts of over 74 miles per hour (hurricane velocity) do occasionally occur in conjunction with a storm front. Severe windstorms can cause damage to homes and businesses, power lines, trees and agricultural crops, and may require temporary sheltering of individuals without power for extended periods of time. Windstorms occur in all areas of Michigan, although more often along the lakeshore and in central and southern lower Michigan.

See <http://www.esri.com/hazards/makemap.html> .

D. Tornadoes:

A violently whirling column of air extending downward to the ground from a cumulonimbus cloud. The funnel cloud associated with a tornado may have winds up to 300 miles per hour and an interior air pressure that is 10-20 percent below that of the surrounding atmosphere. The typical length of a tornado path is approximately 16 miles, but tracks much longer than that - some even up to 200 miles - have been reported. Tornado path widths are generally less than one-quarter mile wide. Historically, tornadoes have resulted in the greatest loss of life of any natural hazard, with the mean national annual death toll being 111 persons. Property damage from tornadoes is in the hundreds of millions of dollars every year. Michigan averages approximately 18 tornadoes per year, most occurring in the southern Lower Peninsula.

See <http://www.esri.com/hazards/makemap.html> .

***Air, Land and Water Transportation Accidents:***

A crash or accident involving an air, land or water-based commercial passenger carrier resulting in death or serious injury. Vulnerable areas would include: 1) communities with, or near, an airport offering commercial passenger service; 2) communities with railroad tracks on which commercial rail passenger service is provided; 3) communities in which commercial intercity passenger bus or local transit bus service is provided; 4) communities with school bus service; and 5) communities in which commercial marine passenger ferry service is provided. A serious accident involving any of the above modes of passenger transportation could result in a mass casualty incident, requiring immediate life-saving community response. In addition, a marine transportation accident would require a water rescue operation, possibly under dangerous conditions on the Great Lakes.

In terms of commercial passenger transportation service, Michigan has approximately: 1) 19 airports that offer commercial air passenger service; 2) 130 certified intercity passenger bus carriers providing service to 220 communities; 3) 72 local bus transit systems serving 85 million passengers; 4) 19 marine passenger ferry services; and 5) 3 intercity rail passenger routes operating on 568 miles of track, along 3 corridors, serving 22 communities.

See the MDOT site at <http://www.mdot.state.mi.us/maps/trafficmaps/> for traffic volume information.

***Severe Winter Weather Hazards:***

A. Ice and Sleet Storms:

A storm that generates sufficient quantities of ice or sleet to result in hazardous conditions and/or property damage. Sleet storms differ from ice storms in that sleet is similar to hail (only smaller) and can be easily identified as frozen rain drops (ice pellets) when bounce when hitting the ground or other objects. Sleet does not stick to trees and wires, but sleet in sufficient depth does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surface, coating the ground, trees, buildings, overhead wires, etc. with ice, sometimes causing extensive damage. When electric lines are downed, inconveniences are felt in households and economic loss and disruption of essential services is often experienced in affected communities. Michigan has had numerous damaging ice storms over the past few decades.

See the NOAA sites at <http://weather.noaa.gov/fax/miscella.shtml#mprecip> and <http://www.nws.noaa.gov/oh/hic/current/snow.shtml> .

B. Snowstorms:

A period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all snowstorms, characterized by low temperatures and strong winds bearing enormous amounts of snow. Most of the snow accompanying a blizzard is in the form of fine, powdery particles of snow which are wind-blown in such great quantities that, at times, visibility is reduced to only a few feet. Blizzards have the potential to result in property damage and loss of life. Just the cost of clearing the snow can be enormous. As a result of being surrounded by the Great Lakes, Michigan experiences large differences in snowfall in relatively short distances. The annual mean accumulation ranges from 30 to 170 inches of snow. The highest accumulations are in the northern and western parts of the Upper Peninsula. Since winter storms tend to move from west to east, the western parts of the state usually have greater amounts of snow than the eastern parts. More information can be found at the NOAA internet sites at <http://weather.noaa.gov/fax/miscella.shtml#mprecip> and <http://www.nws.noaa.gov/oh/hic/current/snow.shtml> .

## Formatting a Hazard Analysis Document

It may make sense in some cases to have closely related hazards combined into a single section of a hazard analysis or mitigation plan. To help organize plan content, it may also be useful to order the hazards so that those of greatest concern are presented first and are analyzed in the greatest detail. Others may prefer to have separate sections dealing with natural, technological, and social/societal hazards, each of which has been prioritized within these subsections according to the risk it poses. For example:

### Natural hazards:

floods, wildfires, drought, thunderstorm hazards (severe winds, tornadoes, hail, lightning), severe winter weather (ice, sleet, and snow storms), extreme temperatures

### Technological hazards:

structural fires (including explosions and industrial accidents), dam failures, hazardous material incidents (fixed site and transportation related), infrastructure failure (water distribution, storm & sanitary sewers, electrical power system, communications systems), oil and gas well/pipeline accidents, land subsidence, transportation accidents (airplane, rail, multi-passenger/multi-vehicle incidents, marine incidents).

### Social / Societal hazards:

nuclear attack/civil defense emergency, weapons of mass destruction/terrorism/sabotage, public health emergencies, civil disturbances (riots, prison uprisings, etc.)

Note that in this example, the ordering of hazards above may not match their priorities in your community. For more information about prioritizing hazards, see the following sections on risk and vulnerability assessments (steps 1c and 1d).

Regardless of how the hazards are ordered, it is usually easiest to read about all aspects of each hazard (identification, risk, and vulnerability) at the same time. Therefore, as information is gathered during additional steps of the analysis, it can be placed in specific hazard sections, following up the initial hazard identification descriptions with a discussion of specific threats to vulnerable parts of the community.



## STEP 1c: RISK ASSESSMENT

This substep and the next one (Vulnerability Assessment) are closely related. Both use gathered information to summarize the risk that each hazard poses to your community. During these two steps, much useful information can be added to the sections that were started for each hazard in the Hazard Identification substep. The tasks involve finding where hazard risks overlap with the people and property you identified in the community profile. The goals of the risk assessment are to map out where hazards exist in your community, and to gain some idea of how often they arise and how much harm they might do in the future. Some hazards may affect your entire community, and may not need mapping if their likelihood and impacts seem to be about the same throughout the area. It will still be important to consider potential impacts they may have on different parts of your community—especially areas that may have a harder time preparing for and responding to an event. The Risk Assessment mainly involves collecting and thinking about this information, which will form the basis for the Vulnerability Assessment to follow. Useful sources of information include base maps from the public works department, road commission or planning department, floodplain information from National Flood Insurance Program Flood Insurance Rate Maps (FIRMs), and Section 302 sites from the Local Emergency Planning Committee (LEPC).

It is also useful to use "worst-case scenarios" in your assessments, by imagining what would happen if the worst possible catastrophe from each potential hazard actually occurred within your community. This type of analysis will suggest areas of overlap where one hazard causes another (such as severe winds causing infrastructure failures) and an assessment of the limits of your community's response capabilities (for example, a large transportation accident may temporarily overwhelm the Emergency Medical Service's capabilities in some areas).

The following table is an example that might have come from a hazard analysis document. Some other table, graph, or text may be used in your document to explain how you analyzed the subject. The table like the one below can be used to summarize hazard potentials in your community. Column 1 names the hazard, columns 2 through 4 come from the hazard identification and risk analysis process, and columns 5 through 7 will be completed as a part of the next step – the Vulnerability Assessment. Those last columns on the right side of the table will be explained in the next section of these instructional materials.

Following the table is an example of a hazards map. (It has a county-wide scale and, for illustration purposes, only includes a limited number of hazards.)

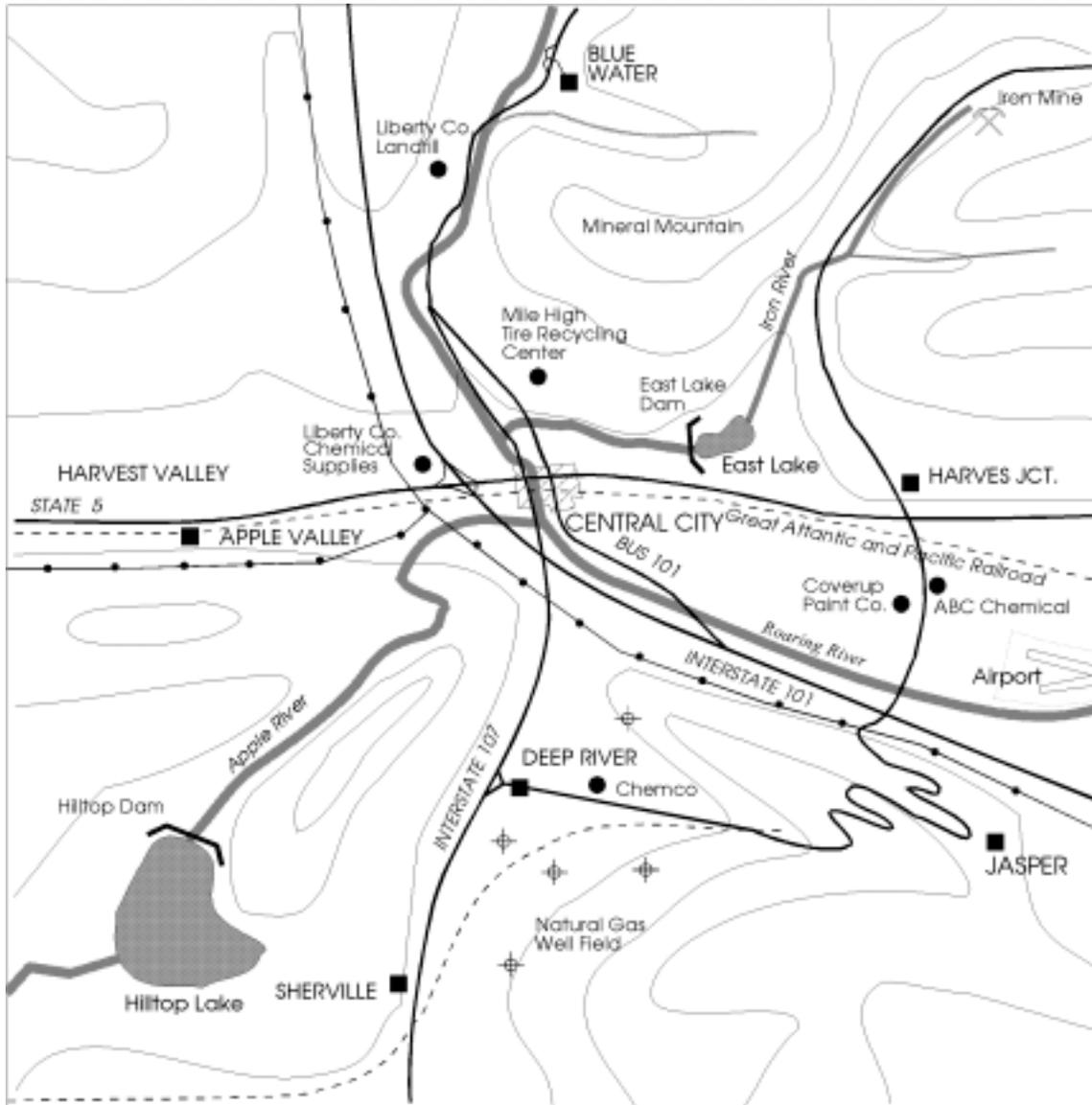
**Risk Assessment Summary Table: (name of community)  
(year)**

<b>HAZARD</b>	<b>How Frequently has the Hazard Occurred in the Past?</b>	<b>How Likely is the Hazard to Occur in the Future?</b>	<b>Potential Geographic Size of the Affected Area</b>	<b>Population Impact  Potential Population Impacted</b>	<b>Significance of Impact (Population, Economic, Environment, etc.)</b>	<b>Ranking  (Priority of Mitigation Activities for this Hazard)</b>
Civil Disturbances <b>FOR EXAMPLE:</b>	Once every 5 years	About every 5 years	Several small sites	Up to 3,000 persons	Assessed hazard rating: 2.2	15 <sup>th</sup>
Drought <b>FOR EXAMPLE:</b>	About every 20 years	About every 20 years	Entire county	4,000 in agricultural sector, 30,000 urban water supply customers	Assessed hazard rating: 2.4	14 <sup>th</sup>
Earthquakes <b>FOR EXAMPLE:</b>	Only one known quake with damage—it was in the 1940s	New Madrid fault line event expected anytime	Weaker structures & infrastructure throughout county	About 75 persons are in structures not up to code; minor breakage expected in 10% of households and offices	Assessed hazard rating: 1.9	17 <sup>th</sup>
Extreme Temperatures <b>FOR EXAMPLE:</b>	Once every 4 years (average of 5 very hot and 13 very cold days per year)	Once every 4 years?	Entire county	Heat: 3,000 outdoor workers at risk and 2,000 in homes without cooling. Cold: 400 outdoor workers, 30 poor families per year have utilities stopped from unpaid bills.	Assessed hazard rating: 4.4	7 <sup>th</sup>
Fire Hazards: Structural Fires <b>FOR EXAMPLE:</b>	Regularly: Averages 3 deaths and 35 events per year:\$380,000i n annual damages.	Mitigation programs lowered average to 29 events per year since 1998.	All structures at some risk. High-risk areas located in the village of Portown and the city of Loki.	50 persons live in high-risk areas, 450 more use high-risk heating systems	Assessed hazard rating: 6.5	4 <sup>th</sup>
Fire Hazards: Wildfires <b>FOR EXAMPLE:</b>	Average of 4 minor events per year, a major event every 4 years.	Mitigation efforts now starting to reduce risk slightly.	45% of land area is forested, 13% of land area has high-risk forest types.	1,400 persons estimated to live in wildland/ urban interface area.	Assessed hazard rating: 7.7	1 <sup>st</sup>
Flood Hazards: Dam Failures <b>FOR EXAMPLE</b>	No reported failures.	Limited failure every 50 years?	Areas down-stream from 2 dams on Poseidon River.	650 persons live or work in structures in the dams' hydraulic shadow.	Assessed hazard rating: 6.4	5 <sup>th</sup>

Etc.

# Liberty County Hazards Map

(EXAMPLE)



LC-10EPO.CDR

- RIVER
- - - RAILROAD
- ROAD
- GAS LINE
- ⊕ NATURAL GAS WELL



## LIBERTY COUNTY

## STEP 1d: VULNERABILITY ASSESSMENT

A Vulnerability Assessment gives quantitative estimates of the people and property in your community that are vulnerable to each hazard. The simplest technique to assess vulnerabilities is to compare the community profile map with hazard maps for the same area, to find areas where hazards overlap with the locations of people, structures and infrastructure. Areas where hazards overlap with development should be examined more closely to estimate what kinds of damages might occur during an emergency event. The goal should be to produce specific information that **measures** the threats from each hazard. As shown in the table previously (starting in the fifth column), information such as the number of persons at risk, the number of structures vulnerable to damage, or estimates of economic losses, are all *quantifiable* concepts. There is no need to reach perfect accuracy with these measurements. In the hazard analysis, they will mainly be used to prioritize which hazards your community is most vulnerable to. As estimates are obtained, they should be included in the hazard analysis when discussing each hazard, and if you are using a Risk Assessment Table as shown previously, this information can be entered into the table. Following this, hazard-specific disaster scenarios can be considered. Such "worst-case scenarios" are essentially a brainstorming activity to aid in determining additional impacts that each hazard might cause. The types of impacts that may be considered include:

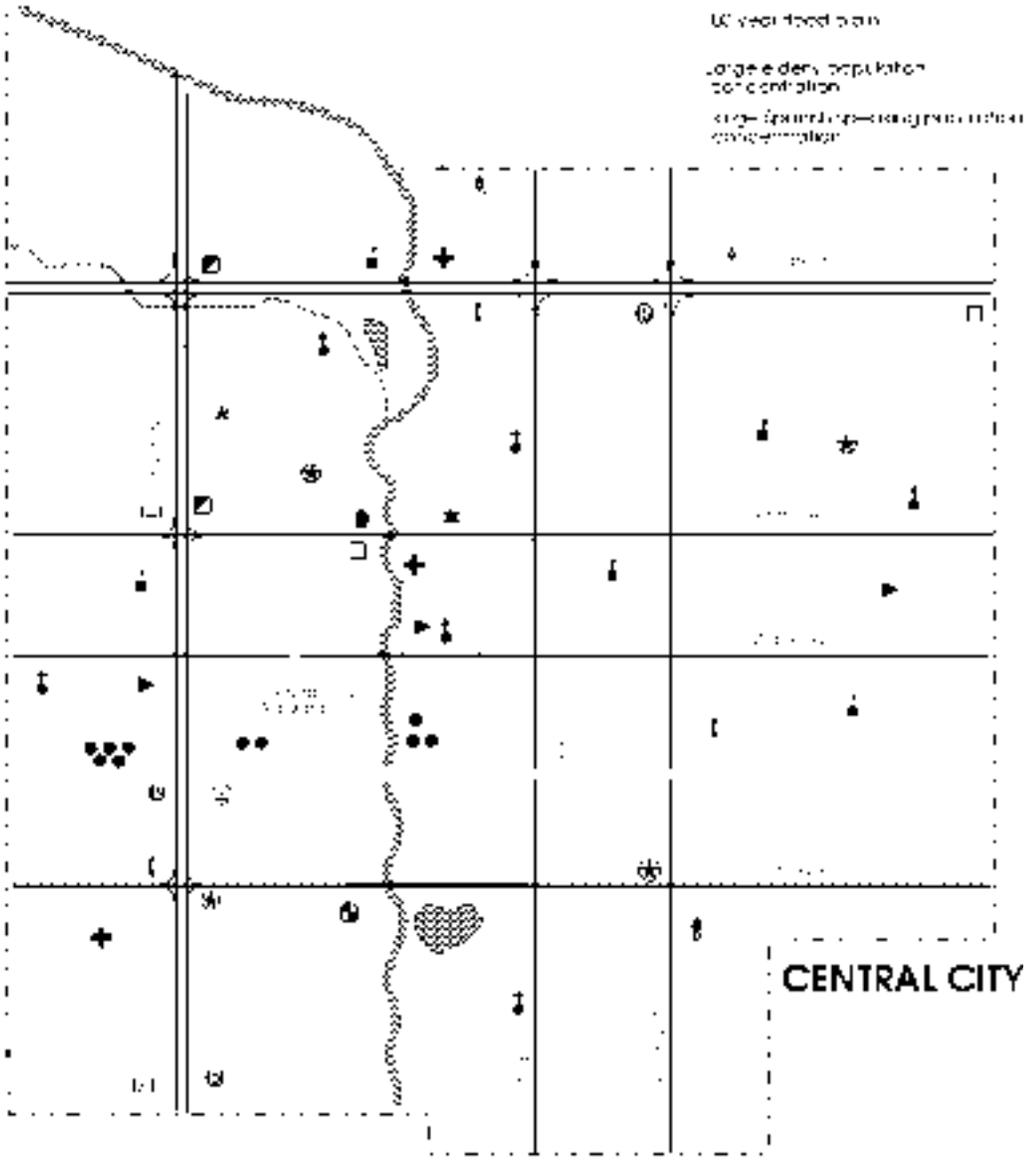
- Impacts on specific sectors of the community
- Life safety consequences and issues (potential deaths, injuries, search and rescue situations, etc.)
- Critical loss of function consequences and issues (lifelines, police/fire/EMS, special needs groups, etc.)
- Public health consequences and issues such as contaminated water, disease, vector control (insects and animals that can spread disease to humans), etc.
- Economic consequences and issues (loss of business activity, unemployment, response and recovery costs, etc.)
- Recovery issues and concerns (re-building public and private facilities, housing needs, project funding, hazard mitigation, etc.)

After applying the various hazard-specific disaster scenarios, the community will have a good idea, in terms of potential numbers, of what it could reasonably expect to encounter in similar situations. It may not be necessary to develop and apply scenarios for EVERY known hazard in the community. At this stage of the analysis, efforts may be focused toward the most important hazards. Each community will have to make that determination based on its needs, priorities and resources.

Text, tables and maps can be used to depict the consequences, issues and considerations raised in the disaster scenarios. This could then serve as a basis for determining community priorities for mitigation activities, emergency planning, and resource allocation. The results could also be used by the community's land use and public facility planners to avoid allowing future developments in hazardous areas.

A Flood Hazard map appears on the next page as an example of identifying areas where a hazard overlaps with development. Notice that this vulnerability map allows more detail because it focuses only on one sector ("Central City") of the county, in which a floodplain overlaps with developed areas. The map is followed by a table in which the impacts of each hazard can be noted.

# EXAMPLE OF FLOOD HAZARD SECTOR MAP FOR A VULNERABILITY ANALYSIS



- ★ Central City Police Station
- ▮ National Guard Facility
- ⚡ Hospital
- ⌚ Food Storage Warehouse
- ⛪ Church

- ★ Fire Station
- ▮ City Equipment Yard
- ▮ Heavy Equipment Storage
- Fuel Storage Tank
- ▮ City Transportation Center
- ▮ Emergency Management Center and EOC

- ▮ Retirement Center
- ⌚ Cemetery
- ⌚ Telephone Switching Station
- ⌚ Electric Power Station
- ⌚ Reservoir
- ⌚ Radio and TV Station

**(name of community) Vulnerability Determination: (year)**  
**(EXAMPLE)**

<b>HAZARD</b>	<b>Sector Issues</b>	<b>Life Safety Issues</b>	<b>Loss of Function Issues</b>
1. <b>(FOR EXAMPLE): Riverine Flooding</b>	a. 80% of Pine Twp. residents are elderly b. Only bridge in Village of Stormy is floodprone c. Seafarer Twp. has summer population increase of 35,000 people d. City of Rolling Hills has many businesses in Pine River floodplain	a. Flash flood on Pine River could result in many deaths and injuries b. Large number of elderly residents in county makes warning difficult c. County has limited water rescue capability d. Propane tanks in floodplain not anchored	a. No backup generator in police station in City of Rolling Hills b. Rolling Hills fire station located in floodplain c. Several sewage lift stations in Pine Twp. are prone to flood damage d. Gas main under Pine River bridge vulnerable
	<b>Public Health Issues</b>	<b>Economic Issues</b>	<b>Recovery Issues</b>
	a. Flooding contaminates private wells in Pine Twp. b. Flooded buildings become contaminated c. Mosquito, rodent and snake populations swell after flooding d. Flood-soaked debris gets piled up for long periods of time	a. Businesses in Pine River floodplain must close for up to two weeks b. Post-flood recovery and cleanup costs are very high c. Public facilities in Rolling Hills incur repetitive damage	a. Damaged public facilities cannot be used for up to two weeks after flood b. Flooded residents must be temporarily housed for up to two weeks c. Potential for business closures due to repetitive flood damage

The last task in the Vulnerability Assessment is to rank hazards according to how vulnerable your community is to each of them. The Risk Assessment Summary Table shown on page 36 had a column in which this ranking could be inserted. Such ranking will help to prioritize mitigation efforts according to the severity of a hazard's risks which they address. In the Risk Assessment Summary Table, the rankings were based on hazard assessment ratings, a more advanced technique that is described in Appendix B of this workbook.

The Vulnerability Assessment, and indeed the entire Hazard Analysis, can be considered complete when (1) specific areas of the community have been identified that are vulnerable to harm from hazards, (2) these areas of vulnerability have been prioritized with estimates of which threats are most important to address, and (3) explanations have been given as to *why* these areas are believed to be vulnerable to hazards, or *how* such vulnerabilities were determined.

Having a presentable and complete document explaining your hazard analysis will allow the information you've researched to be examined and used by many important people in your community, whether planners, officials, or others in emergency management. Feedback and suggestions from these people can be very useful and important for making the hazard analysis as accurate and useful as possible.

---

## **Summary**

At this stage, the information is still somewhat general; however, it provides the community with some idea of what the its problems are, providing a foundation for the planning process. In Step 3, you will need to develop more detailed information to develop appropriate solutions to address your community's most pressing hazard-related problems.

# Step 2

## Define Goals and Objectives

### Overview:

#### “What are goals and objectives?”

**Goals** are general guidelines that explain what you want to achieve in your community. They are usually long-term and represent global visions such as “protect public health and safety.”

**Objectives** define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific, measurable, and have a defined completion date. They are more specific and outline the “who, what, when, where, and how” of reaching the goals.

#### Where are we now?



- Step 1:** Identify hazards and risks

---

- Step 2:** Define goals and objectives

---

- Step 3:** Identify alternatives for solving problems
- Step 4:** Select evaluation criteria
- Step 5:** Select feasible mitigation strategies
- Step 6:** Prepare a draft plan
- Step 7:** Prepare final plan
- Step 8:** Implement plan
- Step 9:** Monitor and periodically revise plan

#### “Why do we need to identify goals and objectives?”

Plans and actions based on clear goals and objectives are more likely to succeed in meeting the community’s needs.

**Vassar, Michigan**  
**1998/99 Mitigation Planning Initiative**

---

**Goals**

- ✓ Reduce flood losses.
- ✓ Improve response and recovery.
- ✓ Enhance community confidence.

**Objectives**

- ✓ Establish on-going floodway acquisition & land-use program.
- ✓ Rezone floodway to reflect current uses.
- ✓ Develop a written Flood Response & Recovery Plan.

**Accomplishments**

- ✓ A floodway is being converted to a riverside park and recreation area.
- ✓ Homes in the flood fringe are being raised above the 100 year elevation.
- ✓ Remaining homes in the floodway are being removed.
- ✓ Community spirit has been renewed.

## Typical goals might include, but are not limited to:

- Minimize damage to public and private property
- Maintain essential public services
- Provide adequate warning time to residents in affected areas
- Promote economic development
- Manage growth/development
- Acquire open space and park land
- Preserve housing stock
- Maintain a positive community image

Goals will not be achieved if they exist in a vacuum or compete with other community goals. Hazard mitigation has a far greater chance for success when its goals are effectively integrated into other community goals. Combining goals in this manner can lead to a “win-win” situation where everyone benefits. A mitigation component may “tip the scale” to allow a marginal but beneficial project to move forward.

Objectives are developed to help achieve goals by dividing them into manageable components. For example, “eliminate flood damage” would be a goal. A supporting objective could be “adopt a zoning ordinance prohibiting new development in the floodplain.” This objective establishes a policy that prohibits building in an area vulnerable to a natural hazard. Successful completion of multiple objectives is needed for each individual goal.

## Prioritizing goals and objectives

Once you have identified the goals and objectives, prioritize them so local officials can better focus their attention on developing alternatives.

---

---

## Summary

Developing clear goals and objectives will help your community clarify problems, issues and opportunities in hazard mitigation as well as other areas. Well-articulated goals and objectives are more likely to succeed. An important part of developing goals and objectives is raising community awareness of the relationship between community development practices and the community’s level of hazard vulnerability and risk. Also, raising citizen awareness can help gain support for ongoing mitigation planning efforts.



# Step 3

## Identify Alternatives for Solving Problems

### Overview

Often, there are different ways that objectives can be met, each of which may have pros and cons, costs and benefits. Brainstorming sessions will be useful for suggesting possible mitigation strategies, which are called *alternatives* until they are narrowed down to one strategy that can receive widespread support. The narrowing-down process will be covered in Steps 4 and 5. First, alternatives must be generated that may address each of the most important hazards in your community, as identified by the hazard analysis produced in Step 1, and to accomplish the goals and objectives identified and defined in Step 2.

### Where are we now?



- Step 1: Identify hazards and risks
- Step 2: Define goals and objectives
- Step 3: Identify alternatives for solving problems
- Step 4: Select evaluation criteria
- Step 5: Select feasible mitigation strategies
- Step 6: Prepare a draft plan
- Step 7: Prepare final plan
- Step 8: Implement plan
- Step 9: Monitor and periodically revise plan



### Key Point

#### Four Basic Hazard Mitigation Approaches

- ✓ **Construction of structural protection measures** to shield people and development from harm keeps the hazard away from the people. Examples of this type of measure are dams, levees, floodwalls, debris basins, and other public works projects designed to redirect the impacts of a hazard.
- ✓ **Preventing or limiting development** in locations where people and development would be at risk keeps people away from the hazard. For example, NFIP flood management ordinances restrict how structures in flood hazard areas can be built, such as requiring no basements, or first floor elevations at or above the base flood elevation. Another example is disclosure legislation, requiring that prospective buyers of property be informed of high hazard situations prior to purchase. Relocation or acquisition projects are also examples of mitigation measures based on hazard avoidance.
- ✓ **Altering the design or construction of development or redevelopment** to make it less vulnerable to known hazards allows the hazards to interact with human systems that have been designed and planned to withstand the potential impacts. Examples of this type of measure include elevating structures, employing wet and dry floodproofing to improve resistance to flood damage, designing structures in certain shapes to lessen the impacts of tornadoes and floods, establishing defensible space around structures in wooded areas, and employing good wind engineering techniques such as gable end bracing and the use of structural fasteners.
- ✓ **Acting upon the hazard itself** involves direct interaction with the hazard. Examples include stream widening to reduce flooding and cloud seeding to increase precipitation in order to generate snow pack in anticipation of impending drought.

The text box on the preceding page presented four basic hazard mitigation approaches. Within that basic framework are numerous "tools" that can be used to help solve hazard-related problems and concerns. Some of those tools will now be described.

## Common Hazard Mitigation Tools

### Corrective Measures

When structures and communities are located in hazardous areas, corrective measures are directed at working with current conditions. Examples of corrective measures include:

1. **Acquisition:** Public acquisition and management of lands that are vulnerable to damage from local hazards. Following acquisition, land uses more appropriate to the degree of risk may be chosen. Public acquisition has been achieved by: a) purchase at full market value; b) purchase at less than full market value through such methods as foreclosure of tax delinquent property, bargain sales, purchase and lease back, etc.; c) donation, through reserved real estate, donation by will, donation and lease back; d) leases; and e) easements.
2. **Relocation:** Permanent evacuation of hazard-prone areas through movement of existing hazard-prone development and population to safer areas. The two common approaches to relocation are physical removal of buildings to a safer area with future use of the vacated area limited to permanent open space, and replacing existing land uses with others that are less vulnerable to the hazard.
3. **Redevelopment:** Rebuilding damaged areas in such a way that future damages are reduced and economic viability is improved. An example of this approach would be the redesign of deteriorated urban areas using renewal authorities and funds.
4. **Modifications:** Modifications can be made both to a site and to a structure. Examples include landscape grading, or retrofitting existing structures to be damage resistant (i.e., floodproofing existing buildings, adding structural braces to buildings to improve earthquake or wind resistance, etc.)

### Public Works Measures

This category covers the most commonly known engineering measures used to contain or redirect natural hazards away from development and affected populations. Examples of these types of measures include:

1. **Structural Protection Measures:** Construction of measures that directly protect people and property at risk (in Michigan, primarily from flood hazards). Examples include dams, reservoirs, dikes, levees, seawalls, bulkheads, revetments, high flow diversions, and spillways.
2. **Land Treatment:** Measures which are intended to reduce the intensity of hazard effects by modifying the natural environment. Examples include reforestation, contour plowing, grading, and soil stabilization.

### Planning and Regulatory Measures

Government has the power and resources to guide and influence the location, type, and amount of development within a jurisdiction. The tools of this "development management" are contained in the community's plans, regulations, public facilities and taxation measures, in addition to land acquisition policies which were discussed previously.

1. **Plans:** Land use plans specify the planned location of types of development activity, including commercial, industrial, and residential. As a hazard mitigation tool, plans can also identify hazard areas such as floodplains, fault zones, landslide and high-erosion areas, and hazardous waste sites. Land use plans can guide concentrated development away from these hazard areas by designating them for open space or other low density uses.
2. **Zoning:** Zoning ordinances are used to regulate the use of land and structures to ensure the public health, safety, and general welfare. Hazard areas such as floodplains can be zoned as low density districts. Hazard

areas can also be identified in other zoning districts where special performance standards may be applied to development.

3. **Regulations:** Certain regulations, such as subdivision regulations, place requirements and standards for the conversion of raw land into building sites. These types of regulations can require floodproofing of such facilities as water and sewer lines, and storm drains. The subdivider can be required to prevent environmental degradation and to mitigate hazards. Development in high-hazard areas can be prevented or protected by requiring elevation or floodproofing. The regulations may also require that hazard information appear on deeds for lots within the development.

Environmental regulations also provide an opportunity to accomplish hazard mitigation. Since sensitive areas are protected by these regulations, mitigation can be accomplished when this protection reduces hazard impacts, and when the protection guides new development away from these areas.

4. **Codes:** Building codes protect lives and property by setting standards for construction materials, techniques, and design procedures. Both performance codes and specification codes can be valuable hazard mitigation tools when used to require protection of new construction. Housing and sanitary codes establish minimum standards, one for occupancy and the other for waste disposal. Special standards may be established for hazard-prone areas.
5. **Disclosure:** Hazard mitigation goals can be accomplished by requiring sellers and real estate brokers to inform prospective buyers about the vulnerability of buildings and lots to specific hazards.
6. **Moratoria:** Ordinances or regulations can be applied to delay rebuilding after a disaster until mitigation priorities have been established. This can be done either before, or immediately following a disaster.
7. **Development Rights:** This type of regulation or policy may prevent development in hazardous areas by purchasing the development rights from the seller. The land can then be maintained as open space, or leased back for agricultural purposes. Another option is to transfer the development rights to another location that is safer. By increasing densities in the safer location in exchange for decreased densities in the hazard zone, both sellers and developers can realize a profit while accomplishing hazard mitigation at little or no cost to government.
8. **Open Space Planning:** By employing some of the same strategies as for acquisition of developed properties, jurisdictions can lessen the potential for natural hazards by acquiring vulnerable undeveloped areas.

### Persuasion and Encouragement

Other mitigation strategies are available to discourage new development in hazardous areas and encourage practices which are consistent with mitigation goals. These include:

1. **Incentives:** Financial incentives and disincentives, such as taxes, mortgage standards, and insurance credits can be used to conform with mitigation objectives. An example of a disincentive would be the denial of loans to would-be borrowers who cannot show that hazard-related standards are being met.
2. **Location:** Leading by example, such as a clear and consistent government policy aimed at preventing the location of public buildings in hazardous areas, may discourage private development in these locations. An extension of this policy would be the denial of public services, such as water, power, and sewage into these areas. Finding alternatives to repairing or rebuilding damaged public facilities which service hazard-prone areas may also set an example for the private sector.

### Public Education and Awareness

Public awareness programs are necessary to periodically inform and remind people about an area's hazards, and the measures necessary to minimize potential damage and injury. Tools in this category include:

1. **Public Relations:** Providing general information or establishing public consensus can be accomplished through a formal or informal public relations program.

2. **Public Information:** Information about hazards or mitigation efforts can be disseminated through the media.
3. **Public Hearings:** The public may obtain information and express opinions about mitigation efforts at public forums run by appropriate government agencies.
4. **Surveys and Polls:** Government agencies or other organizations can gather information about public support for mitigation efforts.
5. **Public Education:** Learning experiences, such as workshops and seminars, may be used to communicate hazard mitigation information to special target audiences.

### **Incorporating alternatives into a plan**

Perhaps one of the best ways to identify alternatives for solving hazard-related problems is to display the information in table format. For example:

#### **City of Vassar, Michigan.**

<b>GOAL: Reduce flood losses to the fullest extent possible.</b>
<b>OBJECTIVE(s): Reduce losses associated with Cass River flooding.</b>
<b>RANGE OF ALTERNATIVE SOLUTIONS:</b>
<u>ALTERNATIVE 1</u> Acquire floodway buildings/properties.
<u>ALTERNATIVE 2</u> Elevate floodway buildings/properties.
<u>ALTERNATIVE 3</u> Wet floodproof floodway buildings/properties.
<u>ALTERNATIVE 4</u> Dry floodproof floodway buildings/properties.
<u>ALTERNATIVE 5</u> Dredge/widen the Cass River to increase water flow.
<u>ALTERNATIVE 6</u> "Relocate" the Cass River by altering its present course.
<u>ALTERNATIVE 7</u> Build a floodwall or dike levee to protect floodway buildings/properties.
<u>ALTERNATIVE 8</u> Join the National Flood Insurance Program to provide limited financial relief for flood victims.
<u>ALTERNATIVE 9</u> Do nothing and absorb flood losses as they occur.

One of the alternatives that should be included in your community's assessments is a "do nothing" alternative, such as the last item in the table above. An alternative of this kind will help people understand the current risks from the hazard, and the need to take action of some kind to mitigate the impacts of that hazard.

In some cases, people may need some ideas with which to propose alternatives that may help mitigate local hazards. On the following pages is an extensive list of "mitigation strategies" for the many hazards that have been identified in the state of Michigan.

**To continue reading about the hazard mitigation planning process, turn to page 57.**

## POSSIBLE MITIGATION STRATEGIES – BY HAZARD

**Civil Disturbances** (prison or institutional rebellions, disruptive political gatherings, violent labor disputes, urban protests or riots, or large-scale uncontrolled festivities)

- Law enforcement training, staffing, and resource provision.
- Incident anticipation and planning, and video documentation of events for later study and use.
- Local law enforcement mutual aid, and support from the Michigan State Police and National Guard.
- Some suggest that design, management, integration, and lowered density of poor or blighted areas will reduce vandalism, crime, and some types of riot events. Crime Prevention Through Environmental Design (CPTED) is a field of planning that deals with this.
- Insure structures and property in risky areas.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, etc. that take into consideration emergency and security needs.

### **Drought**

- Storage of water for use in drought events (especially for human needs during extreme temperatures).
- Measures or ordinances to prioritize or control water use (especially when needed to fight fires).
- Encouragement of water-saving measures by consumers (especially during irrigation and farming).
- Anticipation of potential drought conditions, and preparation of drought contingency plans.
- Designs and plans for water delivery systems that include a consideration of drought events.
- Obtaining agricultural insurance.

**Earthquakes** – (biggest Michigan threats would be to pipelines, buildings that are poorly designed and constructed, and shelving, furniture, mirrors, gas cylinders, etc. within structures that could fall and cause injury or personal property damage)

- Adopt and enforce appropriate building codes.
- Use of safe interior designs and furniture arrangements.
- Obtain insurance.
- "Harden" critical infrastructure systems to meet seismic design standards for "lifelines."
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Extreme Temperatures**

- Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
- Increased coverage and use of NOAA Weather Radio.
- Housing/landlord codes enforcing heating requirements.
- Special arrangements for payment of heating bills.

### **Fire Hazards**

#### **Scrap Tire Fires**

- Policies for regulated disposal and management of scrap tires, and enforcement of regulations related to them (separation of stored scrap tires from other materials; limits on the size of each pile; minimum distances between piles and property lines; covering, chemically treating, or shredding tires to limit mosquito breeding; providing for fire vehicle access to scrap tire piles; training employees in emergency response operations; installation of earthen berms around storage areas; prevention of pools of standing water in the area; control of nearby vegetation; an emergency plan posted on the property; storing only the permitted volume of tires authorized for that site).
- Proper siting of tire storage and processing facilities (land use planning that recognizes scrap tire sites as a real hazard and environmental threat).
- Local awareness of scrap tire risk, training and preparedness of responders.
- Law enforcement to prevent illegal dumping of tires at the site.
- Pest-control measures for mosquitoes and other nuisances around scrap tire yards.

#### **Structural Fires**

- Code existence and enforcement.

- Designs that include the use of firewalls and sprinkler systems (especially in tall buildings, dormitories, attached structures, and special facilities).
- Public education and school programs (especially about the use of stoves, heaters, fireworks, matches/lighters, etc.).
- Landlords and families can install and maintain smoke detectors and fire extinguishers. Install a smoke alarm on each level of homes (to be tested monthly, with the batteries changed twice each year). Family members and residents should know how to use a fire extinguisher.
- Proper installation and maintenance of heating systems (especially those requiring regular cleaning, those using hand-loaded fuels such as wood, or using concentrated fuels such as liquid propane).
- Safe and responsible use of electric and "space" heaters (placed at least 3 feet from objects, with space near hot elements free of combustibles).
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, and recreation areas, and other appropriate sites.
- Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and proper storage of flammable items). Residents should inspect chimneys at least twice a year and clean them at least once a year.
- Posting of fire emergency telephone numbers in accessible places.
- Safe installation, maintenance, and use of electrical outlets and wiring.
- Education and practice of safe cigarette handling and disposal.
- Measures to reduce urban blight and associated arson (including CPTED?).
- Proper workplace procedures, training and exercising, and handling of explosive and flammable materials and substances.
- Pre-planned escape routes and fire alert responses.
- Improved and continuing training for emergency responders, and provision of equipment for them.
- Defensible space around structures in fire-prone wildland areas.
- Proper maintenance of power lines, and efficient response to fallen power lines.
- Transportation planning that provides roads, overpasses, etc. to maximize access and improve emergency response times to all inhabited or developed areas of a community. (Not just planning for average traffic volumes in the community.)
- Control of civil disturbances and criminal activities that could lead to arson.
- Enforced fireworks regulations.
- Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
- Condominium-type associations for maintaining safety in attached housing/building units or multi-unit structures.
- Obtaining insurance.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Wildfires**

- Proper maintenance of property in or near wildland areas (including short grass; thinned trees and removal of low-hanging branches; selection of fire-resistant vegetation; use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains securely away from windows or using heavy fire-resistant drapes; creating and maintaining a buffer zone (defensible space) between structures and adjacent wild lands; use of the fire department's home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on house; thorough cleaning-up of spilled flammable fluids; and keeping garage areas protected from blowing embers).
- Safe disposal of yard and house waste rather than through open burning.
- Use of fire spotters, towers, planes.
- Keep handy household items that can be used as fire tools; a rake, axe, hand/chainsaw, bucket and shovel. Install and maintain smoke detectors and fire extinguishers. Install a smoke alarm on each floor of buildings and homes. Test monthly and change the batteries two times each year. Teach family members how to use the fire extinguisher.
- Post fire emergency telephone numbers.
- Organizing neighborhood wildfire safety coalitions (to plan how the neighborhood could work together to prevent a wildfire).
- Residents should plan several escape routes away from their homes - by car and by foot.
- Use of structural fire mitigation systems such as interior and exterior sprinklers, smoke detectors, and fire extinguishers.
- Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and with any history of flammable substances stored, spilled, or dumped on them).
- Public education on smoking hazards and recreational fires.
- Proper maintenance and separation of power lines. Ask the power company to clear branches from power lines.
- Efficient response to fallen power lines.

- Training and exercises for response personnel.
- GIS mapping of vegetative coverage, for use in planning decisions and analyses through comparison with topography, zoning, developments, infrastructure, etc.
- Media broadcasts of fire weather and fire warnings.
- Local ordinances that require burn permits and restrict campfires and outdoor burning.
- Mutual aid pacts with neighboring communities.
- Prescribed burns and fuel management (thinning of flammable vegetation, possibly including selective logging to thin out some areas. Fuels cleared can be given away as firewood or chipped into woodchips for distribution.)
- The creation of fuel breaks (areas where the spread of wildfires will be slowed or stopped due to removal of fuels, or the use of fire-retardant materials/vegetation) in high-risk forest or other areas.
- Keeping roads and driveways accessible to vehicles and fire equipment—driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates around property should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly).
- Enclosing the foundations of homes and buildings rather than leaving them open and the underside exposed to blown embers or materials.
- Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
- Proper maintenance and storage of motorized equipment that could catch on fire.
- Proper storage and use of flammables, including the use of flammable substances (such as when fueling machinery). Store gasoline, oily rags and other flammable materials in approved safety cans. Stack firewood at least 100 feet away and uphill from homes.
- Avoid structures on hilltop locations (in addition, hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure) and use of proper setbacks from slopes (outside of the "convection cone" of intense heat which would be projected up the slope of the hill as a wildfire "climbs" it).
- Water supplies for emergency fire fighting in accordance with NFPA standards). For residents, identify and maintain an adequate outside water source such as a small pond, cistern, well, swimming pool or hydrant; have a garden hose that is long enough to reach any area of the home and other structures on the property; install freeze-proof exterior water outlets on at least two sides of the home and near other structures on the property. Install additional outlets at least 50 feet from the home; consider obtaining a portable gasoline powered pump in case electrical power is cut off.
- Obtaining insurance.
- Including wildfire safety information in materials provided by insurance companies to area residents.
- When Wildfire threatens, residents should be instructed to carry and listen to battery-operated radios for reports and evacuation information, and follow the instructions given by local officials. Cars should be backed into garages or parked in an open space facing the direction of escape, with doors and windows closed and the key in the ignition. Garage windows and doors should be closed but left unlocked. If residents have time, they can take steps to protect their homes by closing windows, vents, doors, venetian blinds and heavy drapes; removing lightweight curtains; shutting off gas at the meter; turning off pilot lights; opening fireplace damper; closing fireplace screens; moving flammable furniture into the center of the home away from windows and sliding-glass doors; and turning on a light in each room to increase the visibility of homes in heavy smoke. Outside, residents can seal attic and ground vents with pre-cut plywood or commercial seals, turn off propane tanks, place combustible patio furniture inside, connect the garden hose to outside taps, set up a portable gasoline-powered pump, place lawn sprinklers on the roof and near above-ground fuel tanks, wet the roof, wet or remove shrubs within 15 feet of the home, and gather fire tools.
- Residents should be instructed on proper evacuation procedures, such as wearing protective clothing (sturdy shoes, cotton or woolen clothing, long pants, a long-sleeved shirt, gloves and a handkerchief to protect the face); taking a Disaster Supplies Kit; and choosing a route away from fire hazards.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

## **Flooding Hazards**

### **Dam Failures**

- Ensuring consistency of dam Emergency Action Plan (EAP) with the local Emergency Operations Plan (EOP).
- Garnering community support for removal or repair of dams in disrepair.
- Regulate development in the dam's hydraulic shadow (where flooding would occur if there was a severe dam failure).
- Public awareness and warning systems.
- Obtaining insurance.
- Greater local support for/assistance with dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.

- Increased coverage and use of NOAA Weather Radio
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Constructing emergency access roads to dams.
- Pump and flood gate installation/automation.
- Real estate disclosure laws that identify a home's location within a dam's hydraulic shadow.
- Trained, equipped, and prepared search and rescue teams.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Riverine and Urban Flooding**

- Accurate identification and mapping of flood-prone areas.
- Flood plain management – planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
- Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
- Elevation of flood-prone structures above the 100-year flood level.
- Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
- Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Public awareness of the need for permits (MDEQ Part 31) for building in floodplain areas.
- Inclusion of safety strategies for flooded areas in driver education classes and materials.
- Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
- Dredging and clearance of sediment and debris from drainage channels.
- Protection (or restoration) of wetlands and natural water retention areas.
- Enforcement of basic building code requirements related to flood mitigation.
- Formation of a watershed council.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Obtaining insurance.
- Joining the National Flood Insurance Program (NFIP). **VERY IMPORTANT!**
- Participating in the Community Rating System (CRS).
- Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- Higher engineering standards for drain and sewer capacity.
- Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
- Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
- Farmland and open space preservation.
- Elevating mechanical and utility devices above expected flood levels.
- Improved/updated floodplain mapping.
- Real estate disclosure laws.
- Public education and flood warning systems.
- Monitoring of water levels with stream gauges and trained monitors.
- Increased coverage and use of NOAA Weather Radio.
- Training for local officials on flood fighting, floodplain management, floodproofing, etc.
- Anchoring of manufactured homes to a permanent foundation, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas.
- Road closures and traffic control in flooded areas.

- Trained, equipped, and prepared search and rescue teams.
- Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
- Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
- Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
- Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- Increasing functioning and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Purchase or transfer of development rights – to discourage development in floodplain areas.
- Stormwater management ordinances or amendments.
- Wetlands protection regulations and policies.
- Regional/watershed cooperation.
- Use of check valves, sump pumps and backflow preventers in homes and buildings.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Shoreline Flooding and Erosion**

- Accurate identification and mapping of flood-prone areas.
- Floodplain/coastal zone management – planning acceptable uses for areas prone to flooding (comprehensive planning, zoning, open space requirements, subdivision regulations, land use and capital improvements planning).
- Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
- Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
- Elevation of flood-prone structures above the 100-year flood level.
- Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
- Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- Enforcement of basic building code requirements related to flood mitigation.
- Obtaining insurance.
- Joining the National Flood Insurance Program (NFIP). **VERY IMPORTANT!**
- Participating in the Community Rating System (CRS).
- Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- Elevating mechanical and utility devices above expected flood levels.
- Public education and flood warning systems.
- Monitoring of water levels with stream gauges and trained monitors.
- Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas and erosion areas.
- Trained, equipped, and prepared search and rescue teams.
- Control and securing of debris, yard items, or stored objects in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
- Real estate disclosure laws.
- Increased coverage and use of NOAA Weather Radio.
- Road closures and traffic control in flooded areas.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Hazardous Material Incidents**

#### **Fixed Site Hazardous Material Incidents** (including explosions and industrial accidents)

- Maintaining an active and viable Local Emergency Planning Committee (LEPC).
- Developing and exercising site emergency plans and community response plans as required under SARA Title III.

- Development of Risk Management Plans for sites that manufacture, store, or handle hazardous materials, to comply with EPA regulations. (For guidance, see the EPA's CEPPO web site at <http://www.epa.gov/swercepp/acc-pre.html> .)
- Training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.
- Policies stressing the importance of safety above other considerations.
- Trained, equipped, and prepared site and local hazardous material emergency response teams.
- Compliance with/enforcement of Resource Conservation and Recovery Act (RCRA) standards.
- Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
- Hazardous material public awareness and worker education programs.
- Facility and community training and exercise programs.
- Brownfield cleanup activities.
- Identification of radioactive soils and high-radon areas
- Proper separation and buffering between industrial areas and other land uses.
- Location of industrial areas away from schools, nursing homes, etc.
- Evacuation plans and community awareness of them.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Public warning systems and networks for hazardous material releases.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
- Road closures and traffic control in accident areas.
- Trained, equipped, and prepared search and rescue teams.
- Compliance with all industrial, fire, and safety regulations.
- Insurance coverage.
- Enhanced security and anti-terrorist/sabotage/civil disturbance measures.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

#### **Hazardous Material Transportation Incidents**

- Improvements in driver education, traffic law enforcement, and transportation planning that balance the needs of hazardous material transporters with the safety of the general public.
- Improved design, routing, and traffic control at problem roadway areas.
- Long-term planning that provides more connector roads for reduced congestion of arterial roads.
- Railroad inspections and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
- Proper planning, design, maintenance of, and enhancements to designated truck routes.
- Enforcement of weight and travel restrictions for truck traffic.
- Training, planning, and preparedness for hazardous material incidents along roadways and railways (in addition to fixed site emergencies).
- Public warning systems and networks.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
- Use of ITS (intelligent transportation systems) technology.
- Compliance with and enforcement of USDOT and MDOT regulations regarding hazardous materials transport.
- Locating schools, nursing homes, and other special facilities away from major hazardous material transportation routes.
- Road closures and traffic control in accident areas.
- Trained, equipped and prepared local hazardous materials emergency response teams.
- Trained, equipped, and prepared search and rescue teams.
- Evacuation plans and community awareness of them.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

#### **Infrastructure Failures**

- Proper location, design, and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze).
- Burying electrical and phone lines, where possible, to resist damage from severe winds, lightning, ice, and other hazards.
- Redundancies in utility and communications systems, especially "lifeline" systems.
- Mutual aid assistance for failures in utility and communications systems (including 9-1-1).
- Alternative 9-1-1 access through radio operators whose homes are identified through special markings.

- Programs/networks for contacting elderly or homebound persons during periods of infrastructure failure, to assess whether they have unmet needs.
- Separation and/or expansion of sewer system to handle anticipated stormwater volumes.
- Use of generators for backup power at critical facilities.
- Regular maintenance and equipment checks.
- "Rolling blackouts" in electrical systems that will otherwise fail completely due to overloading.
- Replacement or renovation of aging structures and equipment (to be made as hazard-resistant as economically possible).
- Protecting electrical and communications systems from lightning strikes.
- Tree-trimming programs to protect utility wires from falling branches. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
- Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800-482-7171).
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Nuclear Attack**

- Community awareness of designated fallout shelters and attack warning systems.
- Developing and promoting workable population protection plans (evacuation and in-place sheltering plans, as appropriate).
- Construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
- Using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including enemy attack).
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Nuclear Power Plant Accidents**

- Proper awareness of, training on, and implementation of radiological emergency procedures (to include both primary and secondary Emergency Planning Zones, as appropriate).
- Community awareness of designated shelters and accident warning systems.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including plant accidents).
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Oil and Natural Gas Well Accidents**

- Community and operator compliance with industry safety regulations and standards.
- Awareness of hydrogen sulfide gas dangers and personal protection actions for these dangers.
- Using buffer strips to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Contingency plans for worker and public protection, including the inclusion of rescue and evacuation procedures for well hazard areas in the local emergency operations plan.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Pipeline Accidents (Petroleum and Natural Gas)**

- Locating pipelines away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible.
- Increasing public awareness of pipeline locations and appropriate emergency procedures.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800-482-7171).
- Proper pipeline design, construction, maintenance and inspection.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Public Health Emergencies**

- Encouraging residents to receive immunizations against communicable diseases.
- Improving ventilation techniques in areas/facilities prone to crowding, or that may involve exposure to contagion or noxious atmospheres.
- Increasing public awareness of radon dangers and the prevention efforts that can be taken to reduce concentrations of radon in homes and buildings.
- Maintaining community water and sewer infrastructure at acceptable operating standards.
- Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Maintaining a community public health system with sufficient disease monitoring and surveillance capabilities to adequately protect the population from large-scale outbreaks.
- Increasing public awareness of the causes, symptoms, and protective actions for disease outbreaks and other potential public health emergencies.
- Community support of free or reduced-expense clinics and school health services.
- Preventing public contact with contaminated sites or waters (including floodwaters).
- Brownfield and urban blight clean-up activities.
- Pollution control, enforcement, and cleanup; proper disposal of chemicals and scrap materials.
- Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
- Separation of storm and sanitary sewer systems.

### **Sabotage/Terrorism/Weapons of Mass Destruction (WMD)**

- Development of a thorough community risk and threat assessment that identifies potential vulnerabilities and targets for a sabotage/terrorism/WMD attack.
- Alertness, awareness, and monitoring of organizations and activities that may threaten the community.
- Implementing school safety and violence prevention programs.
- Providing legitimate channels of political and public expression.
- Heightening security at public gatherings, special events, and critical community facilities and industries.
- Using laminated glass and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- Greater awareness of, and provision for, mental health services in schools, workplaces, and institutional settings.
- Training, planning, and preparedness by local law enforcement and other responders for terrorist/sabotage/WMD attacks.
- The development and testing of internal emergency plans and procedures by businesses and organizations.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- Establishing avenues of reporting (and rewards) for information preventing terrorist incidents and sabotage.
- Consistent use of computer data back-up systems and anti-virus software.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Subsidence**

- Identification, mapping, and preventing or limiting development in old mining areas or geologically unstable terrain.
- Filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.
- Hydrological monitoring of groundwater levels in subsidence-prone areas.
- Insurance coverage for subsidence hazards.
- Real estate disclosure laws.
- Community awareness of subsidence risks and effects.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Thunderstorm Hazards**

- Increased coverage and use of NOAA Weather Radio.
- Producing and distributing family emergency preparedness information relating to thunderstorm hazards.
- Public education and awareness of thunderstorm dangers.
- Training and increased use of weather spotters.
- Public early warning systems and networks.
- Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)

- Buried/protected power and utility lines.
- Inclusion of safety strategies for severe weather events in driver education classes and materials.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Hail**

- Using structural bracing, window shutters, laminated glass in window panes, and hail-resistant roof shingles to minimize damage to public and private structures.

### **Lightning**

- Using surge protectors on critical electronic equipment.
- Installing lightning protection devices on the community's communications infrastructure.

### **Severe Winds and Tornadoes**

- Using appropriate wind engineering measures and construction techniques (e.g. structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced entry and garage doors, window shutters, waterproof adhesive sealing strips, and interlocking roof shingles) to strengthen public and private structures against severe wind damage.
- Proper anchoring of manufactured homes and exterior structures such as carports and porches.
- Establishing safe and appropriate locations for temporary debris disposal sites.
- Securing loose materials, yard, and patio items indoors or where winds cannot blow them about.
- Construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.

### **Transportation Accidents**

- Improvements in driver education, traffic law enforcement, and transportation planning that balance needs of public transportation conveyers with the safety of the general public.
- Improved design, routing, and traffic control at problem roadway areas.
- Railroad inspections and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
- Long-term planning that provides more connector roads for reduced congestion of arterial roads.
- Use of designated truck routes.
- Enforcement of weight and travel restrictions.
- Use of ITS (intelligent transportation systems) technology.
- Airport maintenance, security, and safety programs.
- Marine safety and general boater awareness programs.
- Commercial operator training and skill enhancement programs.
- Training, planning, and preparedness for mass-casualty incidents involving all modes of public transportation.
- Trained, equipped, and prepared search and rescue teams.

### **Winter Weather Hazards**

- Increased coverage and use of NOAA Weather Radio.
- Producing and distributing family emergency preparedness information relating to severe winter weather hazards.
- Including safety strategies for severe weather events in driver education classes and materials.
- Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
- Buried/protected power and utility lines.
- Establishing heating centers/shelters for vulnerable populations.
- Organizing outreach to isolated, vulnerable, or special-needs populations.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

### **Ice and Sleet Storms**

- Home and public building maintenance to prevent roof and wall damage from "ice dams."

### **Snowstorms**

- Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and storage, etc.
- Farmer preparedness to address livestock needs/problems.
- Pre-arranging for shelters for stranded motorists/travelers, and others.

- Maintaining adequate road and debris clearing capabilities.
- Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.




---



---

## Summary

This section has provided information to assist in developing specific alternative solutions to identified community hazard-related problems. The alternatives should be developed using input from the public as well as community planners, subject matter experts from appropriate governmental agencies, relevant business and trade associations, and other appropriate community-based entities. Public involvement provides the best available information and ideas for solving problems.

The identified range of solutions should be consistent with and work toward implementation of the community's stated goals and objectives.

# Step 4

## Select Evaluation Criteria

---

### Overview

---

---

This section focuses on the selection of appropriate criteria against which the proposed alternatives will be evaluated.

### Selecting a set of criteria

Criteria that support the goals of mitigation planning, as well as the goals of other community planning efforts, must be selected. Criteria should be determined by generating a range of options, analyzing each, and selecting the preferred choices. A common method of selection is to determine the probable consequences associated with one set of criteria over another.

The acceptability of the proposed alternative mitigation measures can then be judged and selected against the chosen criteria.



Common mitigation criteria stipulate that selected measures be: 1) economically justifiable; 2) technically feasible; 3) socially equitable; and 4) environmentally sound. If, for example, relocation of structures is the chosen mitigation measure, the following conditions would have to be met in order to satisfy these criteria:

- The cost of relocation must be less than the cost of the repetitive repairs that would be necessary if there were no relocation.
- The structures must be able to be moved from their present location to a suitable site.
- The relocation must be acceptable to those who are to participate.
- The relocation must be affordable to all it affects, and not discriminate against those who are unable to bear the cost of either moving the structure, or finding comparable housing.
- In the case of a public facility, such as a fire station, the relocation should not result in an inequitable distribution of fire protection services.
- The relocation project must meet appropriate environmental regulations, and not cause any adverse effects.

---

---

### Summary

Selecting the appropriate evaluation criteria will help ensure that the proposed range of alternative mitigation measures will be evaluated in a manner that best reflects the values, policies and desires of the community. Once these criteria have been applied, community officials should have a better idea as to which alternatives are the most meritorious and desirable.

#### Where are we now?



- Step 1: Identify hazards and risks**
- Step 2: Define goals and objectives**
- Step 3: Identify alternatives for solving problems**

---

- Step 4: Select evaluation criteria**

---

- Step 5: Select feasible mitigation strategies**
- Step 6: Prepare a draft plan**
- Step 7: Prepare final plan**
- Step 8: Implement plan**
- Step 9: Monitor and periodically revise plan**

# Step 5

## Select Feasible Mitigation Strategies

### Overview

After comparing the preferred alternatives against the criteria to ensure that they will achieve the chosen goals and objectives, the preferred alternatives should be recommended to the appropriate governing officials in the community. These officials can then conduct both in-house and public reviews, incorporate suitable recommendations, and formally adopt the necessary activities. After the preferred alternatives have been selected and approved, the draft mitigation plan can then be prepared. The plan should lay out detailed steps to achieve objectives and support each goal.

#### Where are we now?



- Step 1: Identify hazards and risks**
- Step 2: Define goals and objectives**
- Step 3: Identify alternatives for solving problems**
- Step 4: Select evaluation criteria**

---

- Step 5: Select feasible mitigation strategies**

---

- Step 6: Prepare a draft plan**
- Step 7: Prepare final plan**
- Step 8: Implement plan**
- Step 9: Monitor and periodically revise plan**

### Selection matrix for decision makers

Perhaps one of the best ways to compare alternatives for solving hazard-related problems is to display the information in table format. For example:

**Evaluation Table for Alternative Mitigation Strategies**

GOAL: To reduce loss of life and property due to flooding.	EVALUATION CRITERIA						
	Cost Effectiveness:			Technically Feasible	Acceptable to Community/ Potential Participants	Non-Discriminatory (EO 12898-Compliant)	Results in Equitable Distribution of Services
	Costs	Benefits	Net				
OBJECTIVE(s): Reduce structural losses associated with Poseidon River flooding.	RANGE OF ALTERNATIVE SOLUTIONS:						
<u>ALTERNATIVE 1</u> Acquire floodway buildings/properties.							
<u>ALTERNATIVE 2</u> Elevate floodway buildings/properties.							
<u>ALTERNATIVE 3</u> Wet floodproof floodway buildings/properties.							
<u>ALTERNATIVE 4</u> Dry floodproof floodway buildings/properties.							
<u>ALTERNATIVE 5</u> Dredge/widen the Poseidon River to increase water flow.							
<u>ALTERNATIVE 6</u> Relocate the Poseidon River by altering its present course.							
<u>ALTERNATIVE 7</u> Build a floodwall or dike levee to protect floodway buildings/properties.							
<u>ALTERNATIVE 8</u> Join the National Flood Insurance Program to provide limited financial relief for flood victims.							
<u>ALTERNATIVE 9</u> Do nothing and absorb flood losses as they occur.							

# Step 6

## Prepare a Draft Plan

The beginning sections of a plan will typically include all the information that has led to the mitigation actions that the plan is recommending. This means that a version of your hazard analysis document will either be included in the hazard mitigation plan, or will be referred to by the plan. Having separate documents, with the most current version of the hazard analysis linked to the plan as an attachment, may make it easier for each document to receive community support and official approval. If something needs to be revised in one of the documents, it is usually easier to gain official adoption of separate documents with limited changes than it is to gain approval for a larger, combined document with many changes throughout.

### Where are we now?

- Step 1: Identify hazards and risks**
- Step 2: Define goals and objectives**
- Step 3: Identify alternatives for solving problems**
- Step 4: Select evaluation criteria**
- Step 5: Select feasible mitigation strategies**

---

- Step 6: Prepare a draft plan**

---

- Step 7: Prepare final plan**
- Step 8: Implement plan**
- Step 9: Monitor and periodically revise plan**

The draft mitigation plan will be written based on the community's hazard analysis, and will also usually have incorporated various recommendations and input from those who helped review the hazard analysis. The plan puts the various goals, objectives, and action steps into a clearly written format, which will be submitted to the governing body of the community for official adoption. In certain cases, the plan may also serve as the basis for the selection and approval of specific projects for funding under grant programs such as the Flood Mitigation Assistance Program (FMAP), Hazard Mitigation Grant Program (HMGP), or contributions from corporate/private or nonprofit organizations.

Through feedback and revisions, the draft plan will be refined into a final plan.

### What constitutes a plan?

A plan documents:

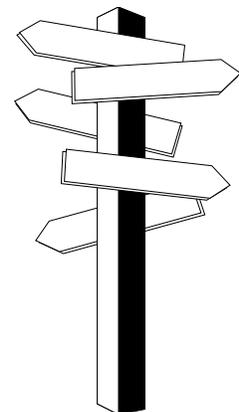
What is (the present)  
(see Step 1)



What ought to be (the desired future); and,  
(see Step 2)



How you get there?  
(Steps 3-8)



A helpful way to create an organized plan could be to adapt the Vulnerability Assessment Table, if you have used that format (see page 40) with extra spaces containing objectives that match each of the identified issues. An example appears below.

**(name of community) Action Steps Development: (year)**  
**(FOR EXAMPLE)**

<b>HAZARD</b>	<b>Sector Issues</b>	<b>Sector Actions Needed</b>	<b>Life Safety Issues</b>	<b>Life Safety Actions Needed</b>
<b>1. (FOR EXAMPLE): Riverine Flooding</b>	<ul style="list-style-type: none"> <li>a. 80% of Pine Twp. residents are elderly</li> <li>b. Only bridge in Village of Stormy is floodprone</li> <li>c. Seafarer Twp. has summer population increase of 35,000 people</li> <li>d. City of Rolling Hills has many businesses in Pine River floodplain</li> </ul>	<ul style="list-style-type: none"> <li>a. Door-to-door warning of elderly and tourists/seasonal residents</li> <li>b. Stage emergency equipment on both sides of river in Village of Stormy</li> <li>c. Volunteer assistance to assist Rolling Hills businesses in elevating essential items</li> </ul>	<ul style="list-style-type: none"> <li>a. Flash flood on Pine River could result in many deaths and injuries</li> <li>b. Large number of elderly residents in county makes warning difficult</li> <li>c. County has limited water rescue capability</li> <li>d. Propane tanks in floodplain not anchored</li> </ul>	<ul style="list-style-type: none"> <li>a. Develop river monitoring system</li> <li>b. Work with aging network to warn elderly residents of flooding</li> <li>c. Develop better water rescue capability within Sheriff Dept. and local fire departments</li> <li>d. Inspect propane tanks to ensure proper</li> </ul>

<b>Loss of Function Issues</b>	<b>Loss of Function Actions Needed</b>	<b>Recovery Issues</b>	<b>Recovery Actions Needed</b>
<ul style="list-style-type: none"> <li>a. No backup generator in police station in City of Rolling Hills</li> <li>b. Rolling Hills fire station located in floodplain</li> <li>c. Several sewage lift stations in Pine Twp. are prone to flood damage</li> <li>d. Gas main under Pine River bridge</li> </ul>	<ul style="list-style-type: none"> <li>a. Backup generator for Rolling Hills police station</li> <li>b. Pre-stage fire equipment out of floodplain in Rolling Hills/sandbag station</li> <li>c. Floodproof sewage lift stations in Pine Twp.</li> <li>d. Floodproof Pine River bridge gas main</li> </ul>	<ul style="list-style-type: none"> <li>a. Damaged public facilities cannot be used for up to two weeks after flood</li> <li>b. Flooded residents must be temporarily housed for up to two weeks</li> <li>c. Potential for business closures due to repetitive flood damage</li> </ul>	<ul style="list-style-type: none"> <li>a. Floodproof, elevate or relocate floodprone public facilities</li> <li>b. Develop post-flood temporary housing plan</li> <li>c. Assist businesses in implementing flood mitigation measures to prevent repetitive flood damage</li> </ul>

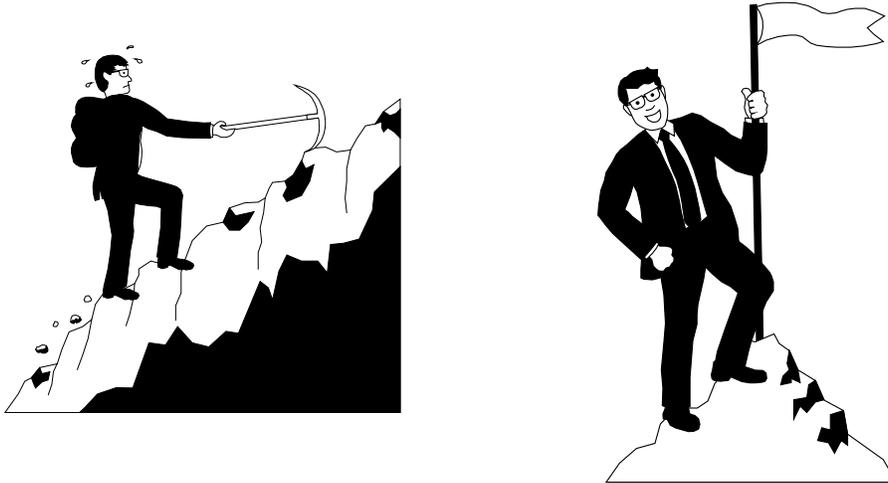
<b>Public Health Issues</b>	<b>Public Health Actions Needed</b>	<b>Economic Issues</b>	<b>Economic Actions Needed</b>
<ul style="list-style-type: none"> <li>a. Flooding contaminates private wells in Pine Twp.</li> <li>b. Flooded buildings become contaminated</li> <li>c. Mosquito, rodent and snake populations swell after flooding</li> <li>d. Flood-soaked debris gets piled up for long periods of time</li> </ul>	<ul style="list-style-type: none"> <li>a. Post-flood well monitoring program</li> <li>b. Post-flood advisories on how to decontaminate buildings</li> <li>c. Post-flood vector control program</li> <li>d. Expedited post-flood debris pickup program, to include private haulers</li> </ul>	<ul style="list-style-type: none"> <li>a. Businesses in Pine River floodplain must close for up to two weeks</li> <li>b. Post-flood recovery and cleanup costs are very high</li> <li>c. Public facilities in Rolling Hills incur repetitive damage</li> </ul>	<ul style="list-style-type: none"> <li>a. Develop flood mitigation plan to reduce future flood losses</li> <li>b. Budget for flood recovery and cleanup</li> <li>c. Floodproof, elevate or relocate floodprone public facilities</li> <li>d. Maximize participation in NFIP</li> </ul>

## Preparing the draft plan

In Steps 1, the “What Is” portion of the plan was addressed. Problems were identified, assessed, and prioritized through the completion of a community hazard analysis. In step 2, the “What Ought to Be” portion of the plan was addressed. Goals and objectives were defined so as to improve current conditions and reshape them toward a vision of the way things should be in the future. The “How To Get There” portion of the plan followed in successive steps. Alternatives were identified for solving the community's problems, evaluation criteria were selected and applied, the best alternatives were selected for implementation from that formal analysis. Now all of this information must be presented and approved by those who can actually implement these mitigation strategies in the community. A draft plan will be reviewed by all these actors and stakeholders, and revised into a form that they can agree to take action upon. Such revisions are part of the next step in the mitigation planning process – the preparation of a final plan.

### NOTE ON FORMAT ALTERNATIVES:

See Appendix A for a possible format that can be used for a stand-alone mitigation plan. The sample plan in Appendix A will also illustrate the amount of detail that may exist in a good mitigation plan. The Appendix A format is well suited for many communities, as it can be developed in segments over time. If your plan includes an element for the federal Flood Mitigation Assistance Program (FMAP), see Appendix C for additional guidance. Appendix D outlines a format for integrating hazard mitigation concepts and strategies into the community's Comprehensive Plan structure. This is, for all intents and purposes, the highest level of hazard mitigation planning, as it integrates hazard mitigation into the many other functional elements in the plan that collectively help shape and mold a community's development pattern. A mitigation plan developed in this manner stands the greatest chance of making a lasting mark on the community. However, it is also the most difficult plan development method due to the many organizations involved and the many varied functional areas that must be addressed. Hazard mitigation is one of many subjects dealt with in the comprehensive plan; hence, the completion time frame is often much longer than it would be for a stand-alone document. However, the fact that this method effectively “institutionalizes” hazard mitigation into the community planning and development process makes this format an attractive one for many communities—especially those that are rapidly growing. See page 10 for information on additional planning resources.



**POSITIVE ATTITUDE, PERSEVERANCE, AND HARD WORK ARE KEY COMPONENTS OF ANY SUCCESSFUL PLANNING EFFORT!**

---

## Summary

In this section, specific alternatives were selected and a draft plan format was suggested. (Note: the format chosen for the draft plan may change as the final document is prepared.)

# Step 7

## Prepare Final Plan

---

### Overview

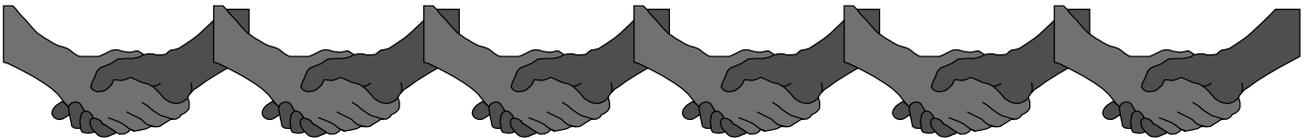
---

The final plan is the document outlining present issues (“what is”), what you would like to do to resolve the issues (“the desired future”) and how you will achieve that desired future. Since the plan is to be adopted by the governing body, it will become official policy.

Previous sections of this workbook have taken you through the following processes:

- ✓ Identifying hazards and risks
- ✓ Defining goals and objectives;
- ✓ Identifying alternatives
- ✓ Selecting evaluation criteria
- ✓ Selecting alternatives
- ✓ Preparing the draft plan.

Once these steps have been completed, it is time to put all of these ideas together and develop the final plan.



**This represents the most critical stage of the entire planning process.** The political leaders and the public will either agree with your plan and approve it, or disagree with it and reject it. The main difference between the draft and final plan is that the final plan should outline public involvement activities, in addition to discussing the process used to select specific mitigation alternatives.

### Planning priorities

The final plan will assign priorities for specific hazards and mitigation measures. You will probably base your priorities on risk. For example, structures in the floodway should have a higher priority than those in the flood fringe. Also, measures that complement other community planning activities (e.g., park land acquisition) may be given higher priority than those that do not. Priorities will also be based on available funding and the stipulations attached to those funding mechanisms.

### “Who writes the final plan?”

This is one place where the Community Planner or Planning Consultant can have a big impact. The Planner will look at everything you’ve completed so far and tie it all together in the final plan. The final document should include not only the technical information in assessing hazard risks but also should incorporate and address all the issues, ideas and perceptions which the planning team and the public have raised. Your chances for gaining the consent of the community and plan approval will obviously be much greater if issues have been addressed up front, which means having the public actively participating.

---

### Summary

Finalizing the plan is the most important stage of the planning process. Community leaders, home and business owners, and other citizens agree that the plan is the direction which the community “ought to take.” It becomes the local policy which establishes the direction of, and impacts, the future direction of the community’s development processes and practices.

#### Where are we now?



- Step 1: Identify hazards and risks**
- Step 2: Define goals and objectives**
- Step 3: Identify alternatives for solving problems**
- Step 4: Select evaluation criteria**
- Step 5: Select feasible mitigation strategies**
- Step 6: Prepare a draft plan**

---

- Step 7: Prepare final plan**

---

- Step 8: Implement plan**
- Step 9: Monitor and periodically revise plan**

# Step 8

## Implement Plan

---

### Overview

---

---

Simply stated, if a plan cannot be put into action, it's virtually worthless!

This chapter recommends strategies to take the planning concepts and make them work. It also suggests practical ideas used by other communities to implement hazard mitigation plans.

### “What good is a plan if it just sits on the shelf and collects dust?”

The plan won't work unless it can be implemented effectively. This section suggests ways to do just that—to translate goals and objectives into actions.

### Suggestion No. 1

**Develop an Action Agenda** that contains the following information:

#### WHAT

Identify specific actions that need to be taken to achieve the goals and objectives and implement the recommended alternatives in the plan.

#### WHO

Identify who is responsible for initiating and implementing each action. One person or department could take the lead role (zoning administrator, planning department or public works department), but often the work will be shared by a number of other individuals, and agencies.

Identify all of the involved individuals and agencies up front and designate their responsibilities in the process. In addition, make sure each is informed of the project and the project timeline.

#### HOW

Identify how each action will be taken. Identify the tool or method for implementing the action. For example, floodproofing a commercial building means hiring an engineering or architectural consultant develop floodproofing concepts for each building, meetings with the property owner, regulatory review of each design concept, developing final plans and specifications for the concept, and implementing the concept through construction.

#### WHEN

Identify when to take each action. Determine the timeframe and the sequence of events, particularly if there are fixed deadlines. For example, a hearing date may be scheduled to gather public comments on an environmental impact statement for a proposed water treatment facility to be located on the watershed. In other cases, you may only need to set general deadlines. One action may not begin until another is completed. A general plan or guide, which considers all the timeframes, will help plan and implement work.

### Where are we now?



- Step 1: Identify hazards and risks**
- Step 2: Define goals and objectives**
- Step 3: Identify alternatives for solving problems**
- Step 4: Select evaluation criteria**
- Step 5: Select feasible mitigation strategies**
- Step 6: Prepare a draft plan**
- Step 7: Prepare final plan**

---

- Step 8: Implement plan**

---

- Step 9: Monitor and periodically revise plan**

(Note: A table format can be used to organize the information, if so desired.) For example:

Action	Who	How	When
Seek state and national historic designation for businesses.	Planning Director Historical Society Consultant	Develop inventory of structures and submit to State Historical Office	Spring 1999
Seek federal \$\$\$ assistance for floodproofing downtown businesses.	Mayor Community Dev. Director EMD/MSP Emergency Manager	Develop and submit application	Application deadline August 22, 1999
Revise zoning ordinance to include more restrictive river protection measures.	Planning Director Zoning Administrator Mayor MDNR	Prepare analysis of zoning options and recommendations	Summer, 1999
Seek \$\$\$ assistance from MDNR to create more open space and parks along riverfront.	Planning Director Community Dev. Director Mayor MDNR	Prepare open space study. Develop and submit application.	Summer, 1999 Application deadline September 3, 1999
Seek federal \$\$\$ assistance to acquire fire station subject to repetitive flooding.	Mayor Community Dev. Director EMD/MSP Emergency Manager	Develop and submit application.	Application deadline August 22, 1999

An Action Agenda (whether in table or narrative format) is vitally important to the successful implementation of the plan. If the person(s) and/or agency(ies) responsible for implementing parts of the plan are identified, and general completion timeframes for actions are established, implementation will be smoother and more effective. It may be necessary to make adjustments as issues come up, but at least there will be a general strategic framework to work from.

## Suggestion No. 2

Implement some inexpensive and highly-visible **demonstration** projects to get the mitigation effort moving.

After you have developed and adopted your Action Agenda, select a few easy projects to implement quickly. Such tangible results will demonstrate to the community that the plan is being taken seriously by community leaders. This strategy was used successfully in the City of Vassar. A few residential flood acquisitions were funded and implemented quickly to overcome public skepticism and to create interest and induce more people to support the program.

Although quickly implementing some inexpensive and visible projects makes good political sense in helping the mitigation effort progress, make sure that you don't lose sight of more complex projects. These may be more important in reducing the community's overall risk and vulnerability.

## Suggestion No. 3

Develop a **newsletter** or a **periodic news release plan** to inform citizens of the mitigation program as projects are implemented or completed. When implementing a hazard mitigation program, keep the flow of communication open between government and the affected and interested public. The public needs to know how regulations affect their property. A newsletter or news release strategy can help communication with the community, thereby precluding the need to visit each individual property owner personally on each issue.



## Suggestion No. 4

Hire or appoint a **Hazard Mitigation Coordinator**.

As your community begins to implement numerous mitigation projects, consideration should be given to hiring or appointing a Hazard Mitigation Coordinator to manage and oversee the flow of work. This Coordinator would work with contractors, act as liaison between property owners and government, write newsletters and conduct other public information duties, and perform other duties related to project development and implementation.

The Coordinator selected should have good facilitating skills and understand the goals and objectives of the community-wide hazard mitigation program. Understanding the program's overall goals and objectives and believing in the underlying principles of hazard risk management are key for the person in this position because he or she will have to personally communicate these concepts to members of the community.

---

---

### Summary of suggestions to help implement the plan:

- Develop an **Action Agenda** within the plan to better focus your plan implementation strategies.
- Implement some inexpensive and/or visible **demonstration** projects to overcome skepticism to get the whole mitigation effort moving.
- Develop a **newsletter** or a **periodic news release plan** to inform citizens once you begin implementing or finish completing various aspects of the mitigation program.
- Hire a **Hazard Mitigation Coordinator** to facilitate your mitigation projects.



# Step 9

## Monitor and Periodically Revise Plan

---

### Overview

---

---

#### “Why monitor the plan?”

Communities and plans are both dynamic entities. Communities grow and change over time. In order to be effective, plans must also grow and evolve to avoid becoming void and obsolete. Planning doesn't stop once the plan is initiated. If a hazard mitigation program is to succeed, it is important to update the plan periodically.

This section suggests how to develop a monitoring system to update the community hazard mitigation plan. A monitoring system also helps keep your plan running on schedule even when there are other jobs or duties to perform.

#### Where are we now?



- Step 1: Identify hazards and risks**
  - Step 2: Define goals and objectives**
  - Step 3: Identify alternatives for solving problems**
  - Step 4: Select evaluation criteria**
  - Step 5: Select feasible mitigation strategies**
  - Step 6: Prepare a draft plan**
  - Step 7: Prepare final plan**
  - Step 8: Implement plan**
- 
- Step 9: Monitor and periodically revise plan**
- 

#### “I don't have the time to monitor plans; I have other things to do!”

Local officials wear different hats and are responsible for multiple assignments. Few have the luxury of focusing on one assignment, task or plan. Therefore, the community must adopt a monitoring system to keep people, and the plan, on task and on time.

One popular system uses a project work schedule to identify the steps and timeline for implementing the mitigation project as well as people's contribution to project implementation (known as the “critical path method”). While you may make adjustments throughout the process as new issues emerge and evolve, this method ensures that you remain on course in implementing your program. The person responsible for overseeing the mitigation program can maintain the work schedule.

#### Annual report can help chart progress

Another suggestion would be to write a brief progress report annually to present to the governing body. This could include recommendations to achieve goals and objectives of the plan, or explain the need to change them in light of new issues and circumstances.

The Community Planner or Hazard Mitigation Coordinator can prepare the report. The National Flood Insurance Program (NFIP)/Community Rating System (CRS) progress report format provides a simple outline that can be followed in preparing an annual progress report.

#### Community Rating System report format

- A review of the goals and objectives of original plan.
- A review of any disasters or emergencies that occurred during the year.
- A review of each element or objective of the original plan, including what was accomplished the previous year.
- A discussion of why any objectives were not reached or why implementation is behind schedule.
- Recommendation for new projects or revised objectives.

---

---

## Summary of suggestions for monitoring and evaluating the Hazard Mitigation Plan:

- Because the local community is often involved in administering numerous other programs, it is important to develop a monitoring system (e.g. project work schedule) to help remind each participant of their part in carrying out the plan as well as when associated tasks should be completed.
- Have the Community Planner, Hazard Mitigation Coordinator, or other appropriate individual prepare a brief, annual progress report to the governing body, with recommendations on how progress can be made to achieve goals and objectives of the plan or whether they should be changed based on new issues or new information (see CRS format).



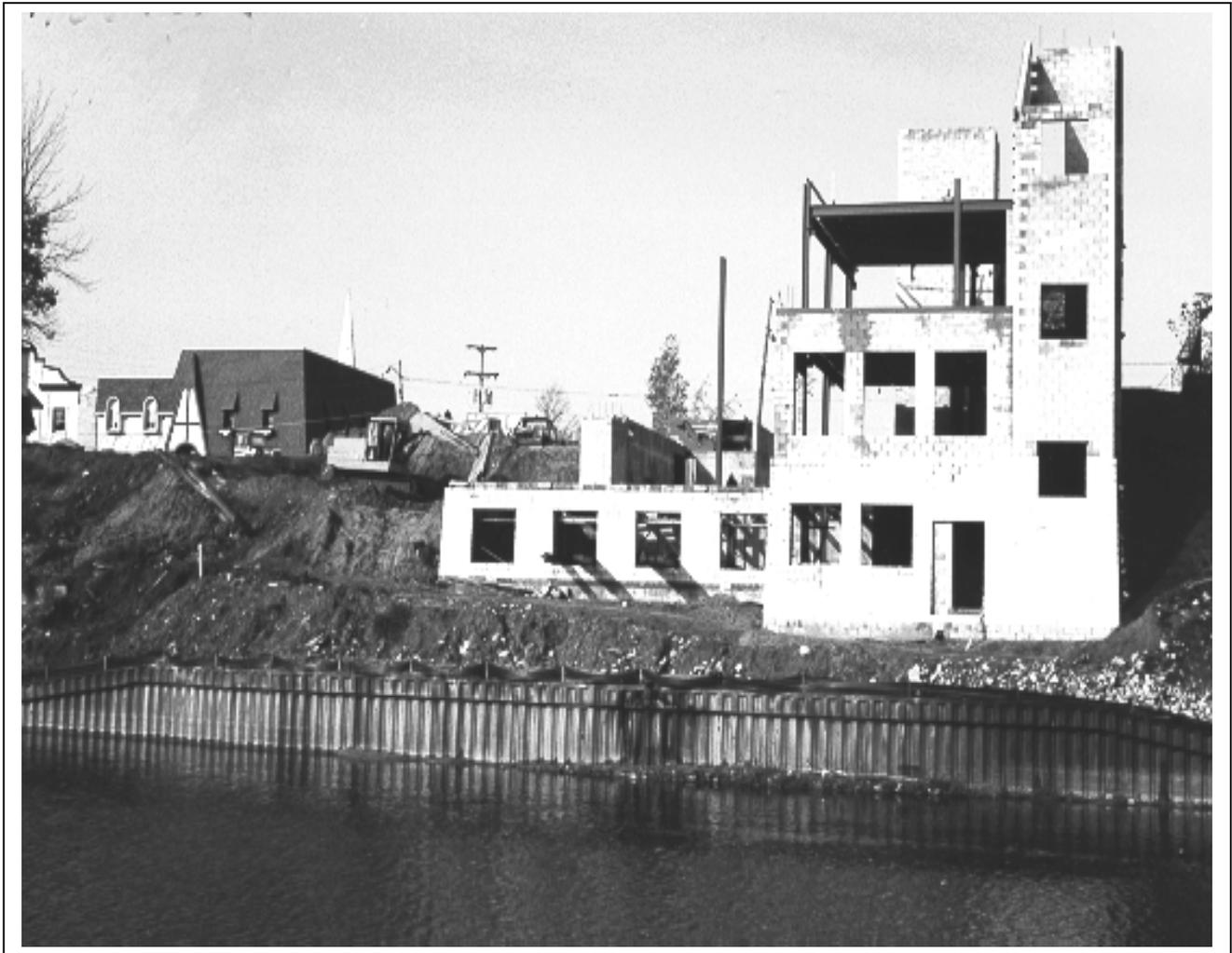
# Appendix A - Sample Plan

---

## **SAMPLE PLAN FOR THE (INSERT COMMUNITY NAME)**

### **Introduction to the Sample Plan**

The Sample Plan outlined in this Appendix provides as an example of what might be included in a stand-alone local hazard mitigation plan. The suggested format and contents are not requirements, but using them will result in a plan that covers hazard mitigation thoroughly and fits well with the Michigan Hazard Mitigation Plan. The Sample Plan is written from an integrated, all hazard approach. Instructional language has been placed in shaded boxes for easy identification.



## Sample Plan Table of Contents

<b>ACKNOWLEDGEMENTS.....</b>	<b>11</b>
<b>INTRODUCTION TO THE SAMPLE PLAN.....</b>	<b>68</b>
<b>SAMPLE LETTER OF TRANSMITTAL FROM CHIEF ELECTED OFFICIAL.....</b>	<b>70</b>
<b>SAMPLE PREFACE .....</b>	<b>71</b>
<b>SAMPLE ACKNOWLEDGMENTS.....</b>	<b>72</b>
<b>SAMPLE EXECUTIVE SUMMARY .....</b>	<b>73</b>
<b>SAMPLE HAZARD MITIGATION PLAN ADOPTION RESOLUTION.....</b>	<b>74</b>
<b>SAMPLE HAZARD MITIGATION PLAN.....</b>	<b>75</b>
<b>PURPOSE.....</b>	<b>75</b>
<b>PLANNING PROCESS.....</b>	<b>75</b>
<b>IDENTIFICATION OF HAZARDS AND RISKS.....</b>	<b>76</b>
<b>HAZARD MITIGATION GOALS AND OBJECTIVES .....</b>	<b>77</b>
<b>IDENTIFICATION OF ALTERNATIVES FOR SOLVING PROBLEMS.....</b>	<b>78</b>
<b>EVALUATION CRITERIA USED TO SELECT AND PRIORITIZE ALTERNATIVES:.....</b>	<b>79</b>
<b>SELECTION OF ALTERNATIVES (FEASIBLE MITIGATION STRATEGIES) .....</b>	<b>79</b>
<b>RECOMMENDED MITIGATION ACTIONS.....</b>	<b>79</b>

## Sample Letter of Transmittal from Chief Elected Official

(Date)

(Organization)  
(Name)  
(Title)  
(Street Address)  
(City), MI (Zip Code)

Dear Mr./Ms.:

Attached is the (insert community name) Hazard Mitigation Plan. This plan has been developed in conjunction with involved agencies, the state of Michigan, affected businesses, and interested members of the public. The plan provides the process for evaluation of land use and development in the (insert community name) from a hazard mitigation perspective, which will protect lives and property in the community. This correspondence serves notice that it is my expectation that all future development decisions in (insert community name) will consider hazard vulnerability reduction as a standard business practice. The intent of the hazard mitigation plan is not to limit development, but to ensure that all development avoids the possibility of damage from natural and technological hazards to the extent practicable.

Questions and concerns related to content and use of this plan should be directed to (name) of the (insert name of applicable local agency).

Sincerely,

(Chief Executive)  
(Chief Executive Title)

*The letter of transmittal is intended as a cover letter in delivery of the plan and to convey the message that the chief executive fully supports hazard mitigation planning and expects the plan to be carried out in its entirety. It is important to state that the intent of the plan is not to curtail development, but to channel it into areas that will not pose undue risk to the owner or occupant, or cause undue need for disaster response by local, state and federal agencies.*

## Sample Preface

Hazard mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property from natural and technological hazards. It is an essential element of emergency management, along with preparedness, response, and recovery. There is a cyclical relationship between the four phases of emergency management. A community prepares for a disaster, and then responds when it occurs. Following the response, there is a transition into the recovery process, during which mitigation measures are evaluated and adopted. This, in turn, improves the preparedness posture of the community for the next incident, and so on. When successful, mitigation will lessen the impacts to such a degree that succeeding incidents will remain incidents and not become disasters.

Hazard mitigation strives to reduce the impact of hazards on people and property through the coordination of resources, programs, and authorities so that, at the very least, communities do not contribute to the increasing severity of the problem by allowing repairs and reconstruction to be completed in such a way as to simply restore damaged property as quickly as possible to pre-disaster conditions. Such efforts expedite a return to "normalcy"; however, replication of pre-disaster conditions results in a cycle of damage, reconstruction, and damage again.

Hazard mitigation is needed to ensure that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage. Hazard mitigation provides the mechanism by which communities and individuals can break the cycle of damage, reconstruction, and damage again.

Recognizing the importance of reducing community vulnerability to natural and technological hazards, the (insert name of community) is actively addressing the issue through the development and subsequent implementation of this plan. The many benefits to be realized from this effort - protection of the public health and safety, preservation of essential services, prevention of property damage, and preservation of the local economic base, to mention just a few - will help ensure that (insert the name of community) remains a vibrant, safe, and enjoyable place in which to live, raise a family, and conduct business.

*The preface serves as a lead in to the hazard mitigation plan. Hazard mitigation is not a well known term, but the principles of hazard mitigation are commonly used. Expand upon the description provided as necessary to give insight as to the impetus for hazard mitigation planning in your jurisdiction.*

## Sample Acknowledgments

This plan is the culmination of our interdisciplinary and interagency planning effort that required the assistance and expertise of numerous agencies, organizations, and individuals. Without the technical assistance and contributions of time and ideas of these agencies, organizations and individuals, this plan could not have been completed. Following is a list of key contributors to the plan:

Agency  
Names

Agency  
Names

Organization  
Names

Private Citizens  
Names

*Acknowledgments should give credit to any individuals that were key supporters or who played a contributing role in the development of the plan. It is especially important to recognize the efforts of private organizations and the public in development of the plan. Acknowledgment of key external participants is not only appropriate, but may also build support during plan implementation.*

*If appropriate, develop a paragraph to describe exemplary contributors.*

## Sample Executive Summary

The (insert community name) Hazard Mitigation Plan was created to protect the health, safety, and economic interests of the (insert community name) residents and businesses by reducing the impacts of natural and technological hazards through hazard mitigation planning, awareness, and implementation. The plan serves as the foundation for hazard mitigation activities and actions within the (insert community name). Implementation of recommendations will reduce loss of life, destruction of property, and economic losses due to natural and technological hazards. The plan provides a path toward continuous, proactive reduction of vulnerability to hazards which result in repetitive and oftentimes severe social, economic and physical damage. The ideal end state is full integration of hazard mitigation concepts into day-to-day governmental and business functions and management practices.

This plan employs a broad perspective in examining multi-hazard mitigation activities and opportunities in the (insert community name). Emphasis is placed on hazards which have resulted in threats to the public health, safety and welfare, as well as the social, economic and physical fabric of the community. The plan addresses such hazards as floods, tornadoes, windstorms, winter storms, forest fires, structural fires, hazardous material incidents, and secondary technological hazards which result from natural hazard events. Each hazard is analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigative action. The plan also lays out the legal basis for planning and the tools to be used for its implementation.

*The Executive Summary provides a quick sketch of the plan and its intended function.*

# Sample Hazard Mitigation Plan Adoption Resolution

## (Resolution No. \_\_ )

Whereas (insert community name), Michigan has experienced repetitive disasters that have damaged commercial, residential and public properties, displaced citizens and businesses, closed streets and bridges dividing the community both physically and emotionally, and presented general public health and safety concerns; and

Whereas the community has prepared a *Hazard Mitigation Plan* that outlines the community's options to reduce overall damage and impact from natural and technological hazards; and

Whereas the *Hazard Mitigation Plan* has been reviewed by community residents, business owners, and federal, state and local agencies, and has been revised to reflect their concerns;

Now, therefore, be it resolved that:

1. The *Hazard Mitigation Plan* is hereby adopted as an official plan of the (insert community name).
2. A hazard mitigation planning group is hereby established as a permanent community advisory body. The (insert name of position) shall designate its members, subject to the approval of (insert community governing body). They shall serve one-year terms. The group's duties shall be as designated in the *Hazard Mitigation Plan*.
3. The (insert name of position) is charged with supervising the implementation of the Plan's recommendations within the funding limitations as provided by the (insert community governing body) or other sources.
4. The (insert name of position) shall give priority attention to the following action items recommended by the *Hazard Mitigation Plan*:
  - a. \_\_\_\_\_ (Recommendation \_\_\_\_\_, page \_\_\_\_)
  - b. \_\_\_\_\_ (Recommendation \_\_\_\_\_, page \_\_\_\_)
  - c. \_\_\_\_\_ (Recommendation \_\_\_\_\_, page \_\_\_\_)
  - d. \_\_\_\_\_ (Recommendation \_\_\_\_\_, page \_\_\_\_)
  - e. \_\_\_\_\_ (Recommendation \_\_\_\_\_, page \_\_\_\_)
5. The (insert name of position) shall convene the hazard mitigation planning group quarterly. The planning group shall monitor implementation of the plan and shall submit a written progress report to (insert community governing body) in accordance with the following format:
  - a. A review of the original plan.
  - b. A review of any disasters or emergencies that occurred during the previous calendar year.
  - c. A review of the actions taken, including what was accomplished during the previous year.
  - d. A discussion of any implementation problems.
  - e. Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by this (insert community governing body).

**Passed this \_\_\_\_ day of (date).**

# Sample Hazard Mitigation Plan

## Purpose

The (insert community name) Hazard Mitigation Plan was created to protect the health, safety, and economic interests of residents by reducing the impacts of natural and technological hazards through hazard mitigation planning, awareness, and implementation. Hazard mitigation is any action taken to permanently eliminate or reduce the long-term risk to human life and property from natural and technological hazards. It is an essential element of emergency management along with preparedness, response and recovery. This plan serves as the foundation for hazard mitigation activities within the community. Implementation of the plan's recommendations will reduce injuries, loss of life, and destruction of property due to natural and technological hazards. The plan provides a path toward continuous, proactive reduction of vulnerability to the most frequent hazards which result in repetitive and often severe social, economic and physical damage. The ideal end-state is total integration of hazard mitigation activities, programs, capabilities and actions into normal, day-to-day governmental functions and management practices.

## Planning Process

The (insert community name) Hazard Mitigation Plan examines multi-hazard mitigation activities and opportunities. Emphasis is placed on hazards which have had significant impact on the community in the past. The planning process followed in the development of the (insert community name) Hazard Mitigation Plan consisted of the following steps:

- 1) Identification of hazards and risks.
- 2) Identification and definition of goals and objectives.
- 3) Identification of alternatives for solving problems.
- 4) Selection of evaluation criteria.
- 5) Selection of alternatives (feasible mitigation strategies).
- 6) Preparation of a draft plan.
- 7) Preparation of the final plan.
- 8) Implementation of the plan.
- 9) Monitoring and periodic revision of the plan.

## Identification of Hazards and Risks

The community's hazard analysis, dated (insert date) lists the following natural and technological hazards, ranked in order of potential severity of impact on the community:

### Hazard Ranking: (name of community) (year)

<b>HAZARD</b>	<b>How Frequently has the Hazard Occurred in the Past?</b>	<b>How Likely is the Hazard to Occur in the Future?</b>	<b>Potential Geographic Size of the Affected Area</b>	<b>Population Impact  Potential Population Impacted</b>	<b>Significance of Impact (Population, Economic, Environment, etc.)</b>	<b>Ranking  (Priority of this hazard for mitigation activities)</b>
Civil Disturbances <b>FOR EXAMPLE:</b>	<b>Once every 5 years</b>	<b>About every 5 years</b>	<b>Several small sites</b>	<b>Up to 3,000 persons</b>	<b>Assessed hazard rating: 2.2</b>	<b>15<sup>th</sup></b>
Drought						
Earthquakes						
Extreme Temperatures						
Fire Hazards: Scrap Tire Fires						
Fire Hazards: Structural Fires						
Fire Hazards: Wildfires						
Flood Hazards: Dam Failures						
Flood Hazards: Riverine/Urban Flooding						
Flood Hazards: Shoreline Flooding/Erosion						
Hazardous Material Incidents: Fixed Site						
Hazardous Material Incidents: Transportation						
Infrastructure Failures						
Nuclear Attack						
Nuclear Power Plant Accidents						
Oil and Gas Well Accidents						

<b>HAZARD</b>	<b>How Frequently has the Hazard Occurred in the Past?</b>	<b>How Likely is the Hazard to Occur in the Future?</b>	<b>Potential Geographic Size of the Affected Area</b>	<b>Population Impact  Potential Population Impacted</b>	<b>Significance of Impact (Population, Economic, Environment, etc.)</b>	<b>Ranking (Priority of this hazard for mitigation activities)</b>
Petroleum and Natural Gas Pipeline Accidents						
Public Health Emergencies						
Sabotage & Terrorism						
Subsidence						
Thunderstorm Hazards: Hailstorms						
Thunderstorm Hazards: Lightning						
Thunderstorm Hazards: Severe Winds						
Thunderstorm Hazards: Tornadoes						
Transportation Accidents: Air, Land and Water						
Severe Winter Weather Hazards: Ice/Sleet Storms						
Severe Winter Weather Hazards: Snowstorms						
Other hazards: (list)						
Other hazards: (list)						

The analysis reveals that (insert top hazard here) is the most problematic hazard for (name of community), followed in order by (list next 8-10 hazards from analysis). Accordingly, this plan focused on those hazards in developing needed mitigation measures for the community.

### **Hazard Mitigation Goals and Objectives**

The mission of the (insert community name) Hazard Mitigation Plan is to protect the health and safety of the public and property of the community by taking action to permanently eliminate or reduce the long-term risk to human life and property from natural and technological hazards.

In order to accomplish that mission, specific goals and objectives have been established. These goals and objectives are based on the community’s hazard analysis, as well as input from the public, home and business owners, community organizations, and other interested entities.

## Goals and Objectives for (insert year)

### Goal 1: Increase local participation in hazard mitigation.

- A. Encourage cooperation and communication between urban planning and emergency management officials.
- B. Encourage local agencies to participate in the hazard mitigation process.
- C. Encourage public and private organization participation.

### Goal 2: Integrate hazard mitigation considerations into the community's comprehensive planning process.

- A. Incorporate hazard provisions in building code standards, ordinances, and procedures.
- B. Incorporate hazard mitigation into the basic land use regulation mechanisms.
- C. Update of zoning ordinances to reflect new building code and shoreline protection rules.
- D. Develop code enforcement and zoning ordinances in urban/wildland intermix areas.
- E. Incorporate hazard area classifications into standard zoning classifications.
- F. Adopt urban forest management plans or ordinances.
- G. Develop community warning systems.
- H. Strengthen anchoring requirements for propane tanks and hazardous material tanks in the floodplain/floodway.
- I. Strengthen the role of the Local Emergency Planning Committee in the land development process.
- J. Integrate hazard mitigation into the capital improvement planning process so that public infrastructure does not lead to development in hazard areas.
- K. Integrate hazard mitigation into the community's planning enabling legislation.

### Goal 3: Apply available resources to hazard mitigation.

- A. Provide a list of desired community mitigation measures to the State for possible future funding.
- B. Encourage the Road Commission to review local roads, bridges, and related transportation infrastructure for hazard vulnerability.
- C. Encourage private business involvement in hazard mitigation projects.

### Goal 4: Increase public awareness of hazard mitigation.

- A. Increase awareness of hazard provisions in building code standards, ordinances, and procedures.
- B. Increase awareness of the National Flood Insurance Program.

### Goal 5: Complete all hazard mitigation projects as scheduled. (List projects as objectives.)

- A. Floodproof City Hall (HMGP project #1226.30)
- B. Install interior sprinkler system in community center.
- C. Relocate DPW gasoline tank outside of the floodplain.
- Etc.

*Mitigation goals must be integrated with other community goals to be fully effective. Hazard mitigation has a much greater likelihood for success when mitigation goals are effectively combined with other community goals. Combining community goals in such a way places the community in a "win-win" situation where everyone benefits. Mitigation goals can often "tip the scale" of community values enough to ensure that everyone's goals are met*

## Identification of Alternatives for Solving Problems

The (name of community) used a variety of sources in developing a range of potential solutions for solving identified problems associated with the various hazards addressed in this plan.

First, a series of "brainstorming" sessions were held on (list dates) to solicit ideas and suggestions from local public officials, citizens, home and business owners, community organizations, the regional planning commission, and state and federal government. At these meetings, literally hundreds of suggestions were made on possible ways to reduce or eliminate community vulnerability to natural and technological hazards. Those suggestions were grouped by hazard type. Then, a screening committee comprised of (describe membership of selection committee) went through the ideas and suggestions and filtered out those that were not compatible

with the community's goals and objectives, or were not technically or financially feasible. Through this screening process, only those alternatives that had a viable chance of being implemented were actually considered.

## **Evaluation Criteria Used to Select and Prioritize Alternatives:**

Next, a set of evaluation criteria was developed in order to determine which of the mitigation alternatives were best suited to address the identified problems within the current framework of mitigation programs and policies within the community. The following evaluation criteria were used to select and prioritize alternatives for this plan:

### Evaluation Criteria

- The cost of the measure must be less than the cost of repetitive repairs that would be necessary if the measure was not implemented.
- The measure must be acceptable to those participating and/or primarily impacted.
- The measure must be affordable to all it affects, and not discriminate against those who are unable to bear the cost.
- The measure must not result in an inequitable distribution of essential public services.
- The measure must be environmentally sound and not cause any permanent, significant environmental concerns.

*Common mitigation criteria stipulate that selected measures be economically justifiable, technically feasible, socially equitable, and environmentally sound. Other criteria could include 1) measures that provide benefit to the greatest number of residents and structures, 2) measures that can be implemented using local resources only, 3) measures providing the greatest protection to public facilities, and 4) measures that support one or more elements of the community's Comprehensive Plan.*

## **Selection of Alternatives (Feasible Mitigation Strategies)**

Community decision-makers then reviewed the list of alternatives against the established evaluation criteria to come up with the list of the most desired alternatives for each community goal. The selected alternatives are presented in the following section.

## **Recommended Mitigation Actions**

The following recommended actions are selected for the goals and objectives that were presented earlier. Each recommended action is addressed similarly and includes the following analysis components:

- Description of the problem
- Description of the action
- Lead manager assigned
- Schedule to initiate action
- Potential sources of technical assistance
- Potential sources of financial assistance

### **The following examples are from the plan of City of Vassar, Michigan:**

#### **1. Reduce flood losses to the fullest extent possible**

##### ***1.1.Reduce losses associated with Cass River flooding***

**1.1.1. Establish an ongoing floodway acquisition and land re-use program. Rezone floodway to reflect current uses and update to reflect additional open space as it becomes available:**

**Description of the problem:** The floodway is the most dangerous portion of the floodplain. It is the area intended to carry the majority of the fast-moving floodwaters. The floodway is intended to carry the entire 100-year flood without increasing that flood height by more than 1/10 of a foot. The floodway has the most stringent development and building regulations within the floodplain. Because it is a dangerous location for a building, and because codes make it difficult to repair, expand, or replace existing structures, all efforts should be made to clear the floodway of obstructions and maintain it in an “open” state. This will also clear the property adjacent to the river so that it can be reused as a contiguous riverfront recreation area.

**Description of the Action:** Establish a voluntary acquisition program of floodway properties based on Fair Market Value. Retain in public ownership and rezone as a conservation area.

**Lead Manager Assigned:** City Manager, City appointed “Board,” or hire an experienced Mitigation Program Manager to manage the entire plan implementation effort. Include that cost in the various grant proposals.

**Schedule to Initiate Action:** Initiate grant applications by Oct. 1, 1998, and resubmit following every Presidential Disaster Declaration within the state of Michigan.

**Potential Sources of Technical Assistance:** State Hazard Mitigation Program, State NFIP Program, Michigan Stormwater-Floodplain Association.

**Potential Sources of Financial Assistance:** FMA, HMGP, CDBG, Clean Michigan Initiative, and USACE Challenge 21 program.

### **1.1.2. Establish an ongoing floodplain property protection program (“floodproofing”):**

**Description of the problem:** The floodplain building inventory identifies structures that are prone to a variety of flood depths. In certain instances, the most cost-effective method of protecting buildings can be through “floodproofing” rather than acquisition and/or relocation.

**Description of the Action:** Establish a floodproofing program to protect appropriate structures within the floodplain.

**Lead Manager Assigned:** City Manager, City appointed “Board,” or hire an experienced Mitigation Program Manager to manage the entire plan implementation effort. Include that cost in the various grant proposals.

**Schedule to Initiate Action:** Initiate grant applications by December 1, 1998, and resubmit following every Presidential Disaster Declaration within the state of Michigan.

**Potential Sources of Technical Assistance:** State Hazard Mitigation Program, State NFIP Program, Michigan Stormwater-Floodplain Association.

**Potential Sources of Financial Assistance:** FMA, HMGP, CDBG, Clean Michigan Initiative, USACE Challenge 21 program, and Homeowner contribution.

### **1.1.3. Revise current Floodplain Management Ordinance:**

**Description of the problem:** The existing floodplain management ordinance for Vassar needs updating to include current standards for “Substantial Damage and Improvement.” Consideration should also be given to including language regarding repetitive losses and the availability of “Increased Cost of Compliance” (ICC) insurance. The first changes are required as a minimum condition of participation within the NFIP. The second change may provide financial relief to insured and repetitively flooded property owners, but may also prove to be more of a burden than it’s worth because it could require some property owners to elevate their properties when they are not eligible for an ICC payment.

**Description of the Action:** Review the “model” ordinances provided to the City, decide upon appropriate changes, and proceed to make the formal changes and adjustments.

**Lead Manager Assigned:** City Manager

**Schedule to Initiate Action:** Within 90 days of plan adoption.

**Potential Sources of Technical Assistance:** State NFIP Program manager

**Potential Sources of Financial Assistance:** None necessary.

#### **1.1.4. Establish a post-flood temporary moratorium on repair of floodway and repetitive flood-loss buildings;**

**Description of the problem:** In order to facilitate recommendation #1.1.1 (floodway acquisition program), Vassar should take actions that would facilitate the removal of floodway (and repetitively flooded) structures rather than their repair. A post-flood temporary moratorium allows for time to conduct a detailed damage assessment of the structure and for coordination with the building owner, so that repair funds could be used to purchase the structure rather than to subject it to flooding again.

In the case of non-floodway repetitive-loss buildings, other loss-reduction techniques may be feasible. However, as a requirement for CRS (see the next recommendation), Vassar *must* have a formal plan to mitigate losses to structures that are repetitively flooded. There are 10 such properties in Vassar.

**Description of the Action:** Adopt an ordinance, or revise the City Code, so that a Temporary Moratorium on permits to repair certain floodprone properties is automatically triggered with a local “Declaration of an Emergency.” If the damage assessment reveals that damage is minimal or non-existent, and/or that the moratorium is unwarranted under existing conditions, it may be suspended by City Council.

Establish as the second priority (after acquisition of floodway properties) a program of mitigation activities for the repetitively flooded structures.

**Lead Manager Assigned:** City Manager

**Schedule to Initiate Action:** Within 60 days of plan adoption.

**Potential Sources of Technical Assistance:** State NFIP Program, State Division of Emergency Management, Model Moratorium provided by planning consultants.

**Potential Sources of Financial Assistance:** None necessary.

#### **1.1.5. Join the Community Rating System to reduce the cost of flood insurance;**

**Description of the problem:** CRS is a program that reduces the cost of flood insurance premiums in communities that implement flood loss reduction activities that exceed the minimum standards of the NFIP. Credit is given for these actions because it has been demonstrated that they result in reduced flood losses. Vassar already undertakes several activities “worth credit” (0.1 floodway rise, BFE +1, warning system, previous acquisition) and will undertake more with the implementation of this plan (including adopting this plan!)

**Description of the Action:** Fill out the CRS application forms and submit.

**Lead Manager Assigned:** City Manager or staff; or a committee of insured property owners (since they reap the benefit of lower insurance costs); or regional planning council.

**Schedule to Initiate Action:** Submit application within 6 months of plan adoption.

**Potential Sources of Technical Assistance:** State NFIP Program, Michigan Stormwater-Floodplain Association, Regional Planning Council, Insurance Services Organization (ISO).

**Potential Sources of Financial Assistance:** None necessary, but application process is time-consuming.

**1.1.6. Model the effects of removing/raising each bridge crossing the Cass to determine the impact of those actions on reducing flood levels. Model removing the “islands,” the old M-15 bridge deck, and “lowering” the Cass through dredging.**

**Description of the problem:** Many people within the community believe that floods are exacerbated by constrictions to the flow of floodwaters, such as the bridges, the “islands” of sediment downstream of where the Moore Drain meets the Cass River.

Due to this discussion, a CPT member from the Land and Water Division of DEQ has already addressed the impacts of removing the old dam, the downstream RR bridge, removing the “islands,” and “lowering” the Cass River through dredging. The proposed actions had little effect (lowers the 100-year flood elevation 0.4 foot by removing dam *and* dredging Cass 3 feet; lowers it 0.4 feet by removing the downstream RR bridge; and lowers it 0.1 foot by removing the “islands.”). (0.1 foot = 1.2 inches; 0.4 foot = 4.8 inches) The analysis is included as Appendix 6.

This recommendation is to complete this effort by modeling the removal of the upstream railroad and M-15 bridges to determine if either of those projects would have a beneficial impact by significantly lowering expected flood heights.

**Description of the Action:** Request DEQ/Land and Water Division to undertake this analysis.

**Lead Manager Assigned:** City Manager (Or Establish an “Implementation Committee” among Vassar CPT members and have them initiate the action)

**Schedule to Initiate Action:** Submit a written request within 30-days of plan adoption.

**Potential Sources of Technical Assistance:** DEQ/Land and Water Division

**Potential Sources of Financial Assistance:** Probably none necessary for modeling on the Cass River because data already exists. If requested to model different scenarios for the Moore Drain (see recommendation 1.2.1[Option A]), funding will likely be required to generate data that the DEQ does not already have. Request that the state Division of Emergency Management provide funding to DEQ under the Technical Assistance provisions of the FMA program.

***1.2.Reduce losses associated with Moore Drain flooding***



Upstream (left) and downstream (right) views of Moore Drain from north side of Huron Street

**1.2.1.a Determine, through hydrological analysis, the effect of relocating the Moore Drain on downtown flooding (Option A). Compare the effects of several different relocations to enlarging, dredging, “opening up” existing location in conjunction with examining upstream retention structure(s) (Option B). Analysis of both options should include the feasibility and hydraulic effects of one or more strategically placed retention ponds within the drain system, redesigning how the drain enters the Cass, and installing a back-flow prevention system (with pump) where the drain enters the Cass.**

- (A) If relocation of the drain is most effective in reducing “nuisance flooding”, proceed with analysis of “best” location (most cost-effective, least path of resistance), determine “beneficiaries” and proceed towards construction. If the drain is relocated, then the existing drain channel should be retained for stormwater purposes, but be enclosed in pipe;
- (B) If relocation of drain is not effective, proceed with Option B (enlarge, improve existing drain);

In either case, if the analyses demonstrate the retention ponds or back-flow prevention systems as effective, they should also be included in the construction plans.

**Description of the problem:** The Moore Drain contributes significantly to the flooding problems of Vassar. When the Cass River is at or above flood stage, the Moore Drain does not empty into the Cass, but rather “backs up” causing flooding along its banks, and in the downtown business district. In events where significant rainfall occurs, but not in conjunction with high water along the Cass River, the Moore Drain can also overflow due to its inadequate capacity. The Moore Drain has been a known source of flooding problems for decades, yet no action has occurred. In 1997, a “Board of Determination” authorized corrective work on the drain to be accomplished. That work should be initiated.

**Description of the Action:** Undertake an engineering analysis to determine the best solution and then implement that solution.

**Lead Manager Assigned:** Tuscola County Drain Commissioner

**Schedule to Initiate Action:** Within 30 days of plan adoption. Determine cost of engineering analysis (check with state agencies). Determine beneficiaries and assess the fees. Consider using fees as “match money” for grants that may support the engineering analysis and the implementation of the solution.

**Potential Sources of Technical Assistance:** DEQ/Land and Water Management Division

**Potential Sources of Financial Assistance:** Assessed fees, FMA, HMGP, CDBG, USACE, Natural Resource Conservation Service (NRCS).

**1.2.1.b If the Moore Drain cannot be relocated, for whatever reason, then Vassar should submit a request to MDOT to raise M-15 (Huron Street), eastward from Main Street, to eliminate the frequent closing of the M-15 bridge across the Cass River.**

**Description of the problem:** When the Moore Drain floods it often inundates Huron Street (M-15) and eliminates access to the M-15 bridge. This divides the community in two, creating significant public safety, economic and social impacts. If frequent downtown flooding caused by the overflow or back-up of the Moore Drain cannot be eliminated by relocating the drain and enclosing the existing drain channel in pipe, then raising M-15 to “tie into” Main Street (or the higher reaches of Huron Street) would rectify the problem of Vassar being split into two isolated areas, though it would not reduce flood losses to the downtown buildings.

**Description of the Action:** Request MDOT to raise M-15, *only if* Moore Drain flooding cannot be resolved through channel relocation or other improvements.

**Lead Manager Assigned:** Vassar City Council

**Schedule to Initiate Action:** 30 days following the failure of recommendation 1.2.1.a.

**Potential Sources of Technical Assistance:** MDOT, DEQ/Land & Water Management Division

**Potential Sources of Financial Assistance:** MDOT, FHWA, HMGP, CDBG, and Assessed fees.

**1.2.2. Implement an annual “clean-up” program along the Drain while study (from recommendation 1.2.1.a is being developed.**

**Description of the problem:** Regardless of the outcome of the above analysis, or the length of time it takes to fund and complete it, efforts should be taken to maintain the existing channel to ensure its peak performance until existing shortfalls are corrected. A common practice is to have “clean up” days, when trash, limbs, barrels, shopping carts, and other potential blockages are removed from the drainageway culverts, channel and adjacent land.

**Description of the Action:** Establish an annual or semi-annual “clean-up” program.

**Lead Manager Assigned:** Tuscola County Drain Commissioner

**Schedule to Initiate Action:** Initiate first clean-up in early spring of 1999.

**Potential Sources of Technical Assistance:** None necessary.

**Potential Sources of Financial Assistance:** None necessary. Use volunteers, scout troops, teenage groups, jail inmates, National Guard, Americorps, etc.

**1.2.3. Enforce existing Drain easement regulations, up and downstream.**

**Description of the problem:** The Michigan Drain Code requires a “set-back” from the actual Moore Drain channel. Reports indicate that it is not enforced, either in town or upstream along agricultural properties. Failing to maintain the set-back along agricultural properties makes it “easier” for wind and water-borne sediments to get into the drainage canal, which in turn, decreases its capacity to carry water. Sediment, yard clippings, branches and illegal dumping occurs along the sides of the drain within town, which also reduces the carrying capacity of the drain. Since the drain no longer carries its designed capacity of water, beneficiaries from this effort are both agricultural and town “users” of the drain.

**Description of the Action:** Enforce existing regulations, and examine existing enforcement mechanisms if they prove to be insufficient.

**Lead Manager Assigned:** Tuscola County Drain Commissioner

**Schedule to Initiate Action:** Identify potential violations within 30 days of plan adoption. Send notification to property owners within 60 days, and follow-up to verify corrective actions within 120 days. Initiate existing enforcement mechanisms after 120 days. Follow-up on inspections and enforcement.

**Potential Sources of Technical Assistance:** None necessary

**Potential Sources of Financial Assistance:** None necessary. Use Drain Commission operating expenses and/or assess violators for costs of corrective action.

***1.3 Improve ability to respond to & recover from flooding events***

**1.3.1 Coordinate with American Red Cross to ensure adequate designated emergency shelters.**

**Description of the problem:** The flood recovery exercise revealed that buildings commonly used as emergency shelters during flooding and other community disasters have not been inspected and certified as adequate facilities by the American Red Cross (ARC), which manages the facilities when operating as shelters. This is required in order for certain associated expenses to be reimbursable and for some liability considerations

**Description of the Action:** Coordinate with the ARC and building owners to facilitate the necessary inspections. Should any inadequacies be identified, be prepared to either make the required repairs and/or alterations, or identify more suitable shelter space.

**Lead Manager Assigned:** City Manager should request ARC to initiate the required “shelter survey” and facilitate the inspections between property owners and the ARC.

**Schedule to Initiate Action:** Initiate request to ARC within 60 days of Plan Adoption. Follow-up as necessary.

**Potential Sources of Technical Assistance:** Tuscola County ARC chapter, State Division of Emergency Management, FEMA Region V (Chicago).

**Potential Sources of Financial Assistance:** None necessary to start.

### **1.3.2 Develop a written Flood Response and Recovery Plan**

**Description of the problem:** This is more a need to formalize existing procedures than a new activity. The Public Works department already has a set of activities that it undertakes when water levels reach certain heights on the Huron Street gage. Among the emergency activities planned is the protection of critical facilities, such as maintaining the availability of water by protecting the city well-house(s) and pump stations (usually with sandbags or other barriers).



#### **Flood stage gage on M-15 (Huron Street) Bridge**

**Description of the Action:** Incorporate this (and other) activity (ies) into a written and annually exercised Flood Response and Recovery Plan. Identify who takes what action at what river stage, and what equipment and materials are necessary to carry out the job.

**Lead Manager Assigned:** Public Works Director.

**Schedule to Initiate Action:** Initiate Flood Response & Recovery Planning process within 90 days of plan adoption. Include those people that will have a responsibility in carrying out the recommended actions in the planning process.

**Potential Sources of Technical Assistance:** State Division of Emergency Management, USACE (Sandbagging advice and demonstrations), Tuscola County Emergency Manager, Flood Mitigation specialists.

**Potential Sources of Financial Assistance:** None necessary

### **1.3.3 Maintain DPW as “EOC” – consider permanent relocation of Police Department to a flood-free location**

**Description of the problem:** The city needs a pre-designated location from which to manage and conduct emergency operations. Since the community is small, and most staff will be responding to events and communicating by radio, the Emergency Operations Center, or “EOC,” does not have to be extremely large or “high tech.” However, it should be flood free so that operations may continue without disruption. The Public Works building is currently designated as the EOC, and it should remain so. It is sited in a flood-free location and the Department of Public Works plays a vital role in the response to flooding events. However, the Police Department headquarters, in the basement of City Hall, is subject to flooding. Since the Police Department also plays a vital role in the response to flooding events, serious consideration should be given to its permanent relocation.

**Description of the Action:** Officially designate the Public Works building as the EOC. Maintain the EOC with a minimal level of necessary equipment (a “white board” and markers, a sufficient number of phone lines, a copier, a fax machine, a computer, 2 or 3 polaroid or disposable cameras, damage assessment forms, building placards, hand-held radios that are compatible with police, fire, and city management, and basic supplies such as tape, markers, hard hats, barricades, first-aid kits).

**Lead Manager Assigned:** Public Works Director

**Schedule to Initiate Action:** Initiate acquisition of supplies as soon as possible. Continue in an on-going manner until adequate supplies can be purchased or obtained through public-private-non-profit partnerships

**Potential Sources of Technical Assistance:** State Division of Emergency Management, State Surplus Supply, and Tuscola County Emergency Manager.

**Potential Sources of Financial Assistance:** Normal departmental operating budgets, surplus supplies, and donations.

### **1.3.4. Establish Memoranda of Understanding, or “MOU’s,” for damage assessment and post-flood permitting with neighboring non-floodprone communities.**

**Description of the problem:** The flood recovery exercise revealed that, following a major flood, it would be difficult to adequately inspect, placard, and issue permits for repairs to buildings due to the number of buildings affected and the small number of trained staff in Vassar. Establishing “MOU’s” with neighboring, non-floodprone communities will ensure that Vassar has sufficient access to qualified, available building officials when warranted. It also sets up the framework for reimbursement should federal disaster assistance be made available.

**Description of the Action:** Establish “MOU’s” for damage assessment and permitting support in a post-disaster scenario.

**Lead Manager Assigned:** City Manager, Tuscola County Building Official and Tuscola County Emergency Manager

**Schedule to Initiate Action:** Initiate MOU’s within 90 days of plan approval.

**Potential Sources of Technical Assistance:** State Division of Emergency Management, Tuscola County Building Official, and Tuscola County Emergency Manager.

**Potential Sources of Financial Assistance:** None necessary.

### **1.3.5. Provide training for conducting Damage Assessments and determining “Substantial Damage;”**

**Description of the problem:** An essential element of post-flood hazard mitigation relies heavily upon an efficient and accurate assessment of building damages. City staff should be trained in the conduct of detailed Damage Assessments (and other emergency management techniques, e.g., post-disaster record-keeping, EOC management, media management, etc.)

**Description of the Action:** Enroll city officials for training courses that cover the responsibilities they will be assigned in a post-flood scenario. These courses are offered frequently, free of charge, in Michigan, at conferences and FEMA’s training institutes.

**Lead Manager Assigned:** Tuscola County Emergency Management.

**Schedule to Initiate Action:** Identify appropriate courses and their scheduled offerings, and coordinate the participation of Vassar officials. Initiate applications as courses become available.

**Potential Sources of Technical Assistance:** State Division of Emergency Management, FEMA Region V, ARC, and Tuscola County Emergency Management.

**Potential Sources of Financial Assistance:** None necessary. Courses are usually offered within the close-by area. FEMA “resident courses” are completely reimbursable except for meals and salary

### **1.3.6. Obtain a “GIS” system to support pre-flood planning, response activities, and post-flood recovery activities**

**Description of the problem:** Effective management of disasters, and day-to-day floodplain management, require an in-depth understanding of the changing circumstances, as well as a method of maintaining and “tracking” critical building information --- such as that contained within the Building Inventory. Geographic Information Systems, or “GIS,” display computerized layers of mapped data, enabling accurate management of floodprone buildings (e.g., percent of damage, number of incidents, floodplain location, insurance payments, assessed values, depth of flooding, land-use versus zoning designations, repair permits issued, etc.). The same principles can be applied for disaster recovery purposes (degree of damage, utility support, occupancy, etc.) Together, this data can be utilized to support response needs (evacuation, traffic routing, shelter management, 911 calls), detailed damage assessments, identifying mitigation projects, establishing environmental baselines, and monitoring changes in land-use.

**Description of the Action:** Initiate grant application for a stand-alone GIS workstation. Determine available data formats and existing systems of other users (state offices) to ensure compatibility *before* purchasing.

**Lead Manager Assigned:** City Manager. Include in Operating Budget request, or identify and submit an appropriate grant application.

**Schedule to Initiate Action:** Initiate grant application within 90 days of Plan Adoption.

**Potential Sources of Technical Assistance:** State Hazard Mitigation Program, USACE, State NFIP Program, Michigan Stormwater-Floodplain Association.

**Potential Sources of Financial Assistance:** USACE-Detroit District

### **1.3.7. Consider requirements for establishing a “Fill Your Basement with Water” Order**

**Description of the problem:** Flooded buildings are often damaged by hydrostatic pressure, created by unequal pressure on building walls. This is created when buildings have water tight, or near watertight basements. It is often aggravated when building owners pump floodwaters out of flooded buildings when the water outside the

building (or the saturated soil) still exerts extreme pressures on building walls. Filling a basement with clean water can prevent serious structural damage by equalizing the pressures and facilitates cleanup because there is clean water, not silt and sewage-laden muddy water in the structure. NFIP policies will pay for damage incurred by policyholders when this is done because the damages are less than they would be otherwise. However, this policy feature is only available when (a) there is an official “Flood Warning” issued by the appropriate National Weather Service office, and (b) a local official (City Manager, County Emergency Manager) has “ordered” property owners to fill their basements. (Of course, you must also have an NFIP policy in force!)

**Description of the Action:** Coordinate with State NFIP Coordinator and FEMA Region V to determine the exact conditions and requirements where such a policy would benefit both the policyholders and the NFIP. No official public action would be necessary prior to enactment of this policy, but pre-planned public information would be critical to maximize the effectiveness of this action.

**Lead Manager Assigned:** City Manager in coordination with Michigan NFIP Coordinator.

**Schedule to Initiate Action:** Initiate discussion with State NFIP Coordinator within 6 months unless a flood is imminent. In that case, make contact immediately.

**Potential Sources of Technical Assistance:** State NFIP Program, Michigan Stormwater-Floodplain Association, FEMA Region V.

**Potential Sources of Financial Assistance:** None necessary.

### **1.3.8. Consider establishing a secure “Community Storage” area for temporary flood-free storage of personal property**

**Description of the problem:** A major source of flood losses results from damaged personal property. In cases where adequate “lead-time” can be provided prior to a flood event, people have reduced their exposure to flood losses by moving their possessions to higher ground (either upstairs in the same building, or to another building in a flood-free location).

**Description of the Action:** Consider establishing a “Community Storage” area. In addition to securing the use of an appropriate building (Ivan Middleton Hall was suggested), security needs to be provided to protect each person’s belongings. The City can consider paying for this service, or making it available through a “user’s fee” or volunteer organization.

**Lead Manager Assigned:** City Manager can make the proposal to City Council. If City Council agrees to implement this action, it can be implemented by any City department, (Police, Public Works) or a citizen or church organization.

**Schedule to Initiate Action:** Initiate discussion within 6 months.

**Potential Sources of Technical Assistance:** Contact the Office of Community Development, City of Frankfort, Kentucky to learn about their similar program.

**Potential Sources of Financial Assistance:** None necessary to establish. Some costs may apply to the use of the building and for providing security. City or “User’s Fees.

### **1.3.9. Obtain an adequate number of barricades to close roads when necessary**

**Description of the problem:** City staff has a plan of what to do and when to do it when waters rise. These actions include closing roads and bridge access in order to keep people from harm's way. However, there often are not enough barricades to accomplish the job, forcing the staff to utilize whatever materials are readily available. This has resulted in road closures that utilize couches and other “non-official” materials to establish barricades. This promotes sightseers circumventing what should be official closures. The City should have an

adequate supply of barricades available on a permanent basis. Rental contracts are a possibility, but do not guarantee their availability when they are needed.

**Description of the Action:** Determine how many barricades are necessary for floods of various elevations, and obtain an adequate supply.

**Lead Manager Assigned:** Public Works Director.

**Schedule to Initiate Action:** Within 60 days of plan adoption.

**Potential Sources of Technical Assistance:** None necessary.

**Potential Sources of Financial Assistance:** Public Works Operating Budget.

### **1.3.10 Develop a written multi-hazard warning plan**

**Description of the problem:** Currently, Vassar utilizes a warning plan that was developed as part of a flood-exercise for community officials. While city department directors know what actions to take at certain river levels as indicated on the M-15 bridge gage, there is no overall process to coordinate all of the actions being taken, or for early public notification. Early public notice can provide “lead time” which can prevent losses. One area worthy of consideration would be using the public siren for flood warnings (in addition to its current use for tornadoes).



Siren on top of Vassar City Hall

**Description of the Action:** As part of the written Response and Recovery Plan (Recommendation 1.3.2) include a section detailing the flood warning process. Consider using the siren in coordination with a public education effort (Recommendation 4.1.1) to inform citizens those conditions under which the siren would be utilized, and where to find additional, official, event-specific information.

**Lead Manager Assigned:** City Manager

**Schedule to Initiate Action:** Within 90 days of plan adoption.

**Potential Sources of Technical Assistance:** Tuscola County Emergency Management, Michigan Stormwater-Floodplain Association, National Weather Service, FEMA Region V, and USACE.

**Potential Sources of Financial Assistance:** Very little necessary. Grant applications can fund the Public Education components.

### **1.3.11. Establish and enforce strict penalties for “No Entry” areas**

**Description of the problem:** In past floods, local authorities have had to divert resources from other high-priority response activities in order to respond to activities that occur as a result of people ignoring posted “no entry” signs (e.g., cars getting stuck in high water, “sightseers” trespassing on private, evacuated property). Establishing, publicizing and enforcing strict penalties for those that violate these temporary “No Entry” zones should deter future violations, and allow city officials to focus on more critical tasks.

**Description of the Action:** City Council should adopt an array of post-disaster, emergency, temporary, ordinances (“no-entry” zones, anti-price gouging, curfew, suspension of sales of liquor and firearms, waiver of mobile-home restrictions, etc.). These can be established so that they are automatically “activated” upon declaration of a Local Emergency (a legal action that is required for emergency authority, expenditure of contingency funds and requesting supplemental assistance from the county, state and federal governments.) In addition, develop and issue “Resident/Business Owner Stickers” so those with an immediate need to be on-site can easily be identified and provided access.

**Lead Manager Assigned:** Police Chief in coordination with Tuscola County Emergency Manager.

**Schedule to Initiate Action:** Initiate within 90 days of plan adoption.

**Potential Sources of Technical Assistance:** State Hazard Mitigation Program, State NFIP Program, Michigan Stormwater-Floodplain Association, FEMA Region V, American Red Cross, USACE-Detroit District.

**Potential Sources of Financial Assistance:** Minimal amount necessary for ID stickers. Could be sold at cost.

### **1.3.12. Stockpile ARC, FEMA, USACE and other damage prevention, and post-flood repair and cleanup publications**

**Description of the problem:** There are many pre- and post-flood publications available that focus on reducing property damage. Most provide self-help guidance for property owners, and others include engineering design details for measures requiring construction.

**Description of the Action:** The City should identify, order and stockpile at least 100 copies of each appropriate publication for post-flood distribution. Public notice should be made, through the Public Education component of this plan, to alert property owners to their pre-flood availability. Additionally, having these publications available to the public is a creditable activity under the Community Rating System (See Recommendation 1.1.5).

**Lead Manager Assigned:** District Library

**Schedule to Initiate Action:** Initiate within 30 days of plan adoption.

**Potential Sources of Technical Assistance:** State Hazard Mitigation Program, State NFIP Program, Michigan Stormwater-Floodplain Association, FEMA Region V, American Red Cross, USACE-Detroit District.

**Potential Sources of Financial Assistance:** None necessary.

### **1.3.13 Create a list of Recovery “Vendors”**

**Description of the problem:** Following floods and other disasters there is often a need for typical and specialized goods and services that exceed those available locally (e.g., cleaning, drying, pumps, repairs, construction supplies, portable refrigeration units, disaster recovery experts.) Having quick and ready access to appropriate vendors, particularly when flooding conditions are widespread, can facilitate a more rapid recovery and reduce continuing post-flood losses.

**Description of the Action:** Establish a list of local and Michigan-based vendors and disaster recovery specialists to support disaster recovery efforts.

**Lead Manager Assigned:** City Manager in coordination with Tuscola County Emergency Manager.

**Schedule to Initiate Action:** Initiate within 90 days of plan adoption.

**Potential Sources of Technical Assistance:** Local and regional Chambers of Commerce, regional contractor's association, Michigan Stormwater-Floodplain Association.

**Potential Sources of Financial Assistance:** None necessary.

### **More examples: (sample mitigation strategies for other hazards)**

## **2. Reduce the ill effects of periodic drought events**

**Description of the problem:** A hazard analysis has revealed that Example County suffers from serious drought events approximately every twenty years, causing extensive agricultural damage, and significant increases in the number of serious wildfire events in the area (as well as increased difficulties in dealing with fire events).

### **2.1. Establish a monitoring and information system**

**Description of the Action:** Find and establish contact with the appropriate person at Local University to form a partnership coordinating university resources with the community's, to establish a hydrologic monitoring and information system.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Initiate Action:** by May 31

**Potential Sources of Technical Assistance:** U.S. Department of Agriculture

**Potential Sources of Financial Assistance:** Possibly the Hydrologic Research Federal Project Grants described in the Catalog of Federal Domestic Assistance (CFDA program number 11.462) or the Watershed Surveys and Planning Program (CFDA 10.906).

### **2.2 Survey local problems**

**Description of the Action:** Contact the local Farmers' Association and attend at least one of their summer meetings so as to survey local problems, resources and remedies.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Initiate Action:** Summer after plan implementation.

**Potential Sources of Financial Assistance:** Local community foundation.

### **2.3 Prepare to implement identified projects**

**Description of the Action:** Begin to implement the drought water reserve facilities projects detailed in the report by ABC Engineering for Maple Township (a low-income area that may qualify for federal grant assistance listed below).

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** Apply for financial assistance by September 30.

**Potential Sources of Financial Assistance:** Emergency Community Water Assistance Project Grant (CFDA 10.763).

### **2.4 Draft a new plan**

**Description of the Action:** Arrange for Local University faculty, research staff, or guided student groups to draft a new Drought Contingency Plan for the county.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** the draft plan should be ready by the end of the year.

**Potential Sources of Financial Assistance:** None needed due to existing partnership.

## **3. Reduce the human and economic impacts of extreme summer heat**

**Description of the problem:** Many residents of the county have their health and even their lives threatened by conditions during summer heat waves, due to a combination of their own vulnerability, lack of access to cooling equipment or cooler living/working facilities, and behavioral choices that render them vulnerable to the harmful effects of such weather.

### **3.1 Identify centers to designate as cooling areas**

**Description of the Action:** Survey the community and recreational centers throughout the county and identify various areas that can be designated as "cooling shelters" where vulnerable residents can go to escape the effects of extreme summer heat.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** Designations should be made before May 15.

**Potential Sources of Financial Assistance:** None needed.

### **3.2 Promote use of cooling shelters**

**Description of the Action:** Once cooling shelters have been identified, their use shall be promoted through retirement networks, neighborhood organizations, and other participating organizations.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** By June 15, each shelter should have at least a draft plan for notifying nearby residents of the potential health impacts of extreme heat, and identifying elderly (or other residents) who may have special needs to help determine strategies that will help them deal with heat problems under all likely conditions.

**Potential Sources of Financial Assistance:** None needed.

### **3.3 Promote public awareness of extreme temperature hazards**

**Description of the Action:** Coordinate with the appropriate county health organizations (and other appropriate bodies) to promote public awareness of extreme temperature hazards and how to deal with them, especially in the event of power failures.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Coordination by March 31. The first public awareness activities should be under way no later than May 15.

**Potential Sources of Financial Assistance:** None needed.

### **3.4 Include schools in awareness efforts**

**Description of the Action:** Contact local schools to ensure that their curriculum includes an awareness of severe summer weather hazards and how a family can prepare for and respond to them.

**Lead Manager Assigned:** Emergency Program Manager.

**Schedule to Complete Action:** Schools should be contacted by March 15.

**Potential Sources of Financial Assistance:** None needed.

## **4. Reduce the human and economic impacts of extreme winter cold**

**Description of the problem:** Many residents of the county have their health and even their lives threatened during winter conditions of extreme cold, or even during prolonged periods of milder cold, due to inadequacies of their housing units to retain or be supplied with heat, or because of behavioral choices that render them vulnerable to the harmful effects of such weather.

### **4.1 Identify centers to designate as heating shelters**

**Description of the Action:** Survey the community and recreational centers throughout the county and identify various areas that can be designated as "heating shelters" where vulnerable residents can go to escape the effects of extreme winter cold.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** Designations should be made before September 30.

**Potential Sources of Financial Assistance:** None needed.

### **4.2 Promote the use of heating shelters**

**Description of the Action:** Once heating shelters have been identified, their use shall be promoted through retirement networks, neighborhood organizations, and other participating organizations.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** By October 15, each shelter should have at least a draft plan for notifying nearby residents of the potential health impacts of cool or freezing temperatures, and identifying elderly (or other residents) who may have special needs to help determine strategies that will help them deal with such problems under all likely conditions.

**Potential Sources of Financial Assistance:** None needed.

### **4.3 Promote public awareness of extreme temperature hazards**

**Description of the Action:** Coordinate with the appropriate county health organizations (and other appropriate bodies) to promote public awareness of extreme temperature hazards and how to deal with them—especially in the event of power failures.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Coordination by August 31. The first public awareness activities should be under way no later than October 15.

**Potential Sources of Financial Assistance:** None needed.

#### **4.4 Create a means to facilitate donations for heating assistance**

**Description of the Action:** Meet with the representatives of the local utility providers, and contact local charitable organizations to work out a donation or financing system to ensure that all residents have heat during the winter, regardless of their ability to pay.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Meetings should be underway during the spring, and at least some financing mechanism or donations management system shall be effective by September 15 to start to deal with this issue.

**Potential Sources of Financial Assistance:** None needed to initiate meetings.

#### **4.5 Include schools in awareness efforts**

**Description of the Action:** Contact local schools to ensure that their curriculum includes an awareness of severe winter weather hazards and how a family can prepare for and respond to them.

**Lead Manager Assigned:** Emergency Program Manager.

**Schedule to Complete Action:** Schools should be contacted by October 15.

**Potential Sources of Financial Assistance:** None needed.

#### **4.6 Volunteer outreach program**

**Description of the Action:** Amateur radio operators and other volunteers shall be informed of the need to contact county residents who may be snowbound during or after blizzard events, and organized to be able to contact such persons and deliver goods or assistance to them in cases of a serious snow emergency.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** To be included as a component of the county's Emergency Operations Plan by June 15.

**Potential Sources of Financial Assistance:** Voluntary contributions.

### **5. Reduce the risks and damages from wildfires in the county**

**Description of the problem:** Many of the county's wildfires could be prevented through greater education, awareness, and alertness. Also, much of the damage and injury caused by wildfires could be prevented through legislation, code enforcement, homeowner awareness and property maintenance, and through adjustments in the planning, development and design process for area structures. Protective steps are especially needed in area of the River National Forest area. The county's hazard analysis has identified numerous rural roads and areas

where safe firefighter access is unlikely in the event of a major wildfire, due to poor road conditions, or limiting features of road design such as narrowness, slope, single directional access, lack of roundabouts, lack of passing spaces, lack of road name and address postings, excessive curves, excessive length of dead-end roads and driveways, and vegetative overgrowth over the roadway, including overhanging canopies of very flammable trees.

### **5.1 Creating firebreaks**

**Description of the Action:** Firebreaks must be created in the River National Forest area to help protect it and nearby property from forest fires. Lands will be acquired so as to achieve continuity of the needed firebreak areas identified in the county's hazard analysis. An investigation will be made into the availability of resources with which to create these firebreaks. If additional resources are found to be needed, applications or requests for those resources will be prepared and submitted.

**Lead Manager Assigned:** Emergency Program Manager.

**Schedule to Initiate Action:** Application for acquisition assistance should be submitted before September 30.

**Potential Sources of Financial Assistance:** Michigan Natural Resources Trust Fund.

### **5.2 Obtain extra fire-fighting equipment**

**Description of the Action:** Two rural townships in the county may qualify for assistance through a Michigan Department of Natural Resources program and be able to acquire needed equipment for fire-fighting efforts.

**Lead Manager Assigned:** Emergency Program Manager.

**Schedule to Initiate Action:** Application for assistance should be submitted before February 1.

**Potential Sources of Financial Assistance:** Michigan Volunteer Fire Assistance Program.

### **5.3 Become a FIREWISE community**

**Description of the Action:** The county shall announce by April 15 that it is officially adopting the recommendations and strategies to be a "FIREWISE community" and shall encourage all residents living in the wildland/urban interface area to become acquainted with FIREWISE mitigation strategies they can use to protect their property from wildfire hazards. This campaign should include the participation of all fire departments and many or most insurance agents, educational organizations, and homeowner associations, and will involve promotional activities, the distribution of informational materials (including its web address at <http://www.Firewise.org/> ), and the possibility of fire inspections and wildfire risk inspections by local fire department personnel.

**Lead Manager Assigned:** Emergency Program Manager.

**Schedule to Initiate Action:** Application for assistance should be submitted before February 1.

**Potential Sources of Financial Assistance:** Financial assistance to some homeowners wishing to replace flammable roofing or deck materials may be available using the Very Low to Moderate Income Housing Loans Program (CFDA 10.410). Wealthier homeowners are probably eligible for loans from local financial institutions.

### **5.4 Revise county transportation plan**

**Description of the Action:** The county's next revision of its transportation plan and road improvement project listings shall take into account those features of rural roads and driveways that inhibit safe fire-fighting efforts in

some areas, as identified in the county's hazard analysis. Emergency Management staff shall assemble a list of suggested improvements and present a written report on the subject to county transportation officials. Advice and information shall then be exchanged between divisions of county and local governments so as to implement projects that improve transportation access, evacuation capabilities, and safety of fire vehicles in rural areas vulnerable to wildfires.

**Lead Manager Assigned:** Emergency Management staff.

**Schedule to Complete Action:** Report to be submitted to county officials by October 31.

## **6. Reduce the county's vulnerability to thunderstorm hazards**

**Description of the problem:** Limited public education efforts and advance warning capabilities currently render many of the county's residents vulnerable to severe thunderstorm hazards.

### **6.1 NOAA Weather Radio**

**Description of the Action:** Timely access to NOAA weather information shall be maintained through upkeep on the aging radio tower in the west of the county, and by the installation of a new tower in the northeast of the county.

**Lead Manager Assigned:** The Emergency Program Manager and County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Research and apply these opportunities by January 14.

**Potential Sources of Financial Assistance:** The county's community foundation, the Iron Corporate Giving Program, and possibly a Public Telecommunication Facilities Planning and Construction Grant (CFDA 11.550).

### **6.2 Alerting of those with special needs**

**Description of the Action:** Through consultation with local community organizations, supplemental means will be identified by which isolated or special-needs populations can be alerted in the event of serious weather emergencies. This shall be done in conjunction with extreme temperature planning with these organizations, and a report on the topic shall be completed by mitigation staff.

**Lead Manager Assigned:** The Emergency Program Manager and County Hazard Mitigation Officer.

**Schedule to Complete Action:** Report to be completed by October 10.

**Potential Sources of Financial Assistance:** Local government support, if needed.

### **6.3 Educational program**

**Description of the Action:** Community schools shall be contacted to ensure that their curriculum includes an awareness of severe thunderstorm hazards and how a family can prepare for and respond to them.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Establish contact by March 15 with all area school districts.

**Potential Sources of Financial Assistance:** Not needed.

### **6.4 Volunteer communication network**

**Description of the Action:** Coordinate the use of amateur radio operators to facilitate communications during times of emergency when phone lines may be inoperable, and include such procedures in the county's Emergency Operations Plan.

**Lead Manager Assigned:** The County Hazard Mitigation Officer, in conjunction with his or her snow emergency preparedness duties.

**Schedule to Complete Action:** September 15.

**Potential Sources of Financial Assistance:** Not needed.

## **7. Reduce the county's long-term vulnerability to Great Lakes shoreline flooding and erosion**

**Description of the problem:** There are several known erosion areas along the lakefront side of the county, which in the near future will threaten vital recreation areas. There are also some historic structures threatened by shoreline flooding and erosion.

### **7.1 Historic preservation measures**

**Description of the Action:** Meet with the local Historic Conservation Society and explore means to fund the floodproofing and possible relocation of many historic structures in floodplain and shoreline erosion areas.

**Lead Manager Assigned:** County Hazard Mitigation Officer.

**Schedule to Complete Action:** August 15.

**Potential Sources of Financial Assistance:** Historic Conservation Society fundraising, the area community foundation, or the Historic Preservation Fund Grants-in-Aid Program (CFDA 15.904).

### **7.2 Army Corps Assistance**

**Description of the Action:** Apply for the Army Corps of Engineers to research and complete projects preventing erosion of critical shoreline areas, using the Beach Erosion Control Projects Program (CFDA 12.101)

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** May 15.

**Potential Sources of Financial Assistance:** U.S. Army Corps of Engineers.

### **7.3 Memorial Grounds protection**

**Description of the Action:** The River Society shall be contacted to discuss fundraising mechanisms for projects to protect the River Memorial Grounds from erosion

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** April 30.

**Potential Sources of Financial Assistance:** To be determined.

## **8. Take steps to reduce property losses from large hail events**

**Description of the problem:** Various structural reinforcements can help homeowners and businesses reduce damages from hail events in the area. Patrons of the Uphill Campground are especially vulnerable, since there are no solidly constructed structures located there. The historic Woodland Place has structures needing special reinforcement in order to resist damage from hail or other severe weather events.

### **8.1 Code Amendments**

**Description of the Action:** Suggest to the County Board of Commissioners and local planning departments that local code requirements for campgrounds be amended to require the provision of at least one structure that can serve as a shelter area in the case of severe weather events.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer.

**Schedule to Complete Action:** Meetings held before April 30.

**Potential Sources of Financial Assistance:** Not needed.

### **8.2 Historic preservation**

**Description of the Action:** Meet with the local Historic Conservation Society to determine what fundraising mechanisms could finance the structural bracing and renovation of the historic structures in Woodland Place.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** Meeting by June 15.

**Potential Sources of Financial Assistance:** To be determined.

## **9. Make the county's residents, property, and infrastructure safer from the effects of lightning strikes**

**Description of the problem:** The county's communication system has been particularly vulnerable to lightning strikes. Phone systems (including 9-1-1) have failed numerous times due to lightning. Some of the urban structures in the county need protection from lightning strikes, such as the historic clock tower, which has been struck twice in the last decade.

### **9.1 Install lightning rods**

**Description of the Action:** Lightning rods should be installed on all at-risk structures that are appropriate for it, according to the county's hazard analysis and NFPA-780 installation standards. This strategy will be encouraged and enforced by local and county code compliance officials.

**Lead Manager Assigned:** County Mitigation Officer.

**Schedule to Complete Action:** Part of official policy by December 31.

### **9.2 Communication alternatives**

**Description of the Action:** Alternatives to the traditional communications media must be available during emergencies in case they fail or are overwhelmed. Coordinate with local amateur radio operators on this issue.

**Lead Manager Assigned:** The County Hazard Mitigation Officer.

**Schedule to Complete Action:** September 15.

**Potential Sources of Financial Assistance:** Not needed.

## **10. Reduce the harm caused by severe wind events in the county**

**Description of the Problem:** Various measures can help reduce the losses endured by homeowners and businesses throughout the county from its annual severe wind events. Also, the historic Woodland Place has structures needing special reinforcement in order to withstand such severe weather events. The Gladness Trailer Park is especially vulnerable to damage from strong winds.

### **10.1 Historic preservation**

**Description of the Action:** Meet with the Historic Conservation Society to determine what fundraising mechanisms could finance the structural bracing and renovation of the historic structures in Woodland Place.

**Lead Manager Assigned:** The County's Assistant Mitigation Officer.

**Schedule to Complete Action:** Discuss by June 15.

**Potential Sources of Financial Assistance:** To be determined.

### **10.2 Anchoring mobile home structures**

**Description of the Action:** Consider establishing local codes requiring area mobile home residents to secure their units to a foundation so as to better resist severe wind effects that could cause the unit to tip or overturn. County mitigation staff shall draft a suggested ordinance or code amendment and submit it to the relevant authorities.

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** To be submitted by May 31.

### **10.3 Window shuttering**

**Description of the Action:** Homeowners should be encouraged to use protective shutters over their windows during severe weather events. Public education programs, insurance brochures, or other information dissemination media could be used. Insurance companies shall be contacted first about this initiative.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** Discuss by July 31.

**Potential Sources of Financial Assistance:** Local Insurance companies.

### **10.4 Urban forestry**

**Description of the Action:** All local jurisdictions and utility companies should be aware of the importance of urban forestry in mitigating damage from falling trees or tree limbs during strong wind events.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** Contact MDNR for technical assistance, and locals for coordination/implementation, by March 31.

**Potential Sources of Financial Assistance:** Michigan Department of Natural Resources, Urban and Community Forestry Program.

## **11. Reduce the county's vulnerability to tornadoes**

**Description of the problem:** As with strong winds (see preceding section), there are many areas of the county that are vulnerable to tornadoes, the strongest of all possible wind events. As with severe weather events in general, the county's warning system needs some improvements. In this section are strategies specific for tornadoes, in addition to the wind and severe weather mitigation actions described elsewhere in this plan.

### **11.1 Shelter areas**

**Description of the Action:** Certain areas should have tornado shelters that are accessible to the public or nearby residents. Meetings with local mobile home park owners/proprietors shall occur to examine the feasibility of installing tornado shelter areas for park residents. Similar meetings will occur with the Downtown Development Authority and the Parks and Recreation Department concerning shelters for downtown and recreational areas. A report will be produced on the subject by mitigation staff.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Discuss by July 15.

### **11.2 Residential safe rooms**

**Description of the Action:** Information about the benefits of safe room installation in homes shall be disseminated, and the construction of such rooms encouraged, through a presentation and display at the annual meeting of the local Farmer's Association.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** The annual meeting of the Farmer's Association occurs in the summer.

**Potential Sources of Financial Assistance:** The Farmer's Home Administration, and possibly the Michigan State Housing Development Authority.

## **12. Reduce the county's vulnerability to severe winter weather hazards**

**Description of the problem:** Limited public education efforts and advance warning capabilities currently render many of the county's residents and businesses quite vulnerable to severe winter weather events. In addition to actions already listed to mitigate the effects of extreme temperatures, the following strategy shall be implemented.

### **12.1 General public awareness**

**Description of the Action:** Coordinate with county health departments and officials to promote public awareness of winter weather hazards and how to deal with them .

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** The first public awareness activities should be in the planning stages no later than May 15.

### **13. Reduce the damages and impacts caused ice, sleet, and snowstorms**

**Description of the problem:** Portions of the area's electrical, communications, and transportation infrastructure are vulnerable to the effects of ice and sleet hazards. Periods of severe cold temperatures and major snow accumulation often cause traffic difficulties, frozen/broken pipes, other structural damages, and school shutdowns in the county. Urban forestry actions (see severe winds section) will be helpful, along with general winter and extreme temperature mitigation actions. In addition, there is another action proposed below.

#### **13.1 Public awareness**

**Description of the Action:** Coordinate with the Sheriff's Office and local police departments to promote public awareness of the dangers of ice and sleet for drivers, and the hazards of downed power lines and frozen/broken water pipes.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Discuss by August 15.

**Potential Sources of Financial Assistance:** Not needed.

### **14. Reduce the likelihood of personal and economic harm from civil disturbances**

**Description of the problem:** Labor unrest in the county's largest city (Largetown) has been a problem since its founding in the late 1910s. This area remains a hot spot for demonstrations and violent activism on labor issues, as last year's major strike demonstrated. On the other side of the county is the Penitent Prison, which is subject to regular disturbances and even riots. At Local University, the stadium and arena buildings sometimes house events where the audiences get out of control and cause damage and disturbances.

#### **14.1 Reduce violence from labor unrest**

**Description of the Action:** Appropriate persons from the city, law enforcement, major industries, and labor organizations shall be contacted to help identify patterns and causes of violent disturbances, and to brainstorm ideas to reduce such violence or facilitate negotiations to calm and prevent it.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Discuss by September 15.

**Potential Sources of Financial Assistance:** Not needed.

#### **14.2 Reduce prison hazards**

**Description of the Action:** Officials from Penitent Prison shall be contacted to assess possible needs and organize adjacent community responses and mutual aid, should the need be identified for assistance in quelling an uprising within that institution.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Discuss by October 31.

**Potential Sources of Financial Assistance:** Not needed.

#### **14.3 Reduce destruction from festivities**

**Description of the Action:** Emergency site plans for the stadium and arena shall be updated, in consultation with university, city, and county planners and emergency management staff, and will include sections dealing with civil disturbances. Also being addressed at a broader planning level are possible regulations and re-design of nearby student housing areas and commercial districts, to reduce harm from large-scale festivities.

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** Draft plan by December 15.

**Potential Sources of Financial Assistance:** Not needed.

## **15. Increase the county's capacity to withstand an enemy attack involving weapons of mass destruction**

**Description of the problem:** According to the Michigan Emergency Management Plan, the county has two targets identified as probable attack aim points in the FEMA attack planning guidance document Nuclear Attack Planning Base (NAPB) – 1990. (The NAPB-1990 document provides the basis for the nuclear attack planning strategy adopted for Michigan.) Areas identified as aiming points are subject to the most severe direct weapon effects including blast, heat, fire, and radiation. A combination of evacuation and in-place sheltering is the best population protection alternative.

**Alternate problem description for non-target areas:** According to the Michigan Emergency Management Plan, the county is not identified as a probable attack aim point under the FEMA attack planning guidance document Nuclear Attack Planning Base (NAPB) – 1990. (The NAPB-1990 document provides the basis for the nuclear attack planning strategy adopted for Michigan.) Nonetheless, the county is still vulnerable to indirect weapon effects such as intense radiation and fallout from other attack aim points in the state. Therefore, the best population protection strategy is in-place sheltering in public shelters and home basements.

### **15.1 Evacuation and sheltering plans**

**Description of the Action:** The county's evacuation and sheltering plans are currently being updated by planners and emergency management staff, and will include projects for new shelter areas and expanded road capacities that can better handle evacuation-related traffic flows.

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** Revisions to be completed by December 20.

**Potential Sources of Financial Assistance:** Not needed.

### **15.2 Safe room sheltering uses**

**Description of the Action:** "Safe rooms" designed for protection from tornadoes can also be used in many instances for sheltering from a nuclear attack (see strategy number 11.2). Support will be given for the construction of safe rooms for general emergency sheltering purposes.

See strategy number 11.2.

## **16. Increase the county's capacity to anticipate, manage, and withstand potential incidents involving sabotage, terrorism, or use of weapons of mass destruction**

**Description of the problem:** The county's position as a government, business, education and research center makes it a potential target for a terrorist attack – possibly involving the use of weapons of mass destruction.

## **16.1 Agency coordination**

**Description of the Action:** Meetings shall be scheduled to assist local law enforcement agencies in coordinating their preparedness and response capabilities so as to provide mutual aid when necessary. Action steps to be implemented as a result of these meetings include the adoption of an Incident Command System by all involved agencies, and the coordination of emergency communications equipment and protocols.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer.

**Schedule to Initiate Action:** Meetings to begin by February 15.

**Potential Sources of Financial Assistance:** Not needed.

## **16.2 Information-sharing strategies**

**Description of the Action:** A means will be organized, after conferring with law enforcement agencies at the local, state, and federal levels, to report and share information on potential terrorist organizations and activities. After preliminary meetings, strategies will be developed to include the media – possibly involving the provision of rewards to individuals who provide information or assistance for these efforts.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Meetings will begin by January 15.

**Potential Sources of Financial Assistance:** Law enforcement agencies.

## **16.3 Planning for terrorist threats**

**Description of the Action:** The emergency site plans that are currently being updated by planning and emergency management staff for Memorial Stadium and Central Arena will include sections dealing with terrorist-related threats.

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** Discuss by December 15.

**Potential Sources of Financial Assistance:** Not needed.

# **17. Reduce the threat of potential public health emergencies**

**Description of the problem:** The county is vulnerable to a wide variety of public health threats, including disease epidemics, food and water contamination, temporary loss of water and sewer services, exposure to chemical, biological or radiological agents, and infestations.

## **17.1 Maintain adequate monitoring and surveillance capabilities**

**Description of the Action:** Work with Local University and the County Health Department to ensure adequate resources are in place to monitor public health threats and take the necessary steps to prevent or limit the scope and magnitude of threats that could escalate into public health emergencies.

**Lead Manager Assigned:** The Emergency Program Manager

**Schedule to Initiate Action:** Discussion should be underway by January 15.

**Potential Sources of Financial Assistance:** Local University.

## **17.2 Reducing infestations**

**Description of the Action:** Investigate means of assisting farmers in eradicating infestations that may harm their products and threaten public health. A report will be produced and distributed on the topic.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** The report should be completed by May 1.

**Potential Sources of Financial Assistance:** Not needed to generate report.

## **17.3 Training and inspection assistance**

**Description of the Action:** Training from the U.S. Department of Agriculture will be provided to officials from the County Health Department to assist in inspecting and maintaining the safety of foods at numerous points in their local production and supply chains.

**Lead Manager Assigned:** County Health Department Director.

**Schedule to Complete Action:** Training ends on November 12.

**Potential Sources of Financial Assistance:** Local industries, the U.S. Department of Agriculture.

## **18. Reduce the likelihood and potential effects of dam failures in the county**

**Description of the problem:** The county has four high-hazard and three significant-hazard dams, located mainly in the northern part of the county. A partial or complete failure of one of these structures could endanger the lives and property of thousands of county residents.

### **18.1 Planning and mapping**

**Description of the Action:** Areas and developments within the "hydraulic shadow" of the county's dams will be mapped as part of a local risk assessment on this hazard.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** Assessment and mapping complete by January 5.

**Potential Sources of Financial Assistance:** Not needed.

### **18.2 Renovation of dams**

**Description of the Action:** Local authorities and the Michigan Department of Environmental Quality will be consulted to determine how to assemble funds for renovating the Big River Dam and Maple Rapids Dam, both of which are in need of extensive repairs.

**Lead Manager Assigned:** The Emergency Program Manager

**Schedule to Complete Action:** Discuss by August 15.

**Potential Sources of Financial Assistance:** To be determined.

## **19. Reduce the risks of hazardous material fixed site incidents in the county, and increase the county's ability to respond to such incidents with a minimum of environmental, public safety, and economic impacts**

**Description of the problem:** Several enterprises now deal regularly with large amounts of hazardous materials and require updates to their site emergency plans. There are 16 other SARA Title III Section 302 sites in the county which require special monitoring and planning activities by the Local Emergency Planning Committee (LEPC). The LEPC is currently in need of new and qualified members, due to recent turnover.

### **19.1 Update plans**

**Description of the Action:** Assist sites in updating their Site Emergency Plans.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Discuss by October 15.

**Potential Sources of Financial Assistance:** Not needed.

### **19.2 LEPC strengthening**

**Description of the Action:** Encourage and assist the LEPC in its activities relating to the development and review of SARA Title III Section 302 site emergency plans, and the search for qualified new members for the committee.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Chair will need replacement by May 10. Three other members will need to be replaced by October 31.

**Potential Sources of Financial Assistance:** Not needed.

## **20. Reduce the risk of damage, loss of life, and other costs resulting from transportation accidents**

**Description of the problem:** The county is vulnerable to a wide array of transportation accidents, including air crashes, train derailments, and large-scale traffic accidents involving automobiles and buses. The major plane crash at Local Airport, caused by unauthorized recreational flights originating from the smaller Grass Strip Airport, was a tragedy that can clearly be avoided by the county in the future. The local school system also endured a near-disastrous school bus accident in 1998, and the Memorial Freeway outside the crowded metro business district in River City had a 45 car pile-up that caused it to be closed down for two days during the height of the annual tourist festival in 1999. The Express Railroad Line also poses some clear hazards, as many of its rural crossings in the hilly sections of the county's northwest are difficult to cross safely and truck and bus traffic are particularly at-risk.

### **20.1 Revise transportation procedures**

**Description of the Action:** Airport and bus emergency procedures have been reviewed and amended in response to recent incidents, and re-training has begun using these procedures at Local Airport. Such techniques must be shared with surrounding airports. The county will continue to work with the Express Railroad Line to assess rural rail crossing hazards and identify required mitigative actions.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Complete Action:** Organize transportation accident-reduction training and meetings before November 15.

**Potential Sources of Financial Assistance:** Provided by industry, school district, general funds.

### **20.2 Use new transportation technologies**

**Description of the Action:** The Michigan Department of Transportation (MDOT), County Road Commission, and City of Maple Transportation Department have agreed to investigate and implement where possible pertinent aspects of new Intelligent Transportation System (ITS) technologies on the stretch of I-34 that passes through the county to assist in notifying drivers of hazardous conditions and facilitating smooth traffic flow.

**Lead Manager Assigned:** The City of Maple Transportation Department Technology Enhancement Division.

**Schedule to Complete Action:** Study complete by June 21.

**Potential Sources of Financial Assistance:** Not needed at this time.

### **20.3 Improve at-grade railroad crossings**

**Description of the Action:** Improvements to dangerous at-grade crossings of the Express Railroad Line will be undertaken at locations determined by local, county, and regional transportation planners. A meeting of these planners will be called at the Regional Planning Commission to finalize development of a plan of action for accomplishing this.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Initial Meeting to occur by May 15. Plan of action to be developed by November 15.

**Potential Sources of Financial Assistance:** Possibly Michigan Department of Transportation and the Michigan Rail Loan Assistance Program.

## **21. Increase the county's ability to deal with transportation accidents that involve hazardous materials, and reduce the effects of such incidents on the local communities**

**Description of the problem:** The county has numerous roads that are used for the transport of hazardous materials. In addition, the Express Railroad Line that runs through River City, Maple Grove, and Prairie View also regularly carries shipments of hazardous materials. Smaller-scale transportation accidents involving hazardous materials occur regularly in the county. Larger-scale accidents requiring protective actions for nearby areas have been rare, but the possibility of such incidents always exists.

### **21.1 Changes in the area's transportation network**

**Description of the Action:** Risk from transportation of hazardous materials should be reduced in the north of the county if the new expressway extension proceeds as planned through less densely-populated areas. Local efforts and ordinances shall be encouraged to cause signs to be installed and require routing of hazardous material shipments along this less-dangerous route whenever possible.

**Lead Manager Assigned:** Mitigation staff.

**Schedule to Complete Action:** Ongoing.

**Potential Sources of Financial Assistance:** Michigan Department of Transportation.

## **21.2 Response training**

**Description of the Action:** The county's vulnerability to transportation incidents will be reduced by training response personnel to a higher level in hazardous material response, using the FY02 budget increases earmarked for this purpose.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer.

**Schedule to Initiate Action:** First training session begins September 2.

**Potential Sources of Financial Assistance:** Earmarked in budget.

## **22. Decrease the county's vulnerability to infrastructure failures caused by accidents, system overload, or disaster damage**

**Description of the problem:** The county is dependent on its network of public and private utility infrastructure to provide essential life-supporting services such as electric power, heating and air-conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of these independent, yet interrelated systems fail due to accidents, system overload, disaster damage, or other causes, the consequences can be severe. Unfortunately, the county has experienced several infrastructures failures in recent years that highlighted its tremendous vulnerability to these incidents. For example, the major power failure in the summer of 1997 caused many problems with traffic as the majority of Treeville's traffic signals failed to function properly. A convention that was scheduled in town at the time had to be cancelled due to the power outage. Area hospitals had a hard time caring for their patients under such conditions. A major water main break in 1999 flooded a nearby school (causing extensive damages), significantly reduced water pressure for firefighting, closed area businesses and government offices, and required the provision of bottled water to over 2,000 residents for a 72-hour period. Severe cold weather in 1992 caused a similar break and emergency conditions that lasted for nearly four days. Major system failures also occurred in 1994 (telephone service) and 1991 (sewage treatment plant damaged by flooding). Both of these incidents created emergency conditions that lasted for several days and adversely affected thousands of county residents.

### **22.1 Emergency generators**

**Description of the Action:** The purchase and installation of power generators could provide short-term relief from power failures at critical facilities such as sewage pump stations, hospitals and medical centers, nursing home facilities, and traffic signals at high-priority intersections. Meetings will be held with utilities and local Public Works Departments to determine the resources and funding required to mitigate recurring infrastructure failures.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer.

**Schedule to Initiate Action:** Discuss by November 15.

**Potential Sources of Financial Assistance:** To be determined.

### **22.2 Water line protection**

**Description of the Action:** Several water supply lines in River City that have been determined to be vulnerable to ground freeze shall be buried below the frost line as part of the current fiscal year's Capital Improvement Program. Another water line that cannot easily be buried deeper will instead be fitted with extra insulation. Additional funding will be sought for similar future mitigative actions.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Preliminary planning done by March 15, with summer implementation following.

**Potential Sources of Financial Assistance:** Department of Public Works.

### **22.3 Volunteer outreach**

**Description of the Action:** A network of volunteers are needed to regularly check on the needs and conditions of the elderly, disabled and homebound persons, and other special-needs groups during and after severe weather conditions.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Organized by September 1, active by October 15.

**Potential Sources of Financial Assistance:** A generous donation from the Iron Corporate Giving Program has provided funding for the initial organization and early operations of this volunteer network for its first year or so. Once active, some of its members will be assigned to investigate revenue sources that will allow it to continue operating.

## **23. Ensure that the county is adequately prepared to protect residents, property, and the environment in the event of a nuclear power plant accident or radiological release**

**Description of the problem:** The county is located within the 50 mile Emergency Planning Zone (EPZ) for the Donald C. Cook Nuclear Plant. In addition, the nuclear research facility at Local University works with significant quantities of enriched uranium, plutonium, and other sources of ionizing radiation.

### **23.1 Exercises**

**Description of the Action:** Develop a functional exercise to test and enhance preparedness and response procedures for a radiological release at the nuclear research facility at Local University.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Exercise should be developed by October 31 and then held in early December.

**Potential Sources of Financial Assistance:** Local University; other participating agencies and communities.

### **23.2 Revised site plan**

**Description of the Action:** Revise the site emergency plans for the Local University nuclear research facility, and promote agency and responder awareness and coordination with these plans to the fullest extent possible.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Complete Action:** Plan revisions should be complete by February 15; awareness and coordination meetings should be held by June 15.

**Potential Sources of Financial Assistance:** Local University.

### **23.3 Improve warning system coverage and effectiveness**

**Description of the Action:** Install new warning sirens in the southern sections of the county, and identify areas where additional sirens may also be needed. Investigate the feasibility of alternative warning systems and produce a written report on the topic.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer.

**Schedule to Initiate Action:** Siren installation in the southern sections to be completed by June 1. Report to be completed by September 15.

**Potential Sources of Financial/Technical Assistance:** Federal Emergency Management Agency.

## **24. Decrease the potential harm from industrial accidents involving the county's petroleum and natural gas wells, pipelines, storage tanks, and refineries**

**Description of the problem:** Wells have not always been adequately protected against the wildfire hazards present in the county's forested areas. Some pipelines in the county pass through very heavily populated and densely-developed areas.

### **24.1 Wildfire protection**

**Description of the Action:** Oil and gas production facilities, property, and equipment will be protected against the possibility of wildfires to the greatest extent possible. To do this, production companies and land owners will employ FIREWISE principles of proper grounds maintenance, equipment storage, vegetation clearance, and other techniques, as related to them at the recent FIREWISE workshop organized by the county's Emergency Program Manager.

**Lead Manager Assigned:** The Emergency Program Manager; local code enforcement officials.

**Schedule to Initiate Action:** Facilities will be reviewed during the month of May.

**Potential Sources of Financial/Technical Assistance:** Involved companies; local fire departments.

## **25. Reduce the county's vulnerability to scrap tire fires**

**Description of the problem:** Several large storage sites for scrap tires (holding a total in excess of 2,000,000 tires) have been identified in the county's hazard analysis. A major lawsuit was filed against one of these for the environmentally disastrous fire that spread through their 300,000-tire scrap pile in late March. Neighbors around other sites report that prolific mosquito breeding constitutes a tangible nuisance and public health problem.

### **25.1 Compliance with MDEQ regulations**

**Description of the Action:** Tires at the county's known and licensed storage locations will be inspected regularly and concerns reported to the Michigan Department of Environmental Quality. The regulations of that department's Scrap Tire Regulatory Program will be strictly enforced.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer; officials from MDEQ.

**Schedule to Initiate Action:** Additional inspections scheduled to begin in April.

**Potential Sources of Financial Assistance:** Storage site proprietors (fees and fines authorized by a local ordinance that is expected to pass on February 6); MDEQ.

### **25.2 Local processing of scrap tires**

**Description of the Action:** An agreement will be sought between the currently licensed scrap tire storage areas and the Grindemup Processing Plant and Energy Center, to provide for the Plant to use local tires in its energy-producing activities.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer; representatives of the involved companies.

**Schedule to Initiate Action:** Initial business meetings scheduled for November 4.

**Potential Sources of Financial Assistance:** Not needed.

### **25.3 Denial of permit to operate**

**Description of the Action:** One of the identified scrap tire storage areas (the Mile-High Tire Recycling Company) will not be allowed to operate in the county until economic, legal, and regulatory requirements have been complied with.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Site closed until required operating conditions are met.

**Potential Sources of Technical Assistance:** Local code enforcement officials; MDEQ district staff.

## **26. Reduce the county's losses from structural and industrial fires**

**Description of the problem:** The county currently has over 150,000 residential, commercial, and industrial structures – over 40% of which were built before World War II. In addition, many dormitories at the Local University, and several high-rise structures in downtown River City, either lack sprinkler facilities altogether or have determined that existing systems require maintenance and upgrading. Several of the older community business districts date back as far as the 1860s and are at higher risk from fires.

### **26.1 Sprinkler system installation**

**Description of the Action:** The Local University dormitories are now required to have sprinkler systems. Installation of the new systems will be completed before the new school year begins on August 20.

**Lead Manager Assigned:** The County's Hazard Mitigation Officer; university fire officials.

**Schedule to Initiate Action:** Will begin at the beginning of the summer semester on May 20 and end before August 20.

**Potential Sources of Financial Assistance:** Local University; State Legislature.

### **26.2 Sprinkler upgrade in high-rise towers**

**Description of the Action:** Plans are being developed for a major renovation to the Tall Tower building in downtown River City, one of several structures currently not in compliance with the requirements of the city's new fire safety ordinance.

**Lead Manager Assigned:** The County's Assistant Hazard Mitigation Officer.

**Schedule to Initiate Action:** Plans should be complete by January 4; the sprinkler system should be completely installed by December 31.

**Potential Sources of Financial Assistance:** Tall Tower Property Management, Inc.

### **26.3 Firewalls and design alterations in old "Main Street" areas**

**Description of the Action:** Old "Main Street" mixed-use districts in River City, Prairie View, and Maple Grove will be altered or reconstructed with improved designs and more effective firewall separations between adjacent units to help prevent fire spread from occurring in the future. These activities are part of planned community downtown renovations being funded under the Community Development Block Grant (CDBG) program.

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Construction begins in River City on March 5 and in Prairie View and Maple Grove in July.

**Potential Sources of Financial Assistance:** CDBG funds; historic preservation funds; Main Street Program funds; business and insurance contributions and subsidies.

## **27. Reduce the risk of damage and loss of life from subsidence in the county's old mining areas**

**Description of the problem:** The locations of many of the county's old mines are not precisely known, but some have recently been found underlying areas of major roads and development. According to the county's hazard analysis, subsidence could cause serious problems throughout most of the northwest quadrant of the county.

### **27.1 Locate all old mining areas**

**Description of the Action:** As a result of last November's meeting with the county's historical society, the society's members have agreed to perform an exhaustive search of local records to locate all possible information on the location of old mines in the county. They will report their findings to the county emergency management office. Coordination will be maintained with the Michigan Department of Environmental Quality's Geological Survey Division.

**Lead Manager Assigned:** Members of the county's historical society.

**Schedule to Complete Action:** Findings of historical research are anticipated by December 31.

**Potential Sources of Financial Assistance:** Not needed – volunteer effort.

### **27.2 Field research on subsidence threat**

**Description of the Action:** The County Planning Commission, local building inspectors, and the Regional Planning Commission have begun extensive interviews with local property owners to locate areas that are at risk from land subsidence. Projects will be identified from this study, some of which will be submitted by the Regional Planning Commission for funding assistance under the federal Rural Abandoned Mine Program (CFDA 10.910).

**Lead Manager Assigned:** The Emergency Program Manager.

**Schedule to Initiate Action:** Surveys will commence by February 1, with completion expected by December 31.

**Potential Sources of Financial Assistance:** Historic preservation funds; Main Street Program funds; business and insurance contributions and subsidies.

**(END OF MITIGATION STRATEGY EXAMPLES)**

## **Monitoring and Periodic Revision of the Plan**

The plan will be monitored on a regular basis by (list responsible party[ies]). Because (name of community) is a dynamic, constantly changing community, it is expected that the plan will be revised frequently. Plan evaluation and maintenance are the responsibility of (list the responsible party[ies]). Proposed changes in the plan will be presented to the (list community body) as needed, but not less than annually.

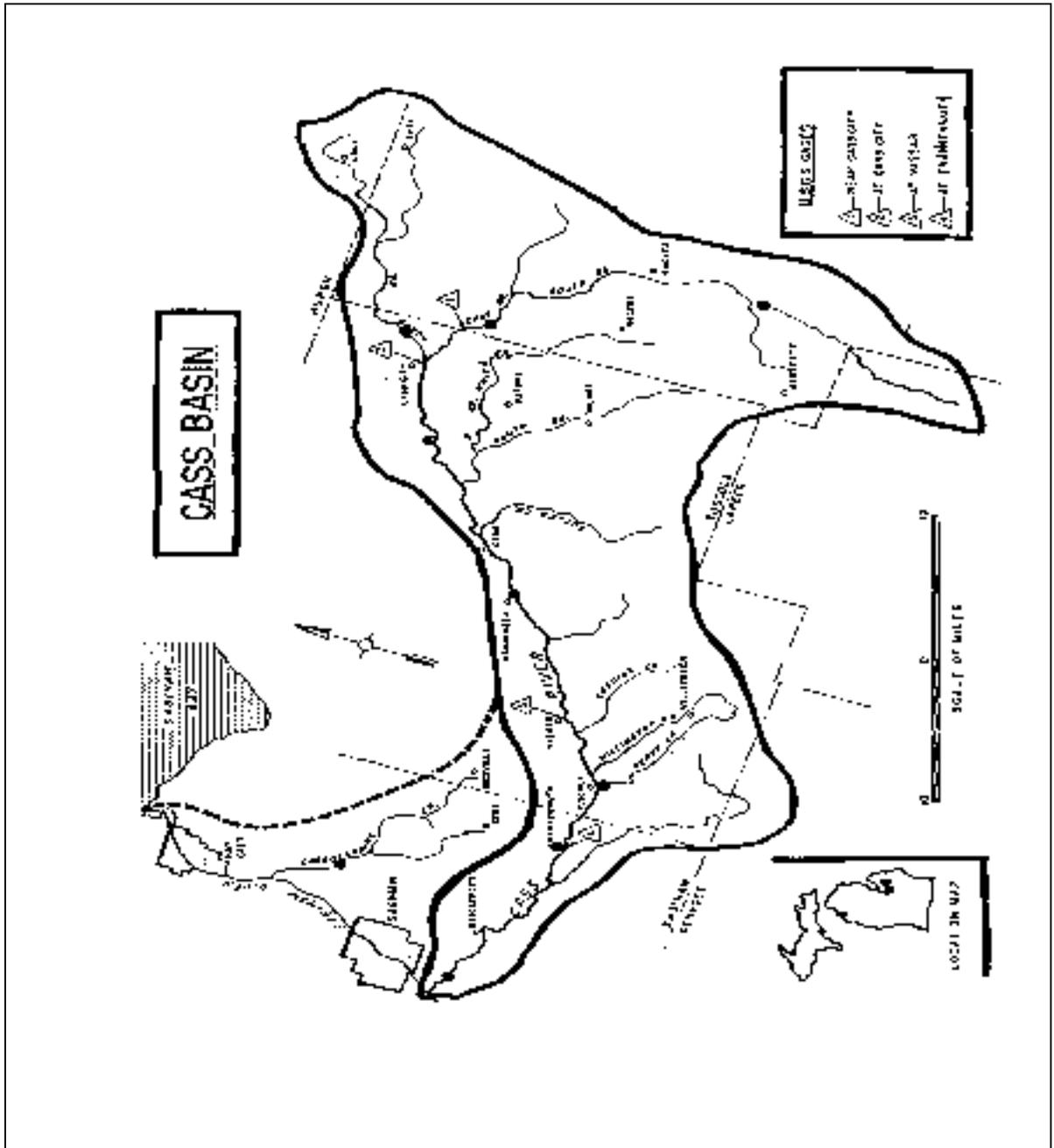
*In that hazard mitigation is a program in its infancy as a formal process, it is critical to monitor progress on the plan to keep the process moving forward. The hazard mitigation plan should be updated annually following its implementation until the process has become an ingrained practice. Goals and objectives should be reviewed quarterly. Each individual assigned an objective should be required to provide a brief progress report. If problems are being encountered, a meeting may be necessary to initiate a barrier removal process.*

**NOTE: THIS AND THE 9 PAGES FOLLOWING CONTAIN ATTACHMENTS FROM THE CITY OF VASSAR HAZARD MITIGATION PLAN, INCLUDING EXAMPLES OF THE SORT OF DETAIL THAT IS USEFUL AND REQUIRED FOR A PLAN TO CONFORM WITH THE REQUIREMENTS OF THE FLOOD MITIGATION ASSISTANCE PROGRAM (FMAP).**

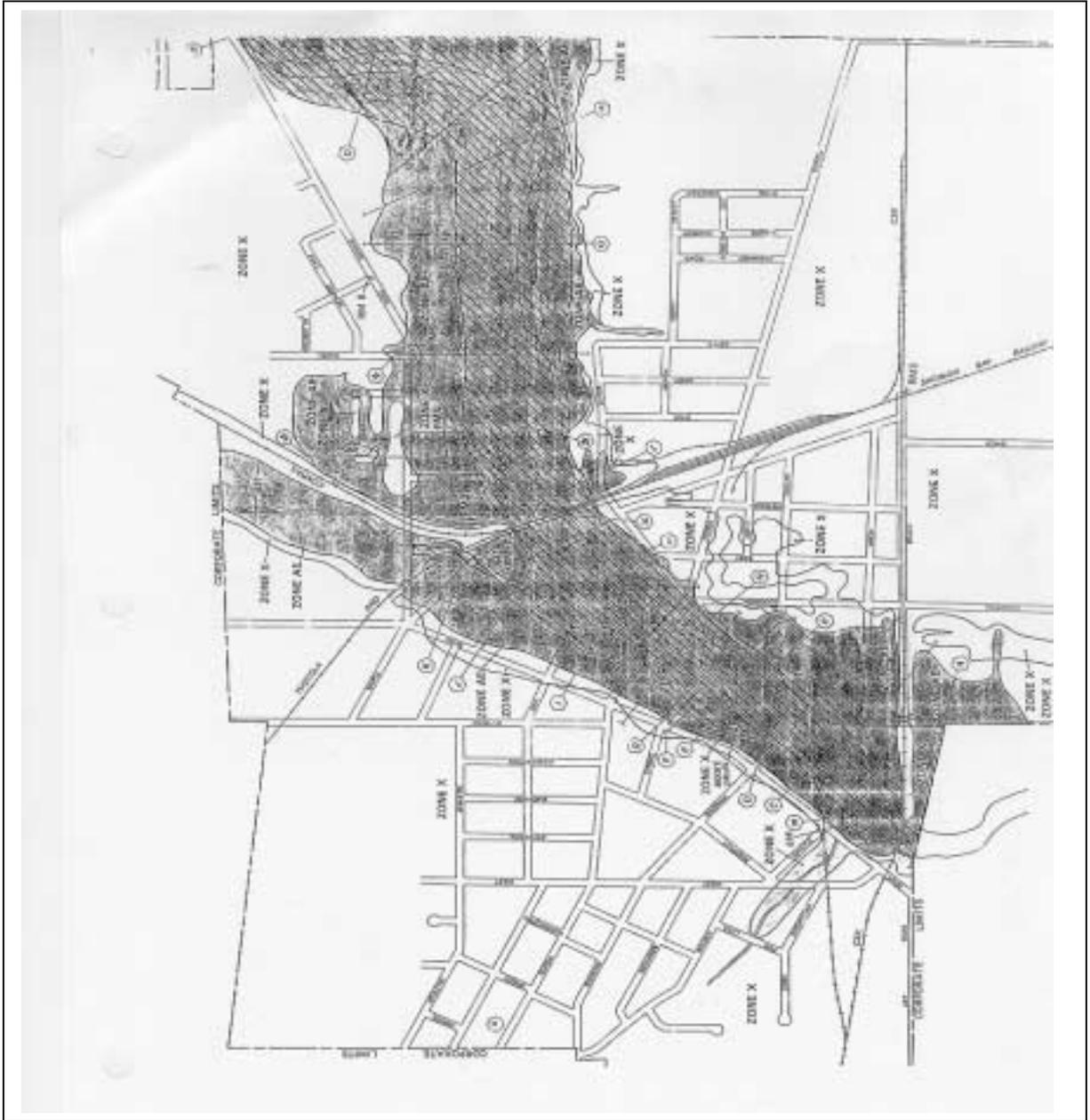
## Acronyms

ACP	Association of Contingency Planners
ARC	American Red Cross
ASFPM	Association of State Floodplain Managers
BFE	Base Flood Elevation (Base Flood is the same as the 100-Year Flood, or 1% event)
CBD	Central Business District
CDBG	Community Development Block Grant (HUD program)
CPT	Community Planning Team
CRS	Community Rating System (NFIP program)
DDA	Downtown Development Authority
DEQ	Department of Environmental Quality (Michigan)
EDA	Economic Development Agency (Federal Department of Commerce Program)
EOC	Emergency Operations Center
FEMA	Federal Emergency Management Agency
FHwA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance (NFIP program)
GIS	Geographic Information System
HMGP	Hazard Mitigation Grant Program (FEMA program)
HUD	Department of Housing and Urban Development
ICC	Increased Cost of Compliance
ISO	Insurance Services Organization
MDOT	Michigan Department of Transportation
MOM	Multi-Objective Management
MOU	Memorandum of Understanding
NFIP	National Flood Insurance Program
NRCS	Natural Resource Conservation Program
NWS	National Weather Service
SBA	Small Business Administration
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

Map of Vassar



# Map of Vassar



## DEFINITIONS

B	Basement
BK	Brick
C	Commercial
CBC	Concrete Block Construction
CO	City Owned
COND	Condition of Building (1 = essentially not salvageable; 10 = new)
CS	Crawl Space
Depth 1	Depth of Flood = Flood Elevation – LAG
Depth 2	Depth above First Floor = Flood Elevation – LF
Flood Elev.	100 – year (1% chance) Flood Elevation
FLDWY	Located within the Designated Floodway
LAG	Lowest Adjacent Ground Elevation
LF	Lowest Floor Elevation (excluding standard basements)
LO	Lowest Opening into Structure
R	Residential-Single Family
RMF	Residential-Multi Family
SOG	Slab on Grade
STN	Stone
WF	Wood Frame

# CITY OF VASSAR, MICHIGAN

## FLOOD INVENTORY, March 1998

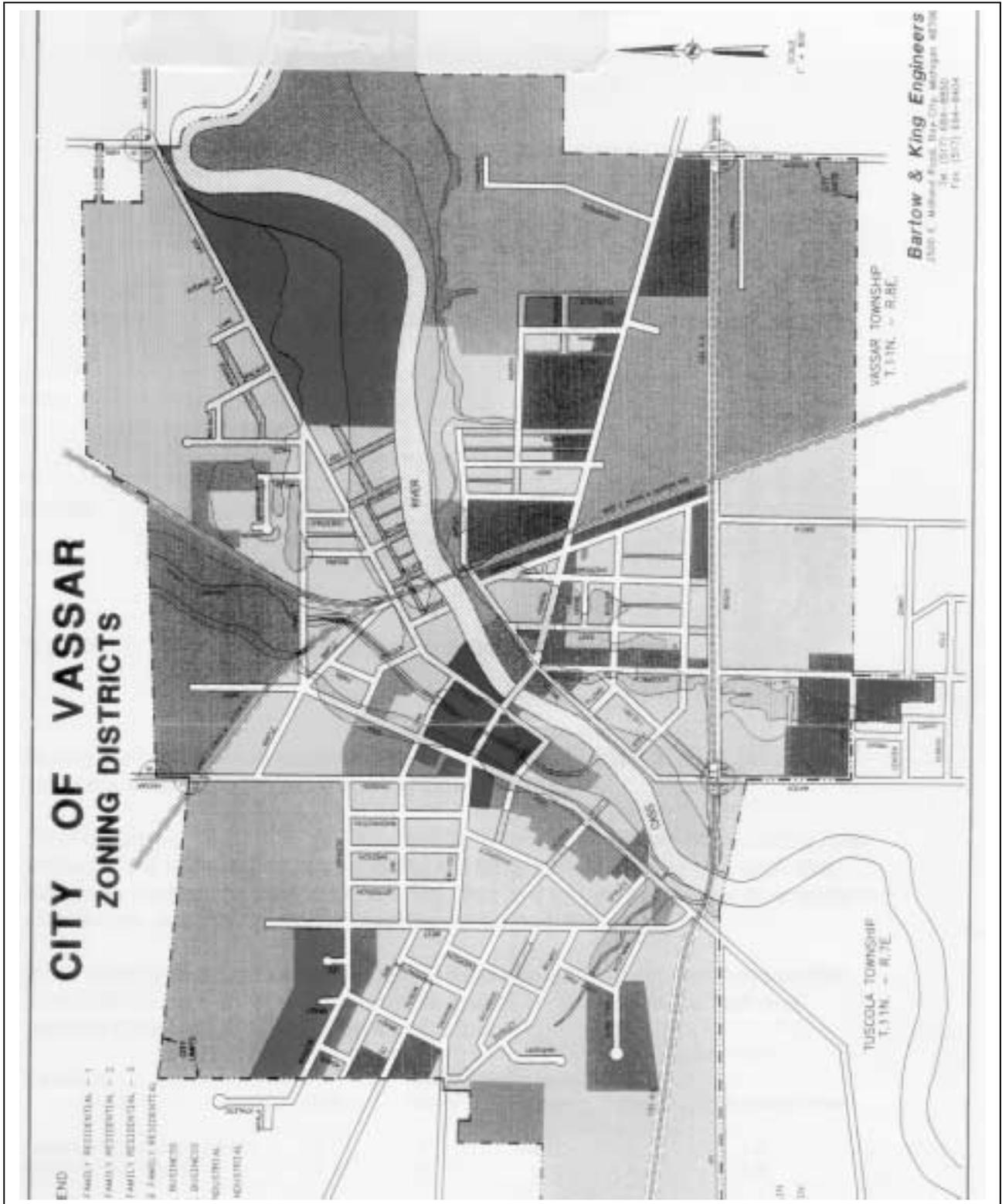
ADDRESS	USE	TYPE CONST	COND	ASS'D VALUE	FDWY	FLOOD ELEV	LF	LAG	LO	DEPTH 1	DEPTH 2
<b>ARCH</b>											
219	R	WF B	1	1,000	YES	635.6	630.7	626.9		8.7	4.9
254	R	WF B	4	16,200	NO	635.6	633.2	630.6	631.1	5.0	2.5
260	R	WF CS	7	25,100	NO	635.6	632.0	630.3		5.3	1.3
267	R	WF B	6	29,900	NO	635.6	634.6	632.6		3.0	1.0
268	R	WF CS	9	39,500	NO	635.6	632.9	630.9		4.7	2.7
274	R	WF B	4	19,800	NO	635.6	634.7	631.9	632.3	3.7	0.9
278	R	WF B	5	21,800	NO	635.6	635.9	633.2	633.2	2.4	
279	R	WF B	8	18,400	NO	635.6	638.1	634.7	635.2	0.9	
282	R	WF B	7	18,800	NO	635.6	637.1	634.7	634.7	0.9	
<b>BOURN</b>											
508	R	WF CS	7	10,200	NO	637.5	633.9	631.2		6.3	2.7
511	R	WF B	8	28,300	NO	637.5	634.2	631.9	631.9	5.6	3.3
517	R	BK CS	8	33,400	NO	637.5	634.2	632.8		4.7	3.3
528	R	WF B	8	25,200	NO	637.5	636.0	633.3	633.3	4.2	1.5
532	R	WF B	8	25,000	NO	637.5	634.6	634.0	634.0	3.5	2.9
537	R	WF B	7	25,600	NO	637.5	637.5	635.8	635.8	1.7	
540	R	WF CS	6	12,900	NO	637.5	636.2	634.7		2.8	1.3
546	R	WF B	8	31,500	NO	637.5	638.0	635.6	635.9	1.9	
<b>CASS</b>											
118	C	CBC SOG	5		YES	636.4	630.3	630.3	630.3	6.1	6.1
119	C/R	WF/BK B	1	14,600	NO	636.4	632.5	630.2	630.2	6.2	3.9
121/123	RMF	WF B	5	16,900	YES	636.4	631.1	631.0	631.1	5.4	5.3
126	R	WF B	2	13,200	YES	636.4	632.3	629.9		6.5	4.1
127	R	WF B	6	14,100	YES	636.4	634.4	631.8	631.8	4.6	2.0
133	R	WF B	7	28,100	YES	636.5	636.3	632.7	632.7	3.8	0.2
200	R	WF B	6	32,400	YES	636.5	635.3	630.3	631.7	6.2	1.2
203	R	BK CS	3	24,100	YES	636.7	636.0	633.0		3.7	0.7
209	R	WF B	8	21,600	YES	636.7	635.6	632.9	632.9	3.8	1.1
221	R	WF B	3	16,600	YES	636.7	634.2	632.1	632.1	4.6	2.5
227	R	WF CS	4	13,500	YES	636.7	632.7	631.9		4.8	4.0
301	RMF	WF B	7	18,700	YES	636.7	631.3	629.0	629.0	7.7	5.4
305	C	WF CS	8	CO	YES	636.7	632.5	630.2		6.5	4.2
312	R	STN B	7	22,600	YES	636.7	632.4	629.6	629.9	7.1	4.3
321	R	WF B	2	1,900	NO	636.9	630.8	628.3	628.3	8.6	6.1
337	R	WF B	5	16,400	NO	637.0	630.6	627.1	627.1	9.9	6.4
419	R	WF B	5	19,400	NO	637.4	634.2	631.2	631.3	6.2	3.2
426	R	WF CS	5	13,600	YES	637.5	632.9	631.4		6.1	4.6
429	R	WF/BF B	7	15,000	YES	637.5	633.6	630.9	632.1	6.6	3.9
506	R	WF B	8	15,100	YES	637.5	636.0	632.3	633.1	5.2	1.5
512	R	WF B	8	18,400	YES	637.5	635.4	632.6	None	4.9	2.1
515	R	WF B	7	13,000	YES	637.5	635.4	631.4	633.4	6.1	2.1
520	R	WF CS	6	13,900	YES	637.5	635.8	632.3		5.2	1.7
526	R	WF B	8	21,700	YES	637.5	636.2	632.2	None	5.3	1.3
600	R	WF B	8	16,400	YES	637.5	632.1	630.0	None	7.5	5.4
615	R	WF B	7	23,200	NO	637.5	636.8	631.8	635.4	5.7	0.7
619	R	WF B	7	25,200	NO	637.5	636.3	635.1	633.1	2.4	1.2
620	R	WF B	8	14,000	NO	637.5	634.4	632.5		5.0	3.1
623	R	WF B	7	17,200	NO	637.5	637.3	633.5	635.0	4.0	0.2
626	R	WF B	7	18,300	NO	637.5	636.0	632.4		5.1	1.5
627	R	WF CS	6	27,800	NO	637.5	636.4	634.1		3.4	1.1
633	R	WF B	7	30,200	NO	637.6	639.4	634.8		2.8	
634	R	WF B	7	16,500	NO	637.6	637.7	636.1	636.3	1.5	
716	R	WF B	7	23,300	NO	637.6	639.4	637.1	637.1	0.5	
717	R	WF CS	7	20,300	NO	637.6	638.5	636.9		0.7	

ADDRESS	USE	TYPE CONST	COND	ASS'D VALUE	FDWY	FLOOD ELEV	LF	LAG	LO	DEPTH 1	DEPTH 2
719	R	WF CS	6	12,700	NO	637.6	637.3	636.4		1.2	0.3
728	R	WF B	6	17,600	NO	637.6	639.0	636.9	636.9	0.7	
801	R	WF B	8	25,700	NO	637.6	640.3	636.9	637.5	0.7	
802	R	WF B	7	29,200	NO	637.6	637.4	636.5	636.9	1.1	0.2
808	R	WF B	7	12,800	NO	637.6	639.3	637.1	637.7	0.5	
CHERRY											
218	R	WF	B	21,300	NO	635.7	634.7	631.2	631.5	4.5	1.0
223	RMF	WF	B	19,200	NO	635.7	636.7	634.6	634.6	1.1	
224	RMF	WF	B	15,000	NO	635.7	635.1	631.3	631.3	4.4	0.6
231	R	WF	B	22,400	NO	635.6	636.1	632.4	633.4	3.2	
236	R	WF	CS	34,400	NO	635.6	633.1	631.1		4.5	2.5
237	R	WF	B	14,800	NO	635.6	632.3	631.8		3.8	3.3
240	R	WF	CS	1,700	NO	635.6	632.8	630.8		4.8	2.8
243	R	WF	CS	21,700	NO	635.6	633.4	632.0		3.6	2.2
245	R	WF	B	20,700	NO	635.6	632.1	630.3	630.6	5.3	3.5
246	R	WF	B	18,800	NO	635.6	632.7	628.9	630.5	6.7	2.9
CHESNUT											
529	R	WF B	6	11,300	NO	637.5	636.0	634.7	634.7	2.8	1.5
537	R	WF CS	7	12,300	NO	637.5	637.2	634.3		3.2	0.3
542	R	WF CS	7	20,300	NO	637.5	636.0	634.8		2.7	1.5
552	R	WF B	7	25,200	NO	637.5	637.1	635.3	635.3	2.2	0.4
EAST											
124	R	WF B	4		NO	636.6	639.5	636.7	636.7	NFP	
GRANT											
420	R	WF B	8	34,500	NO	637.4	639.9	637.4	637.4	NFP	
423	R	WF B	4	19,000	NO	637.4	638.5	631.5	631.5		5.9
528	R	WF CS	5	11,000	NO	637.5	637.2	635.7		1.8	0.3
530	R	WF B	9	26,900	NO	637.5	637.6	635.2	635.2	2.3	
616	R	WF CS	9	16,800	NO	637.5	637.9	636.3		1.2	
657	R	WF CS	9	11,000	NO	637.6	639.3	636.3		1.3	
HURON											
119	C/RMF	BK B	6	29,100	NO	636.0	636.4			NFP	
120	C/RMF	BK B	5	29,200	NO	636.0	635.8				0.2
125	C/RMF	BK	6	23,600	NO	636.0	634.0				2.0
126	C/RMF	BK B	7	15,300	NO	636.0	633.5				2.5
HURON											
134	C	BK	7	12,900	NO	636.0	632.2				3.8
135		BK	6	13,900	NO	636.0	631.2				4.8
139	C/RMF	BK	5	21,400	NO	636.0	630.2				5.8
140	C	BK B	6	36,900	NO	636.0	630.1				5.9
145	C	WF	4	23,000	NO	636.0	629.9				6.1
152	C	BK	1	2,900	NO	636.0	629.3				6.7
161	C/RMF	WF	4	15,200	NO	636.0	628.8				7.2
164	C	WF	7	12,900	NO	636.0	628.9				7.1
165	C/RMF	WF	6	17,900	NO	636.0	629.8				6.2
171/179	C/RMF	BK	6	59,000	NO	636.0	628.4				7.6
195	C/RMF	CONC	6	43,500	NO	636.0	631.2				4.8
287	C	BK	9	CO	YES	636.5	629.7	629.4	629.7	7.1	6.8
288	C	BK SOG	8	30,900	YES	636.0	634.6	634.0		2.0	1.4
302	C	BK SOG	8	14,400	NO	636.0	635.4	635.4		0.6	0.6
310	C	WF CS	7	36,200	NO	636.0	636.4	635.5		0.5	
314	R	WF B	6	12,700	NO	636.0	640.5	636.8	636.8	NFP	
S. MAIN											
100	C/RMF	BK B	5	32,500	NO	636.0	639.4			NFP	
101	C/RMF	BK B	5	25,800	NO	636.0	640.2		637.1	NFP	
201/203	RMF	WF B	8	26,600	NO	635.6	635.1	631.2	631.5	4.4	0.5
221	RMF	WF CS	7	20,700	NO	635.6	634.7	630.6		5.0	0.9
227	R	WF B	5	20,600	NO	635.6	637.1	630.4	634.3	5.2	
233	R	WF CS	6	22,400	NO	635.6	634.0	627.6		8.0	1.6
ADDRESS	USE	TYPE CONST	COND	ASS'D VALUE	FDWY	FLOOD ELEV	LF	LAG	LO	DEPTH 1	DEPTH 2

MAPLE											
204	R	WF B	6	7,500	NO	636.7	638.0	641.0	641.0	NFP	
209	R	WF B	6	18,100	NO	636.7	636.7	634.4	634.4	4.3	
213	R	WF CS	6	14,100	NO	636.7	633.4			4.8	3.3
218	R	WF B	1	23,800	NO	636.7	638.5	636.4	636.4	0.3	
OAK											
114	R	WF B	4	17,700	NO	636.5	636.7	632.0	633.4	4.5	
115	R	WF CS	7	23,300	NO	636.5	638.3	635.3		1.2	
121	R	WF B	7	18,100	NO	636.5	633.3	630.4	630.9	6.1	3.2
129	R	WF B	2	12,800	NO	636.5	631.9	627.7	628.4	8.8	4.6
PARK											
318	R	WF CS	9	32,100	NO	636.7	637.2	635.2		1.5	
PLUMB											
210	R	WF B	2	13,200	NO	635.6	634.1	632.0		3.6	1.5
215	R	WF CS	5	14,100	NO	635.6	635.0	633.2		2.4	0.6
220/222	RMF	WF B	4	23,200	NO	635.6	635.7	633.4	2.2	2.2	
SPRING											
136	C	WF	6		YES	635.6	631.4	626.8	631.4	8.8	4.2
Warehouse	C	BK	5	CO	YES	635.6	630.7	629.2	630.7	6.4	4.9
S. WATER											
1	C	CBC CS	3	9,500	YES	635.7	634.2	633.8		1.9	1.5
120	R	WF B	3	7,400	NO	635.6	634.5	631.1	633.2	4.5	1.1
133	R	WF	4	12,400	NO	635.6	634.0	632.9	633.3	2.7	1.6
211	R	WF CS	4	9,000	NO	635.6	635.2	630.3		5.3	0.4
215	R	WF CS	1	1,200	NO	635.6	633.2	631.4		4.2	2.4
223	C	CBC SOG	2	?	NO	635.6	632.7	632.1		3.5	2.9
225	R	WF SOG	4	9,100	NO	635.6	631.1	629.8		5.8	4.5
243	R	WF CS	2	8,700	NO	635.6	631.6	627.5		8.1	4.0
N. WATER											
Mart	C	WF SOG	7	69,500	NO	636.4	636.8	636.4		NFP	
Café	C	WF SOG	7	53,200	NO	636.5	636.3	635.6		0.9	0.2
221	C	CBC BK	6	69,400	YES	636.6	Wk. 634.1 off. 636.0	630.4		6.2	2.5 0.6
501	C	WF/CBC	5	113,700	YES	637.5	Wk. 637.7 Off.638. 3	636.7 638.0		0.8	

NFP = Not Flood Prone

City of Vassar  
Zoning Districts



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

May 5, 1998

TO: George Hosek  
NFIP Coordinator  
Land and Water Management Division

FROM: Bruce Menerey  
Flood Hazard Management  
Land and Water Management Division

SUBJECT: City of Vassar, Flood Mitigation Assistance

During the May 4, 1998 meeting of the Community Planning Team a couple of concerns were raised in regard to the Cass River.

The first concern was in regard to restrictions to flow that have formed in the river, including the sediment upstream of the old dam, the old M-13 bridge deck that had been dropped into the river, islands that have formed in the river downstream of the dam, and the railroad bridge downstream of the dam.

In an attempt to determine the impact of the sediment and old dam have on the flood elevations, I modified the hydraulic model to remove the old dam and lowered (dredge) the channel by about 3 feet.

Location	Reduction in water level, ft				
	100-yr	50-yr	10-yr	2-yr	summer flow
Upstream of Huron Street	.3	.3	.2	.1	4.0
Upstream of T&SB RR	.5	.3	.2	.2	3.8

The results indicate that the primary impact of removing dam and sediment would be on the low flows. There would be a slight decrease in the flood elevations upstream of Huron Street and the Tuscola and Saginaw Bay Railroad crossing primarily as a result of increased bridge opening due to the dredging. If the old dam is removed, the accumulated sediments would likely wash downstream, and the community could be liable for any damages caused by the increased sedimentation. It would be necessary to remove the sediments before removing the dam.

**Removal of downstream railroad crossing**

If the downstream railroad bridge were totally removed, 100-year flood stages, downstream of Huron Street may lowered about .4 feet (the impact on the flood elevations for lower floods would be less). There would minimal impact upstream of Huron Street. The flood elevations upstream of Huron Street are primarily controlled by the Huron Street bridge opening, and the elevation of Huron Street. Minor changes in flood elevations downstream of Huron Street will negligible impact upstream of the bridge.

**Removal of downstream islands**

The hydraulic analysis was modified to try to show the removal of the islands. The results of the analysis indicate that if the islands downstream of the dam were removed, the impact on the flood profiles would **less than .1 feet**, downstream of Huron Street, and that there would essentially be no impact upstream of Huron Street.

Environmentally, the dredging and/or removal of the islands, would experience significant opposition from both DNR Fisheries Division, and National Fish & Wildlife Service.

**Effects of changing Land Use**

The second concern was in regard to what impact that upstream draining of wetlands and tiling of farm fields has had on flood flows. There has not been any detailed studies done on the Cass River basin which looks at the long term effect of draining upstream wetlands. Intuitively I would expect some increase in peak flows, a decrease in low (drought) flows, and a quicker time for floods to peak. Since floods vary due to rainfall, snow cover, temperature, time of the year, etc., it is difficult say what the trend has been over the years. The best approach to determine the impact would be to develop a basin wide hydrologic model and look at changing land uses over the years. Along that same line, the model could also indicate the impact of restoring wetlands in the watershed. This modeling may be something that the Corps of Engineers could do under Floodplain Management Services.

# Appendix B – Detailed Techniques for a Hazard Analysis (Optional)

---

## **Hazard Assessment Ratings (optional but highly recommended)**

If you have trouble comparing hazards with each other to prioritize or rank them, or if you will need to describe to others (the readers of your document) *how* you assessed that your community is more vulnerable to some hazards than to others, you will want to use a technique like the Hazard Assessment Ratings described here. The best way to explain how this technique works is simply to describe each step it involves. In the end it should make sense. You will want to discuss this technique with other local officials to be certain that your choices reflect the goals and attitudes of your community. If they do, it will be much easier to gain community support and official approval for your emergency management goals and mitigation projects as a result of the mitigation plan that will emerge from this process.

1. Choose evaluation criteria – First, it must be determined what aspects of a hazard are of most concern to those in your community. Are rare but destructive events of greater concern than persistently annoying hazards? The following aspects should be considered for evaluating hazards. Go through the list below and determine (in consultation with others whenever possible) which items you and those in your community feel would be useful in evaluating each hazard. Check the column that you feel best describes how important each aspect of a hazard is. If you decide not to consider a particular aspect, mark the right column called "Not Worth Considering." Those aspects will not be considered in the assessment that will follow. Marking any other column means that an aspect will at least be given a little bit of consideration in assessing which hazards are more important. You may select these columns for only a few aspects, or may select the entire list as at least worth considering, and even add a few more of your own items to the end of the list (such as recovery issues or public health concerns, as listed in the Vulnerability Determination Table). The important point is to select at least some items as a basis for assessing hazard vulnerabilities in your area.

Hazard Aspect	Always Very Important	Usually Important	Sometimes Important	Rarely of Importance	Not Worth Considering
Likelihood of Occurrence					
Size of Affected Area					
Speed of Onset (amount of warning time)					
Percent of population affected					
Potential for causing casualties					
Potential for negative economic effects					
Duration of threat from hazard					
Seasonal risk pattern					
Environmental impact					
Predictability of hazard					
Ability of hazard impacts to be mitigated					
Availability of warning systems					
Public awareness of hazard					
Corollary effects (ability to cause other hazards to result)					
(Other considerations may be added to this list)					

2. Assign points to each evaluation criterion – Once some items are selected as at least a little bit useful to consider, these should be rated as to their importance. The importance of each criterion can be rated by taking 100 points and dividing it up between all the aspects selected above, so that more important aspects are given more points than less important ones. The result will be numbers attached to each selected aspect, which will add up to a total of 100 points. For example, if four aspects are chosen, and one receives 50 points, it is considered twice as important as another that receives 25 points. The other two aspects will be worth 25 points together (possibly 10 for one and 15 for the other) so that the total points assigned to all criteria will be 100. The degree of importance you gave each aspect in the table above can help you estimate how many points (from

the total of 100) to assign it. Those considered "always very important" should be assigned more points than those considered "Usually Important" or "Sometimes Important," and so on.

The reason for assigning 100 points between the selected hazards is that the points assigned to one aspect will be equivalent to a percentage of all criteria, and will allow the detailed analysis to proceed neatly by using percentages, instead of some more awkward set of numbers.

3. Begin to make a Hazard Assessment Rating Table – Make a table with a list of all significant hazards going down the left-most column. In the top row, label the other columns of the table with the aspects for evaluation which you have just selected and assigned points to. Do not yet place numbers into any of the cells within this table. Merely begin by listing the hazards along the left, and the evaluation criteria along the top. An example appears below.

### Hazard Assessment Rating Table

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

Hazard	Likelihood of Occurrence (30 points)	Percent of population affected (20 points)	Potential for causing casualties (20 points)	Potential for negative economic effects (15 points)	Corollary effects (10 points)	Public awareness of hazard (5 points)
Civil disturbances						
Drought						
Earthquakes						
Extreme temperature						
Scrap tire fires						
Structural fires						
Wildfires						
Dam failures						
Riverine flooding						
Shoreline flooding						
Fixed site hazmat incident						
Hazmat transportation incident						
Infrastructure failures						
Nuclear attack						
Nuclear power plant accidents						
Oil & gas well accidents						
Pipeline accidents						
Public health emergencies						
Terrorism/sabotage/WMD						
Subsidence						
Hail						
Lightning						
Severe winds						
Tornadoes						
Transportation accidents						
Winter weather hazards						

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

4. Select rating scale for each hazard evaluation aspect – Next, each chosen evaluation aspect will be given a specific rating scale, such as from 0 to 10. A rating of 0 represents a condition that poses no threat to the community, while a rating of 10 represents a condition of unmitigated serious threat. Numbers in between 0 and 10 will represent conditions between these two extremes. Each of the hazard evaluation aspects you have chosen can be represented with numbers on this scale from 0 to 10. (NOTE: this scale is not related to the 100 points that you previously assigned among these criteria – that was a different element of the procedure to assess your hazards, and will be considered again at a later point in these instructions.)

To illustrate, let's consider the criterion of "Likelihood of Occurrence." This is a measure that should already have been estimated in the Risk Assessment Summary Table. The rating on this measure that would represent the least threatening condition for any hazard would be 0: no chance of occurrence. On the other side of the rating scale, a 10 would represent a continually occurring hazard. In between you might place numbers such as "3: usually occurs once every 10 years", "5: occurs every year", "8: occurs every week", or any other estimates that you consider appropriate for your community. Look over the range of likelihoods you estimated for all the

hazards and use that to determine what a "3," "5," "7," and other numbers will actually stand for. You will soon be able to rate all hazards from 0 to 10 on this aspect of threat.

Proceed on to your next chosen criterion and again come up with some ideas about a rating scale from 0 to 10. For example, "size of affected area" would have conditions ranging from "0: none of my community would be affected" to "10: my entire community would be affected." Go through your entire list of selected hazard aspects and define what numbers from 0 to 10 can be used to describe the range of conditions, from the least threatening to the most, for that particular aspect of any hazard. Make sure that 0 is always the least threatening condition. For example, on "Ability of hazard impacts to be mitigated," the least threatening condition would be a hazard that is easy to completely eliminate, while the most threatening condition is one that is impossible to mitigate (some strategies to improve preparedness, response, or recovery would be appropriate for such hazards, if they truly can't be mitigated. Since these ratings will be used to prioritize hazards, however, your community may wish to reverse the ratings in this case and give higher priority to the hazards that are *easiest* to mitigate, by rating them as a 10 and the hardest as a 0.)

5. Rate each hazard from 0 to 10 on all the aspects you have chosen – Now you may begin to insert values into the table you have made (although I recommend using a pencil or leaving extra space to change these values later in the analysis). For each hazard listed in the left column, go across its row and fill in a rating from 0 to 10 assessing each aspect of the hazard using the rating scales you have just created. After you have filled in all empty cells of the table with a number from 0 to 10, proceed on to the next task.

### Hazard Assessment Rating Table

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

Hazard  <b>ALL NUMBERS IN TABLE SHOW HOW EACH HAZARD RATES ON A SCALE FROM 0 TO 10.</b>	Likelihood of Occurrence (30 points)	Percent of population affected (20 points)	Potential for causing casualties (20 points)	Potential for negative economic effects (15 points)	Corollary effects (10 points)	Public awareness of hazard (5 points)
Civil disturbances	2	2	3	6	3	1
Drought	3	7	1	5	3	2
Earthquakes	1	5	1	2	2	1
Extreme temperature	7	9	3	3	4	4
Scrap tire fires	1	1	1	4	2	1
Structural fires	9	1	4	4	2	5
Wildfires	5	5	5	5	3	9
Dam failures	2	2	8	7	5	3
Riverine flooding	7	2	4	4	5	8
Shoreline flooding	4	1	2	4	2	7
Fixed site hazmat incident	3	1	6	4	2	4
Hazmat transportation incident	6	3	6	4	3	2
Infrastructure failures	7	9	3	5	5	8
Nuclear attack	1	10	7	10	9	3
Nuclear power plant accidents	1	1	1	2	2	2
Oil & gas well accidents	2	1	3	3	3	1
Pipeline accidents	2	3	5	6	5	2
Public health emergencies	3	4	4	5	3	2
Terrorism/sabotage/WMD	2	4	7	7	8	1
Subsidence	1	1	1	1	2	1
Hail	5	4	1	2	3	2
Lightning	5	2	2	4	4	2
Severe winds	6	9	3	4	6	4
Tornadoes	3	6	6	8	7	8
Transportation accidents	6	2	5	6	4	2
Winter weather hazards	8	9	4	5	7	4

**SCALE: from 0 (poses the least threat) to 10 (poses the greatest threat)**

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

6. Change the 100 "points" you distributed into percentages (called "weights") – Only now that all hazards have been rated on each criteria that was chosen do we now go back and use the "weights" that were assigned to each assessment criterion, early in the assessment process. These were the 100 points that were distributed between all the categories your community decided to use in assessing its hazards. Since these "points" add up to 100,

we can change them into percentages simply by shifting the decimal point so that the number 50, for example, becomes 0.50 (or 50%). Instead of adding up to 100, these converted ratings will now add up to 1.00, or 100%. It is recommended that these percentages be placed at the head of the Hazard Assessment Rating Table. They will be used as weights to assess each of the hazard aspects you rated from 0 to 10, to produce a total hazard assessment rating for each hazard.

7. Do the math to calculate the hazard assessment ratings – The math is really very simple, since it only uses addition and multiplication. We need to add a new column on the right side of the Hazard Assessment Rating Table, which will contain summary hazard assessment ratings. Each cell that currently contains a number from 0 to 10 will be multiplied by the percentage weight appropriate for the aspect that the hazard is being rated on in that cell of the table. Every cell in each column will be multiplied by the same number—the percentage obtained from the assignment of "points" to that criterion. After the rating numbers have been multiplied by the appropriate percentages for each cell in the table, the results from the cells in each row of the table should be added together. This will result in a single number from 0 to 10 for each hazard, called the hazard assessment rating, which should be entered into the new column that was added onto the right side of the table. See the example table on the next page.



$$? \times ? = ?$$

This work can be quite simple for those who use spreadsheet software, but such software is not necessary so long as the basic math has been done carefully, and double-checked for correctness. The result of these estimates and calculations is that each hazard is given a specific rating which can be used to establish (and explain) mitigation priorities in your community. In the example table on the next page, each hazard has ratings assigned in the right-most column, and if these are placed in descending order, the example community's top hazards have been calculated as follows:

1. Winter weather hazards (rated 6.65)
2. Nuclear attack (6.25)
3. Infrastructure failures (6.15)
- 4 & 5. Tornadoes and severe winds (5.60)
6. Extreme temperatures (5.55)
7. Wildfires (5.00)
8. Riverine flooding (4.80)
- 9 & 10. Structural fires and terrorism/sabotage/WMD
- 11 & 12. Transportation accidents/transportation hazardous material incidents
13. Dam failures

For this hypothetical community, other significant hazards are pipeline accidents, drought, public health emergencies, lightning, fixed site hazardous material incidents, hail, shoreline flooding, and civil disturbances. The hypothetical community's least significant hazards were calculated to be oil & gas well accidents, earthquakes, scrap tire fires, nuclear accidents, and subsidence. For other communities, these calculations would probably be much different.

The results of this detailed technique are hazard rankings that can be entered into the Risk Assessment Table and used to establish which hazards are higher-priority. Proper use of this technique also provides a way to build consensus about these priorities, and to explain (or defend) decisions that have been made from these priorities.

## Hazard Assessment Rating Table

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

Hazard	Likelihood of Occurrence	Percent of population affected	Potential for causing casualties	Potential for negative economic effects	Corollary effects	Public awareness of hazard	Total rating: sum of all columns (100%)
	30%	20%	20%	15%	10%	5%	
Civil disturbances	2 x 0.30 = <b>0.6</b>	2 x 0.20 = <b>0.4</b>	3 x 0.20 = <b>0.6</b>	6 x 0.15 = <b>0.9</b>	3 x 0.10 = <b>0.3</b>	1 x 0.05 = <b>0.05</b>	<b>2.85</b>
Drought	3 x 0.30 = <b>0.9</b>	7 x 0.20 = <b>1.4</b>	1 x 0.20 = <b>0.2</b>	5 x 0.15 = <b>0.75</b>	3 x 0.10 = <b>0.3</b>	2 x 0.05 = <b>0.1</b>	<b>3.65</b>
Earthquakes	1 x 0.30 = <b>0.3</b>	5 x 0.20 = <b>1.0</b>	1 x 0.20 = <b>0.2</b>	2 x 0.15 = <b>0.3</b>	2 x 0.10 = <b>0.2</b>	1 x 0.05 = <b>0.05</b>	<b>2.05</b>
Extreme temperatures	7 x 0.30 = <b>2.1</b>	9 x 0.20 = <b>1.8</b>	3 x 0.20 = <b>0.6</b>	3 x 0.15 = <b>0.45</b>	4 x 0.10 = <b>0.4</b>	4 x 0.05 = <b>0.2</b>	<b>5.55</b>
Scrap tire fires	1 x 0.30 = <b>0.3</b>	1 x 0.20 = <b>0.2</b>	1 x 0.20 = <b>0.2</b>	4 x 0.15 = <b>0.6</b>	2 x 0.10 = <b>0.2</b>	1 x 0.05 = <b>0.05</b>	<b>1.55</b>
Structural fires	9 x 0.30 = <b>2.7</b>	1 x 0.20 = <b>0.2</b>	4 x 0.20 = <b>0.8</b>	4 x 0.15 = <b>0.6</b>	2 x 0.10 = <b>0.2</b>	5 x 0.05 = <b>0.25</b>	<b>4.75</b>
Wildfires	5 x 0.30 = <b>1.5</b>	5 x 0.20 = <b>1.0</b>	5 x 0.20 = <b>1.0</b>	5 x 0.15 = <b>0.75</b>	3 x 0.10 = <b>0.3</b>	9 x 0.05 = <b>0.45</b>	<b>5.00</b>
Dam failures	2 x 0.30 = <b>0.6</b>	2 x 0.20 = <b>0.4</b>	8 x 0.20 = <b>1.6</b>	7 x 0.15 = <b>1.05</b>	5 x 0.10 = <b>0.5</b>	3 x 0.05 = <b>0.15</b>	<b>4.30</b>
Riverine flooding	7 x 0.30 = <b>2.1</b>	2 x 0.20 = <b>0.4</b>	4 x 0.20 = <b>0.8</b>	4 x 0.15 = <b>0.6</b>	5 x 0.10 = <b>0.5</b>	8 x 0.05 = <b>0.4</b>	<b>4.80</b>
Shoreline flooding	4 x 0.30 = <b>1.2</b>	1 x 0.20 = <b>0.2</b>	2 x 0.20 = <b>0.4</b>	4 x 0.15 = <b>0.6</b>	2 x 0.10 = <b>0.2</b>	7 x 0.05 = <b>0.35</b>	<b>2.95</b>
Fixed site hazmat incident	3 x 0.30 = <b>0.9</b>	1 x 0.20 = <b>0.2</b>	6 x 0.20 = <b>1.2</b>	4 x 0.15 = <b>0.6</b>	2 x 0.10 = <b>0.2</b>	4 x 0.05 = <b>0.2</b>	<b>3.30</b>
Hazmat transportation incident	6 x 0.30 = <b>1.8</b>	3 x 0.20 = <b>0.6</b>	6 x 0.20 = <b>1.2</b>	4 x 0.15 = <b>0.6</b>	3 x 0.10 = <b>0.3</b>	2 x 0.05 = <b>0.1</b>	<b>4.60</b>
Infrastructure failures	7 x 0.30 = <b>2.1</b>	9 x 0.20 = <b>1.8</b>	3 x 0.20 = <b>0.6</b>	5 x 0.15 = <b>0.75</b>	5 x 0.10 = <b>0.5</b>	8 x 0.05 = <b>0.4</b>	<b>6.15</b>
Nuclear attack	1 x 0.30 = <b>0.3</b>	10 x 0.20 = <b>2.0</b>	7 x 0.20 = <b>1.4</b>	10 x 0.15 = <b>1.5</b>	9 x 0.10 = <b>0.9</b>	3 x 0.05 = <b>0.15</b>	<b>6.25</b>
Nuclear power plant accidents	1 x 0.30 = <b>0.3</b>	1 x 0.20 = <b>0.2</b>	1 x 0.20 = <b>0.2</b>	2 x 0.15 = <b>0.3</b>	2 x 0.10 = <b>0.2</b>	2 x 0.05 = <b>0.1</b>	<b>1.30</b>
Oil & gas well accidents	2 x 0.30 = <b>0.6</b>	1 x 0.20 = <b>0.2</b>	3 x 0.20 = <b>0.6</b>	3 x 0.15 = <b>0.45</b>	3 x 0.10 = <b>0.3</b>	1 x 0.05 = <b>0.05</b>	<b>2.20</b>
Pipeline accidents	2 x 0.30 = <b>0.6</b>	3 x 0.20 = <b>0.6</b>	5 x 0.20 = <b>1.0</b>	6 x 0.15 = <b>0.9</b>	5 x 0.10 = <b>0.5</b>	2 x 0.05 = <b>0.1</b>	<b>3.70</b>
Public health emergencies	3 x 0.30 = <b>0.9</b>	4 x 0.20 = <b>0.8</b>	4 x 0.20 = <b>0.8</b>	5 x 0.15 = <b>0.75</b>	3 x 0.10 = <b>0.3</b>	2 x 0.05 = <b>0.1</b>	<b>3.65</b>
Terrorism/sabotage/WMD	2 x 0.30 = <b>0.6</b>	4 x 0.20 = <b>0.8</b>	7 x 0.20 = <b>1.4</b>	7 x 0.15 = <b>1.05</b>	8 x 0.10 = <b>0.8</b>	1 x 0.05 = <b>0.1</b>	<b>4.75</b>
Subsidence	1 x 0.30 = <b>0.3</b>	1 x 0.20 = <b>0.2</b>	1 x 0.20 = <b>0.2</b>	1 x 0.15 = <b>0.15</b>	2 x 0.10 = <b>0.2</b>	1 x 0.05 = <b>0.1</b>	<b>1.15</b>
Hail	5 x 0.30 = <b>1.5</b>	4 x 0.20 = <b>0.8</b>	1 x 0.20 = <b>0.2</b>	2 x 0.15 = <b>0.3</b>	3 x 0.10 = <b>0.3</b>	2 x 0.05 = <b>0.1</b>	<b>3.20</b>
Lightning	5 x 0.30 = <b>1.5</b>	2 x 0.20 = <b>0.4</b>	2 x 0.20 = <b>0.4</b>	4 x 0.15 = <b>0.6</b>	4 x 0.10 = <b>0.4</b>	2 x 0.05 = <b>0.1</b>	<b>3.40</b>
Severe winds	6 x 0.30 = <b>1.8</b>	9 x 0.20 = <b>1.8</b>	3 x 0.20 = <b>0.6</b>	4 x 0.15 = <b>0.6</b>	6 x 0.10 = <b>0.6</b>	4 x 0.05 = <b>0.2</b>	<b>5.60</b>
Tornadoes	3 x 0.30 = <b>0.9</b>	6 x 0.20 = <b>1.2</b>	6 x 0.20 = <b>1.2</b>	8 x 0.15 = <b>1.2</b>	7 x 0.10 = <b>0.7</b>	8 x 0.05 = <b>0.4</b>	<b>5.60</b>
Transportation accidents	6 x 0.30 = <b>1.8</b>	2 x 0.20 = <b>0.4</b>	5 x 0.20 = <b>1.0</b>	6 x 0.15 = <b>0.9</b>	4 x 0.10 = <b>0.4</b>	2 x 0.05 = <b>0.1</b>	<b>4.60</b>
Winter weather hazards	8 x 0.30 = <b>2.4</b>	9 x 0.20 = <b>1.8</b>	4 x 0.20 = <b>0.8</b>	5 x 0.15 = <b>0.75</b>	7 x 0.10 = <b>0.7</b>	4 x 0.05 = <b>0.2</b>	<b>6.65</b>

**EXAMPLE: FOR INSTRUCTIONAL PURPOSES ONLY**

# Appendix C – Planning Requirements for Flood Mitigation Assistance (FMA)

---

Plans that are being produced for the Flood Mitigation Assistance Program have some additional requirements that must be met before the plan can receive approval from FEMA. A well-written and researched plan will already have satisfied many of FMA's requirements, but there are some specific aspects of the flood analysis section that are harder to achieve. This section will give information on these requirements and how to meet them.

## Introduction

There are elements that are a required part of an FMA plan, which should automatically have been addressed in the course of writing a good hazard analysis and mitigation plan in general. A description of the process of developing the plan and gaining public involvement is required, with a description of meetings and activities that this involved. A discussion of past flood events and a general assessment of flood risk is required. All critical facilities should be identified and assessed for any flood risk. Criteria for selecting projects should be described. Procedures encouraging implementation and monitoring of projects, and future revisions to the plan, should also be present. These would all be included in a general mitigation plan of high quality.

In addition, the following items must be included in the plan to meet the FMA plan development requirements:

1. Flood depth and damage potential
2. Map and describe existing flood hazards
3. Estimate the number and type of structures at risk
4. Describe the need and procedures for warning the community
5. Describe land use trends and floodplain redevelopment strategies
6. Summarize the economic impacts of flooding on the community
7. Include floodplain management goals in the plan
8. Include strategies to reduce flood risk
9. Include strategies to maintain and encourage compliance with the National Flood Insurance Program (NFIP)

Many of these items are self-explanatory, but others will be described in this section, since they require some special research to assess. The FMA typically offers planning grants specifically allotted for the writing of mitigation plans, due to the extra detail that is needed in their plan requirements.

**1. Flood depth and damage potential** – The National Flood Insurance Program (NFIP) has been involved in the creation of flood maps for their member communities. These maps are called Flood Insurance Rate Maps (FIRMs) and often are the best information available to a community with which to assess its flood risks and vulnerabilities. There has been much research performed by the U. S. Army Corps of Engineers and by the Michigan Department of Environmental Quality to estimate flood hazards for specific waterways and shoreline areas throughout the state. Contacting them can determine whether any studies have been performed that relate to your community. If studies are unavailable, FIRMs may exist with which to assess flood hazards. As a last resort, soil survey data can be used to locate areas with hydric soils, and topographic maps can be used to locate areas of lower elevation, into which waters can be expected to drain and possibly cause flooding. Once some information has been found with which to estimate flood risks, some estimate of flood depths can either be copied from past research, estimated from past flood events, or estimated from topographic information. Damage potential may include roads or other infrastructure, but typically focuses on structures that are located within known floodplain areas, or subject to urban flooding in low-lying areas with inadequate storm sewer systems, or other drainage problems. More information about at-risk structures is given under item number 3, below. FIRMs may already include information on flood depths, or damage assessment reports from past flood events may give some indication of the potential depths. Combining this depth information with that of a structure's value can yield estimates of damage potential in terms of monetary costs. For other "costs," see item 2, below. These first three criteria are extensively linked together.

2. **Map and describe existing flood hazards** – Maps are hopefully already available from the sources just mentioned, but a description of the type of flood hazard will also be important. Riverine flooding, shoreline flooding, and urban flooding (from inadequate drainage, unusual conditions, etc.) should be identified for each and all areas known to be at risk. Also, the impacts of flooding on infrastructure, life safety, transportation, critical facilities, the economy, and quality of life may be worth noting in the plan. These have hopefully already been considered during the normal vulnerability assessment pertaining to flood hazards.

3. **Estimate the number and type of structures at risk** – Zoning and land use maps, as well as plat books, can help identify whether there is vulnerable development or critical facilities in a flood-prone area. Once an area of focus has been identified as possibly being at-risk, the number and type of structures located there will need to be estimated. For rural areas, the U. S. Geological Survey has produced much excellent information. Maps such as those available on the internet at <http://www.topozone.com> can provide information on the structures that exist in an area, and aerial photographs can also be used to determine whether structures are in a floodplain. Historical data and damage assessment reports are also useful. Finally, actual fieldwork can be undertaken to determine what is at risk. Information about the value of structures (to estimate potential damages) should be specifically available from local municipal offices, or can be more generally obtained from census data.

The other items in the FMA requirements are relatively straightforward. On the next two pages is the text of the review sheet that is used by FEMA to judge plan compliance with FMA standards.

For more information on FMA, refer to EMD Publication 916 – Flood Mitigation Assistance Program Applicant Handbook, or visit the EMD/MSP web site at [www.mspemd.org](http://www.mspemd.org) .



# Flood Mitigation Plan Review Sheet

---

**COMMUNITY:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**STATE:** \_\_\_\_\_

**REVIEWER:** \_\_\_\_\_

---

**YES    NO**

- The plan includes a description of the planning process and public involvement.
  - a. Was a professional planner involved in the preparation of the plan?  
Yes  No     (CRS REQUIRED ONLY)
  - b. What community departments were involved in the preparation of the Plan?  
\_\_\_\_\_  
(CRS REQUIRED ONLY)
  - c. What activities were implemented to explain the planning process and encourage input?  
How many meetings were held?  
\_\_\_\_\_Workshops    \_\_\_\_\_Public Meetings    \_\_\_\_\_Public Hearings
- The plan includes a description of the extent of flood depth and damage potential.
- The plan includes a map and description of the existing flood hazard, identification of the flood risk, and a discussion of past floods.
- The plan includes estimates of the types and number of structures at risk, and the fair market value of the structures, if available.
- The plan includes a map and discussion of repetitive loss properties and potential mitigation activities for repetitive loss structures.
- The plan assesses the problem. In addition to discussing the number and type of buildings at risk, the plan should:
  - a. Describe the impact of the flooding on infrastructure, public health and safety;
  - b. Describe the need and procedures for warning and evacuating residents and visitors;
  - c. Identify critical facilities, such as hospitals, fire stations and chemical storage companies;
  - d. Include a description of development trends including a discussion of redevelopment in the floodplain, the watershed and natural resource areas;
  - e. Include a summary of the impact of flooding on the community and its economy.
- The plan includes the applicants floodplain management goals for areas covered by the plan.
- The plan includes a strategy for reducing flood risk.
- The plan includes a strategy for continued compliance with the National Flood Insurance Program (NFIP) regulations.
- The plan includes a map and description of other natural hazards.
- The plan includes a description of how the community has coordinated with other agencies and organizations and when their input was requested.

- The plan includes identification and evaluation of cost effective and technically feasible mitigation actions considered.
- The plan includes procedures for ensuring implementation.
- The plan includes procedures for reviewing progress.
- The plan includes procedures for recommending revisions to the plan.
- The documents submitted with the plan include documentation of formal plan adoption by the entity submitting the plan.
- If the plan has been submitted by an entity other than a community, documents submitted with the plan include documentation of a formal interagency agreement signed by all parties to the agreement.
- The plan includes a list of potential projects and an explanation of how each project or group of project contributes to the overall mitigation strategy. (CRS REQUIRED ONLY)
- The plan includes an action plan and establishes post-disaster mitigation policies and procedures. (CRS REQUIRED ONLY)
- The plan identifies types of projects and their applicability to specific conditions or geographic areas:

**Project type    Condition or Area**

- Elevation \_\_\_\_\_
- Acquisition \_\_\_\_\_
- Relocation \_\_\_\_\_
- Demolition \_\_\_\_\_
- Other activities \_\_\_\_\_
- Minor Physical \_\_\_\_\_  
Mitigation Projects
- Beach Nourishment \_\_\_\_\_

- Do any proposed activities duplicate flood prevention activities of other programs or Federal agencies?

# The National Flood Insurance Program's Community Rating System

**Every community with any flood risk at all should join the National Flood Insurance Program (NFIP). One component of the NFIP is the Community Rating System.**

## How the Community Rating System Works

Every year, flooding causes hundreds of millions of dollars worth of damage to homes and businesses around the country. Standard homeowners and commercial property policies do not cover flood losses. So, to meet the need for this vital coverage, the Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP).

The NFIP offers reasonably priced flood insurance in communities that comply with minimum standards for floodplain management.

The NFIP's Community Rating System (CRS) recognizes community efforts beyond those minimum standards by reducing flood insurance premiums for the community's property owners. Discounts range from 5% up to 45%.

The discounts provide an incentive for new flood protection activities that can help save lives and property in the event of a flood.

To participate in the CRS, your community can choose to undertake some or all of the 18 public information and floodplain management activities described in the CRS Coordinator's Manual.

You're probably already doing many of these activities. To get credit, community officials will need to prepare an application documenting the efforts.

The CRS assigns credit points for each activity. The tables on the following pages list the activities and the possible number of credit points for each one. The table also shows the average number of credit points communities earn for each activity. These averages may give a better indication than the maximums of what your community can expect.

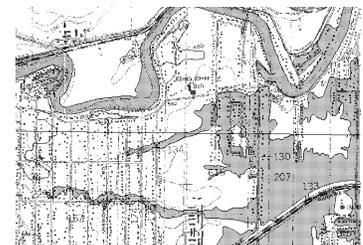
To be eligible for a CRS discount, your community must do Activity 310, Elevation Certificates. If you're a designated repetitive loss community, you must also do Activity 510, Repetitive Loss Projects. All other activities are optional.

Based on the total number of points your community earns, the CRS assigns you to one of 10 classes. Your discount on flood insurance premiums based on your class.

For example, if your community earns 4,500 points or more, it qualifies for Class 1, and property owners in the floodplain get a 45% discount. If your community earns at least 500 points, it's in Class 9, and property owners in the floodplain get a 5% discount. If a community does not apply or fails to receive at least 500 points, it's in class 10, and property owners get no discount.



# CRS...



## What You Can Do to Get Credit

The CRS grants credit for 18 different activities that fall into four series:

<b>Series 300</b>	<b>Public Information</b>	<b>Maximum Points*</b>	<b>Average Points*</b>
	<b>This series credits programs that advise people about the flood hazard, flood insurance, and ways to reduce flood damage. The activities also provide data that insurance agents need for accurate flood insurance rating.</b>		
<b>310</b>	<b>Elevation Certificates</b> Maintain FEMA elevation certificates for new construction in the floodplain. (At a minimum, a community must maintain certificates for buildings built after the date of its CRS application.)	<b>142</b>	<b>70</b>
<b>320</b>	<b>Map Information</b> Provide Flood Insurance Rate Map (FIRM) information to people who inquire and publicize this service.	<b>140</b>	<b>140</b>
<b>330</b>	<b>Outreach Projects</b> Send information about the flood hazard, flood insurance, flood protection measures, and/or the natural and beneficial functions of floodplains to floodprone residents or all residents of a community.	<b>265</b>	<b>64</b>
<b>340</b>	<b>Hazard Disclosure</b> Real estate agents advise potential purchasers of floodprone property about the flood hazard. Regulations require notice of the hazard.	<b>81</b>	<b>31</b>
<b>350</b>	<b>Flood Protection Library</b> The public library maintains references on flood insurance and flood protection.	<b>30</b>	<b>20</b>
<b>360</b>	<b>Flood Protection Assistance</b> Give inquiring property owners technical advice on how to protect their buildings from flooding, and publicize this service.	<b>66</b>	<b>53</b>
<b>Series 300</b>		<b>Total</b>	<b>724</b>
			<b>378</b>

**\*Maximum and average points subject to change annually.  
See the current CRS Coordinator's Manual for the latest information.**

Series 400	<b>Mapping and Regulations</b>	Maximum Points*	Average Points*
	<b>This series credits programs that provide increased protection to new development.</b>		
<b>410</b>	<b>Additional Flood Data</b> Develop new flood elevations, floodway delineations, wave heights, or other regulatory flood hazard data for an area not mapped in detail by the flood insurance study. Have a more restrictive mapping standard.	<b>360</b>	<b>49</b>
<b>420</b>	<b>Open Space Preservation</b> Guarantee that currently vacant floodplain parcels will be kept free from development.	<b>550</b>	<b>100</b>
<b>430</b>	<b>Higher Regulatory Standards</b> Require freeboard. Require soil tests or engineered foundations. Require compensatory storage. Zone the floodplain for minimum lot sizes of 1 acre or larger. Regulate to protect sand dunes. Have regulations tailored to protect critical facilities or areas subject to special flood hazards (for example, alluvial fans, ice jams, or subsidence).	<b>905</b>	<b>75</b>
<b>440</b>	<b>Flood Data Maintenance</b> Keep flood and property data on computer records. Use better base maps. Maintain elevation reference marks.	<b>160</b>	<b>48</b>
<b>450</b>	<b>Stormwater Management</b> Regulate new development throughout the watershed to ensure that post-development runoff is no worse than pre-develop runoff. Regulate new construction to minimize soil erosion and protect or improve water quality.	<b>405</b>	<b>87</b>
<b>Series 400</b>	<b>Total</b>	<b>2,380</b>	<b>359</b>

Series 500	<b>Flood Damage Reduction</b>	Maximum Points*	Average Points*
	<b>This series credits programs that reduce the flood risk to existing development.</b>		
<b>510</b>	<b>Repetitive Loss Projects</b> Devote special attention to repetitively flooded areas. (This is a minimum requirement for all repetitive loss communities.)	<b>441</b>	<b>17</b>
<b>520</b>	<b>Acquisition and Relocation</b> Acquire and/or relocate floodprone buildings so that they are out of the floodplain.	<b>1,600</b>	<b>83</b>
<b>530</b>	<b>Retrofitting</b> (Credit is based on the number of floodproofed or elevated pre-FIRM buildings in the floodplain.)	<b>1,400</b>	<b>26</b>
<b>540</b>	<b>Drainage System Maintenance</b> Conduct periodic inspections of all channels and retention basins, and remove debris as needed.	<b>380</b>	<b>254</b>
<b>Series 500</b>	<b>Total</b>	<b>3,821</b>	<b>380</b>

Series 600	Flood Preparedness	Maximum Points*	Average Points*
	<b>This series credits flood warning, levee safety, and dam safety projects.</b>		
<b>610</b>	Flood Warning Program Provide early flood warnings to the public, and have a detailed flood response plan keyed to flood crest predictions.	<b>200</b>	<b>120</b>
<b>620</b>	Levee Safety Maintain levees not otherwise credited in the flood insurance rating system that provides some flood protection.	<b>900</b>	<b>254</b>
<b>630</b>	Dam Safety (All communities in a state with an approved dam safety program receive some credit.)	<b>120</b>	<b>64</b>
<b>Series 600 Total</b>		<b>1,220</b>	<b>438</b>
<b>All Series Total</b>		<b>8,145</b>	<b>1,555</b>

The table below shows the number of points required for each class and the corresponding discount.

### How Much Discount Property Owners in Your Community Can Get

Rate Class	Discount	Credit Points Required
<b>1</b>	<b>45%</b>	<b>4,500</b>
<b>2</b>	<b>40%</b>	<b>4,000 – 4,499</b>
<b>3</b>	<b>35%</b>	<b>3,500 – 3,999</b>
<b>4</b>	<b>30%</b>	<b>3,000 – 3,499</b>
<b>5</b>	<b>25%</b>	<b>2,500 – 2,999</b>
<b>6</b>	<b>20%</b>	<b>2,000 – 2,499</b>
<b>7</b>	<b>15%</b>	<b>1,500 – 1,999</b>
<b>8</b>	<b>10%</b>	<b>1,000 – 1,499</b>
<b>9</b>	<b>5%</b>	<b>500 – 999</b>
<b>10</b>	<b>0%</b>	<b>0 – 499</b>

### Extra Credit

Your community can get extra credit points – in addition to the points listed in the table – if you coordinate your activities through a comprehensive floodplain management plan. Also, if your community faces growth pressures, the mapping and regulation activities in Series 400 offer extra credit. See the CRS Coordinator’s Manual for full details.

Many communities can qualify for what the CRS calls “uniform minimum credit,” based on the activities a state or regional agency implements on behalf of its communities. For example, some states have disclosure laws eligible for credit under Activity 340, Flood Hazard Disclosure. Any community in those states can receive the uniform minimum credit.

Your community may want to consider floodplain management activities not listed in the CRS Coordinator's Manual. You should evaluate these activities for their ability to increase public safety, reduce property damage, avoid economic disruption and loss, and protect the environment. In addition, you can request a review of these activities to determine whether they should be eligible for CRS credit. FEMA welcomes innovative ways to prevent or reduce flood damage.

## **How to Apply**

Participation in the CRS is voluntary. If your community is in full compliance with the rules and regulations of the NFIP, you may apply. There's no application fee, and all CRS publications are free.

Your community's chief executive officer (that is, your mayor, city manager, or other top official) must appoint a CRS coordinator to handle the application work and serve as the liaison between the community and FEMA. The coordinator should know the operations of all departments that deal with floodplain management and public information. And the coordinator should be able to speak for your community's chief executive officer.

The first step in the application process is to get a copy of the CRS Coordinator's Manual, which describes the program and gives details on the eligible activities.

The manual includes application worksheets and the formulas for calculating credit points. Computer software for completing the application is available at no charge. In addition, the CRS has a Short Form Application that may be more appropriate for your community. The Short Form is easier to complete than the regular worksheets, but it does not cover some of the more complicated activities you may be doing.

Your designated CRS coordinator should fill out and submit your application. The CRS will verify the information and arrange for flood insurance premium discounts.

For more information, write, phone, or fax:

NFIP/CRS  
P.O. Box 501016  
Indianapolis, IN 46250-1016  
Telephone (317) 848-2898  
Fax (317) 848-3578

Additional information on the NFIP may also be found by visiting the following websites:

- Michigan Department of Environmental Quality Land and Water Management Division: [www.deq.state.mi.us/lwm/water\\_mgmt/nfip/nfip.html](http://www.deq.state.mi.us/lwm/water_mgmt/nfip/nfip.html)
- Federal Emergency Management Agency: [www.fema.gov/nfip/](http://www.fema.gov/nfip/)

# Appendix D - Integrating Hazard Mitigation into Community Comprehensive Planning

---

Appendix A provides an excellent example of a stand-alone Hazard Mitigation Plan that could be coordinated with the community's existing Comprehensive Plan. The Appendix A sample plan is multi-hazard in orientation and provides numerous "real world" examples of recommended mitigation actions that could be easily molded to fit the needs of many communities. This is a perfectly viable planning option for developing a Hazard Mitigation Plan. If properly developed and diligently implemented, this option can result in an effective reduction in hazard vulnerability.

However, the more preferable planning option is to integrate hazard mitigation concepts and strategies into the community's existing Comprehensive Plan structure. (Note: Comprehensive Plans are also commonly called Master Plans, General Development Plans, or other similar titles.) Integrating mitigation concepts and strategies into the Comprehensive Plan will, in the long run, result in a greater and more permanent "institutionalization" of hazard mitigation into the community's development processes, practices, and pattern. Comprehensive Plans address many aspects of the community's physical, social and economic environment. As a result, the opportunities for effectuating desirable change and improvement to the community's development pattern and community support systems is greatly enhanced. Under this planning option, mitigation can influence every future decision made in these important areas. In addition, since development control and guidance mechanisms such as zoning and capital improvements planning are predicated, to some degree, by the community's intended or desired development pattern (as articulated in the Comprehensive Plan), mitigation strategies, concepts and initiatives stand a much greater chance of being considered for implementation if they are part of the larger community Comprehensive Plan. For that reason, it is recommended that hazard mitigation planning be undertaken as an integral component of the community's overall comprehensive planning efforts.

Two basic methods can be utilized to integrate hazard mitigation into the community's Comprehensive Plan:

## METHOD 1:

A Hazard Mitigation Element is developed and integrated into the plan.

## METHOD 2:

Hazard mitigation concepts and strategies are integrated directly into existing elements in the plan.

**Note:** Excellent guidance on integration of hazard mitigation into the community comprehensive planning process can also be found in the publication Comprehensive Plan / Hazard Mitigation Interface, produced by the Livingston County Department of Planning. Single copies of this document may be obtained by contacting the Livingston County Department of Planning at 517/546-7555. The Livingston County guidance document is used in a training course (of the same name) delivered by the Emergency Management Division, Michigan Department of State Police as part of its emergency management training program. (Information on this and other EMD/MSP training courses can be obtained at [www.mspemd.org](http://www.mspemd.org), or by calling 517/333-5034.) Several of the ideas and principles outlined in this Appendix were derived from that Livingston County guidance document.



## REMINDER: KEY DEFINITIONS USED IN THIS APPENDIX

**Exposure:** The number of persons and the types, qualities, and monetary values of various types of property or infrastructure that may be subject to an undesirable or injurious hazard event. (Those things in harm's way – people, buildings, infrastructure, etc.)

**Risk:** The predicted impacts that a hazard would have on people, services, and specific facilities and structures. (What could happen – given the worst case scenario.)

**Vulnerability:** The quantification of a community's risk to determine which hazards present the greatest threat to people, property, and essential services. (What will be affected and how bad will it be, after considering existing mitigation and preparedness in the community. The "net effect" the hazard will have on the community.)

## INTEGRATION INTO COMPREHENSIVE PLANS: THE OPTIONS

### **METHOD 1: Hazard Mitigation Element integrated into the community's Comprehensive Plan.**

Appendix A, in addition to being an excellent example of a stand-alone Hazard Mitigation Plan, could also serve as a Hazard Mitigation Element within the community's Comprehensive Plan. It may have to be edited somewhat to fit the overall style of the plan, but its multi-hazard orientation and numerous "real world" examples of recommended mitigation actions can easily be molded to fit the needs of many communities.

### **METHOD 2: Hazard mitigation concepts, strategies and policies integrated into existing elements in the community's Comprehensive Plan.**

Probably the most effective method for fostering and promoting the implementation of hazard mitigation concepts, strategies and policies within the community is to completely integrate them into existing elements in the community's Comprehensive Plan. Under this scenario, there would not be a separate Hazard Mitigation Element within the plan. Rather, mitigation concepts, strategies and policies would appear in appropriate places throughout the plan. For example, those mitigation concepts, strategies and policies that affect land use issues would appear in the Land Use Element; those that affect transportation facilities would appear in the Transportation Element and/or the Public Facilities Element; etc. In addition, the community's Hazard Analysis – the foundation for the hazard mitigation strategies and policies – should be included because hazard risk and vulnerability affect every other functional element within the plan.

This method recognizes that hazard mitigation is not a separate, optional activity, but rather a **necessary activity** that must be addressed under each functional element in the plan. Although the focus on hazard mitigation may be somewhat more diluted, the potential for greater attention to mitigation concepts and implementation and effectiveness of mitigation strategies and policies makes this a highly favorable approach for many communities.

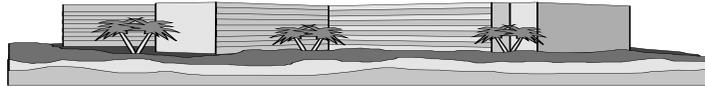


**Note:** Methods 1 and 2 are consistent with the American Planning Association’s “Growing Smart” initiative, as outlined in the “Growing Smart Legislative Guidebook” (Chapter 7, Local Comprehensive Plans) and Planning Advisory Service (PAS) Report Number 483/484, “Planning for Post-Disaster Recovery and Reconstruction” (Appendix E, Model Natural Hazards Element). Methods 1 and 2 are also consistent with the Institute for Business and Home Safety (IBHS) “Community Land Use Evaluation (CLUE)” for Natural Hazards initiative – the focus of which is a survey tool that local planners can use to assess how well their community addresses natural hazards mitigation in its comprehensive or general plans.

## **COMMUNITY DEVELOPMENT AND THE MITIGATION OF HAZARDS**

### **FACTORS CONTRIBUTING TO THE GROWING RISK OF DISASTERS IN MICHIGAN AND ACROSS THE UNITED STATES**

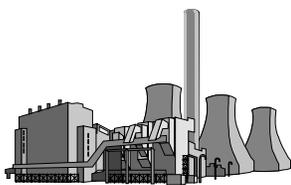
- Concentrated population in urban areas.
- Development in hazardous areas – especially coastal areas and floodplains.



- Surges in holiday, weekend, and seasonal populations in coastal and heavily wooded resort areas (problematic for evacuations during disasters and preventing wildfires).
- Deforestation – more people living in forested areas, which results in wildfires and more forests being damaged or destroyed for land development.



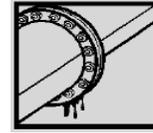
- Human actions – such as building dams and dikes (many of which are now in need of maintenance and may be unsafe), filling in wetlands, and paving large areas of land.



- Unsafe buildings due to lax enforcement of building codes, and older buildings that have not been retrofitted to newer, more stringent building standards.
- Increase in the manufacture, storage, transport, and use of hazardous materials.

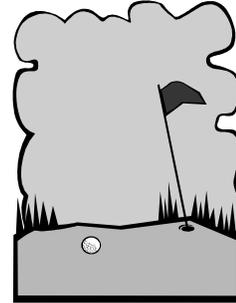
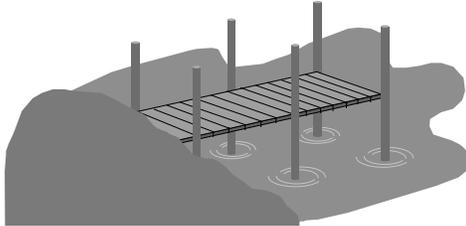


- Old infrastructure that was not built to withstand the excessive forces of nature.



## HAZARD MITIGATION: KEY LAND USE ISSUES FOR COMMUNITIES TO CONSIDER

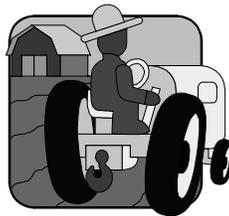
1. **Safe, beneficial use for hazard prone areas:** i.e., floodplains, subsidence areas, steep slopes, high risk erosion areas, unstable soil areas, etc.



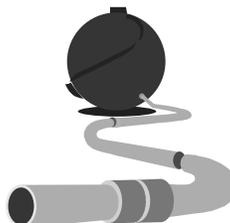
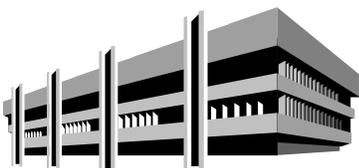
2. **Concentration issues:** i.e., of population, utility infrastructure, critical public facilities, etc. The greater the concentration of people and structures, the greater the risk.



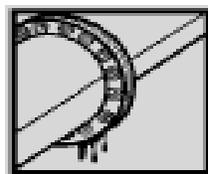
3. **Proximity issues:** The spatial relationship between hazardous areas and surrounding land uses (what is immediately adjacent to hazardous areas). The greater the concentration of people and structures, the greater the risk. For example, intense development in close proximity to sites that manufacture, store, use or transport hazardous materials can lead to more serious incidents when a spill or discharge occurs. The greater the concentration of people and structures, the greater the likelihood of injury, death and property damage. This, in turn, creates even greater problems for the responders, because they have increased population and property protection concerns to address (over and above the actual handling of the hazardous material itself).



4. **Location of public facilities and infrastructure:** Does the placement of public facilities and infrastructure promote growth and development in hazardous or undesirable areas? Are critical community facilities and infrastructure located in harm's way? If so, what is being done to protect them?



5. **Development standards for public facilities and infrastructure:** How strong and functionally adequate are the facilities and infrastructure in the community? For example, is the storm drain system built to handle a 10-year storm, a 25-year storm, or a 100-year storm? Are roads and bridges built to withstand expected flooding? Do water and sewer lines have sufficient structural integrity and are they buried deep enough to prevent freeze-ups and breaks during extended severe cold spells? What fill material is used around the pipes? Are public facilities put in harm's way, such as in a floodplain? If so, what steps have been taken to protect the structures from damage?



6. **Effect of accumulated development on community systems and facilities:** For example, what effect does accumulated development upstream have on storm water management and flooding potential downstream? Unless the hazard vulnerability implications of land development are considered on a regional (or watershed) basis, downstream communities are always going to feel the ill effects of intensive development upstream. This can adversely impact both private and public properties.



## **REDUCING COMMUNITY EXPOSURE, RISK, AND VULNERABILITY TO NATURAL AND TECHNOLOGICAL HAZARDS THROUGH THE APPLICATION OF LAND USE / DEVELOPMENT MEASURES**

The relationship between wise land use planning and the reduction of a community's exposure, risk, and vulnerability to hazards is clear. Experience has shown that those communities that carefully plan the location, type, and structural requirements of development to avoid (to the extent possible) hazard areas and vulnerable structures suffer much less disaster-related damage and impact than do communities that don't carefully plan for development. The benefits of wise land use and development planning, from a disaster recovery standpoint, include:

- less disruption to a community's economic, social, and physical structure;
- less impact on the community's tax base;
- less impact on the provision of essential services; and
- less financial impact in terms of local participation in disaster program cost-sharing.

In addition, communities that are more prone to disaster damage may be looked upon less favorably by potential business enterprises as a safe, secure place in which to conduct business. Clearly, wise land use planning has very practical benefits for all communities.

### **Prevention is the Key**

Preventing land use or development related problems in the first place (**preventive mitigation**) is much more prudent and desirable than attempting to go back and correct the problems (**corrective mitigation**) at a later time. The old adage "an ounce of prevention is worth a pound of cure" is certainly true when it comes to land use planning and community development. Buildings, homes, businesses, and public infrastructure that are

vulnerable by location, design, or construction are doomed to eventual failure. It might not occur overnight, but experience has shown that eventually it will occur. The unfortunate part is that the community is left with the job of picking up the pieces in the aftermath of an emergency or disaster.

### **Hazard Mitigation is Primarily a Local Function**

Fortunately, local governments have many tools available to guide the type, location and structural requirements of development. For that reason, and since development occurs at the local level, hazard mitigation is inherently a local government function. State government has an important role to play in that laws and processes governing the use of land and development of property originate at the state level. In addition, state agencies administer a wide variety of programs that affect – either directly or indirectly – the development and use of land. Therefore, successful implementation of a program to reduce hazard vulnerability must, out of necessity, be a joint cooperative effort between the State and local governments. State government provides the means (i.e., enabling laws) for regulating land development, and local governments put that means to use and actually make land use / development decisions.

For land use / development decision making to be effective in limiting or eliminating hazard exposure, risk and vulnerability, local and state actions must be carefully coordinated. The State must ensure, through appropriate legislation and rules / regulations, that local governments have the necessary means to effectively guide and manage land use change and development. In addition, the State must ensure that its development related actions do not contribute to an increase in hazard exposure, risk and vulnerability.

Local governments, in turn, must make good land use decisions and exercise prudent stewardship of the land development process within their communities. Adequate guidance, oversight, and enforcement at the local level are critically important to successfully mitigating hazards.

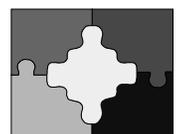
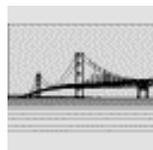
Successful implementation of this process will help ensure that Michigan’s land use / development pattern lends itself to a reduction in the exposure, risk, and vulnerability to natural and technological hazards.

## **LAND USE / DEVELOPMENT GUIDANCE AND REGULATORY MEASURES IN MICHIGAN**

Local governments in Michigan can utilize the following measures to effectively guide and regulate land use and development:

- comprehensive planning
- zoning ordinances
- building codes
- subdivision regulations
- special area, use and design regulations
- capital improvements planning
- financial incentives
- disclosure requirements
- transfer of development rights
- public acquisition and management of lands
- public education

Etc. (This list is certainly not all inclusive.)



**FOLLOWING IS AN OUTLINE OF WHAT COULD BE CONSIDERED A “TYPICAL” COMMUNITY COMPREHENSIVE PLAN IN MICHIGAN IN WHICH SUGGESTIONS HAVE BEEN MADE FOR INTEGRATING MITIGATION CONCEPTS, STRATEGIES AND POLICIES INTO APPROPRIATE PLAN ELEMENTS:**

**(NAME OF COMMUNITY) COMPREHENSIVE PLAN**

(The planning elements in **boxes below** are suggested locations within a Comprehensive Plan that hazard mitigation concepts, strategies and policies can be addressed. Notes pertaining to the suggestion are provided in **bold type** at the end of each plan section. Since there is no uniform, standard format or required planning elements for a Comprehensive Plan in Michigan, the sample individual elements listed may not mesh exactly with a community’s existing Comprehensive Plan. Adjustments may have to be made to fit the local situation and planning priorities.)

**INTRODUCTION**

- History of Planning in (name of community)
- Purpose and Role of the Plan
- Creation of this Plan
  - Citizen Participation

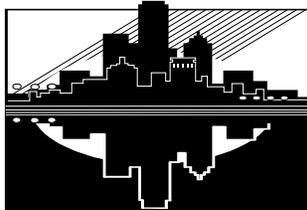


**Planning Documents and Technical Studies\***

**\*Note: In this introductory section, the community’s Hazard Analysis and Hazard Mitigation Strategies can be discussed and given special note as having provided an informational foundation for the creation of the Comprehensive Plan. It may be appropriate to include the Hazard Analysis or Hazard Analysis Summary as an attachment or appendix to the plan.**

Overarching Principles

**Sustainability\***

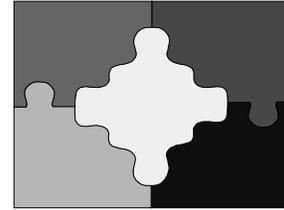


**\*Note: The philosophy of “sustainability” is well founded in professional urban planning practice. Creating and fostering a sustainable development pattern within the community will, by its very nature, address hazard risk and vulnerability reduction activities. Specific elements of a sustainable community include:**

- **Ecological integrity**
- **Economic security**
- **Empowerment and responsibility**
- **Social well-being**



All of these elements have at their very roots the idea that the community and its facilities and services will be reasonably protected from hazards – be they human-induced, such as crime, or natural and technological in nature, such as floods, tornadoes, thunderstorms, hazardous material accidents, or fire.



## LAND USE ELEMENT

### **Vision Statement\***

**\*Note:** The Vision Statement can articulate a “vision” of a community land use pattern that minimizes (or, if possible eliminates) the long term risk and vulnerability to people, property, and the environment from human-induced, natural, and technological hazards. Such a vision is consistent with the generally accepted desire to foster and create a “sustainable” development pattern that provides current and future generations with a full range of choices and opportunities in creating and maintaining a community that is 1) ecologically responsible; 2) physically, economically, and socially strong; and 3) perceived as a desirable and safe place in which to live, work, and conduct business.

### **Land Use Policy and Action Plan\***

**\*Note:** In this section, specific background information can be provided regarding known hazard areas within the community. Possible acceptable land uses and necessary public safety / development standards for those areas can be discussed. Areas to address might include:

- floodplains
- high-risk Great Lakes shoreline flooding / erosion areas
- areas of steep slopes subject to landslide
- areas of expansive / unstable soils
- subsidence areas
- seismic hazard areas
- high wind areas
- urban / wildland intermix areas
- environmentally contaminated areas
- areas within the determined vulnerability zone of a SARA Title III / Section 302 site
- areas within the determined vulnerability zone (10-mile Emergency Planning Zone) of a commercial nuclear power plant
- areas within the identified inundation zone (hydraulic “shadow”) of a “high” or “significant” hazard dam
- areas contiguous to oil / gas wells, pipeline terminals, storage facilities, production facilities, or compressor stations
- areas contiguous to railroads, highways, or waterways that regularly carry significant quantities of hazardous materials
- areas contiguous to high-volume commercial passenger airports and other passenger transportation terminals and facilities



This section should also discuss the impacts of these hazard areas on the community's overall land use pattern. (For example, proposed developments within the floodplain will have to meet more stringent elevation standards that may alter the character and/or appearance of the structures. High concentrations of SARA Title III / Section 302 sites in certain areas may make surrounding areas inappropriate for high density residential development unless strict public safety measures can be implemented and/or buffer zones are established. Etc.)

## NATURAL ENVIRONMENT ELEMENT

Vision Statement

### **Fragile Ecosystems\***



**\*Note:** In this section, specific background information can be provided on those hazard areas that are also part of fragile ecosystems, such as:

- floodplains
- high-risk Great Lakes shoreline flooding / erosion areas
- areas of steep slopes subject to landslide
- urban / wildland intermix areas
- areas of expansive / unstable soils

These hazard areas, because of their fragile nature, either should not be developed, or development should occur in such a way that stringent public safety / development standards are implemented to ensure that no injuries or loss of life occurs and structural / ecological damage is kept to a minimum.

### **Natural Environment Policy and Action Plan\***

**\*Note:** In this section, specific background information can be provided regarding known hazard areas within fragile ecosystems (as per the Fragile Ecosystems section above), and possible acceptable land uses and necessary public safety / development standards for those areas can be discussed. In addition, the benefits of not developing these areas, or developing them at very low density (to reduce hazard vulnerability and preserve the environment) should be discussed. (For example, undeveloped or lightly developed floodplains provide enhanced natural storage areas for surface runoff and snowmelt. Undisturbed steep slopes are less likely to collapse and slide in heavy rainfall, thus reducing the likelihood of injury or damage to persons and structures down slope. Undeveloped dunes and shoreline habitat along the Great Lakes serve as natural buffers to flooding, high winds, and heavy wave action from the frequent storms that strike the Great Lakes. Undeveloped or lightly developed wildland fringe provides a natural buffer against destructive wildfires. Etc.)

## HOUSING / BUILT ENVIRONMENT ELEMENT

### **Vision Statement\***



**\*Note:** The Vision Statement can articulate a “vision” of the community's built environment that minimizes (or, if possible eliminates) the long term risk and vulnerability to people, property, and the environment from human-induced, natural, and technological hazards. Such a vision is consistent with the generally accepted desire to foster and create a “sustainable” development pattern within the community.

## **Housing / Built Environment Policy and Action Plan\***

**\*Note:** In this section, specific background information can be provided on ways in which the community's housing stock and other built environment elements can be made as resistant to human-induced, natural, and technological hazards (i.e., "sustainable") as possible. Discussion can center on ways to make homes and businesses less vulnerable to crime, wind, water, hail, lightning, fire, extreme temperatures, and ground shift / collapse. Such vulnerability reduction is primarily achieved by guiding and regulating the location, size, design, type, construction methods, and materials used in structures. Much of the discussion should highlight existing codes, standards, and design / construction review practices and processes currently in use in the community (or that need to be instituted). If appropriate, discussion could also focus on the need for protecting vulnerable historically significant structures and methods that could be employed to preserve their historic character and appearance while at the same time protecting them from damage from hazard related damage.

(Public structures can also be addressed here, although it may be more desirable to present the bulk of that discussion in the Public Facilities and Infrastructure section of the plan that follows.)

## TRANSPORTATION ELEMENT



### **Vision Statement\***

**\*Note:** Because the land use and transportation policies of the Plan are necessarily linked, transportation alternatives must reflect the land use pattern put in place to foster and promote "sustainability" and the reduction or elimination of vulnerability to human-induced, natural, and technological hazards. The Vision Statement for Transportation must address that reality. In addition, the Vision Statement should articulate the desire to create a transportation system that, in and of itself, does not impede evacuations or increase community vulnerability to transportation accidents or hazardous material incidents.

### **Transportation Policy and Action Plan\***

**\*Note:** In this section, specific background information can be provided on ways in which the community's transportation system can be developed and/or enhanced to foster, promote, and meet the needs of the community land use pattern that seeks to reduce or eliminate vulnerability to human-induced, natural, and technological hazards. For example, if the community is seeking to prevent development in the floodplain, then public transit stations / lines and highways should not be built in or in close proximity to those areas. Specific routes can be designated for shipments of hazardous materials – routes that balance the needs of business and industry with those of public safety and protection. Rail crossings can be designed in such a way to minimize the likelihood of car-train crashes – a major cause of rail transportation accidents. Highways and local streets can be designed with community-wide evacuations in mind. Transportation facilities can be designed and constructed to withstand the excessive forces of nature – thus ensuring safe and reliable transportation in the periods immediately following a disaster.

## PUBLIC FACILITIES AND INFRASTRUCTURE ELEMENT



### **Vision Statement\***

**\*Note:** As per the Housing / Built Environment Vision Statement, the Vision Statement for the Public Facilities and Infrastructure section should articulate a “vision” of the community’s public built environment that minimizes (or, if possible eliminates) the long term exposure, risk and vulnerability to human-induced, natural, and technological hazards. Such a vision is consistent with the generally accepted desire to foster and create a “sustainable” development pattern within the community. If a community is actively fostering and promoting sustainable private development, then it must lead by example by ensuring that public facilities and infrastructure are as disaster resistant as possible. The Public Facilities and Infrastructure Vision Statement should emphatically state the desire to create the highest level of protection possible against disaster damage through prudent facility location, design, construction, and maintenance. In addition, the Vision Statement should indicate that every attempt will be made to ensure that current and future public facilities and infrastructure do not contribute to an increase in the community’s exposure, risk and vulnerability to hazards.

### **Public Facilities and Infrastructure Policy and Action Plan\***

**\*Note:** In this section, specific background information can be provided on ways in which the community’s public built environment can be developed and maintained to ensure that it is 1) as disaster resistant as possible, and 2) does not directly or indirectly contribute to an increase in the community’s exposure, risk and vulnerability to human-induced, natural, and technological hazards. For example, if the community is seeking to prevent development in the floodplain, then public facilities and infrastructure should not be built in or service those areas. Public facilities and infrastructure should be located out of harm’s way and built to the highest engineering / structural and public safety standards economically possible to prevent damage from natural forces and potential loss of human life. Whenever possible, deconcentration of public facilities providing essential public services should be a desired goal, since services provided by one central facility are always more at risk than those provided by several smaller facilities. The principle of deconcentration also should be applied to the design of service networks – roads, pipelines, cables, etc. – to reduce risk of failure and loss of service. (Long lengths of supply lines are at risk if they are damaged at any point. Networks that interconnect and allow more than one route to any point are less vulnerable to local failures, providing that individual sections can be isolated when necessary. The same holds true for roads.)

## ECONOMIC DEVELOPMENT ELEMENT



### **Vision Statement\***

**\*Note:** The Vision Statement can articulate the importance that the community’s built environment minimize (or, if possible eliminate) the long term risk and vulnerability to human-induced, natural, and technological hazards. Such a vision fosters and promotes a “sustainable” development pattern within the community, which has at its very roots the idea of protecting the community’s economic base from undue harm and disruption. Simply put, a community that is not disaster resistant cannot be “sustainable” economically.

## **Economic Development Policy and Action Plan\***

**\*Note:** Policies relating to a “sustainable” community development pattern should be addressed in the preceding sections. However, it may be desirable to discuss the community’s most strategic locations for development – away from known hazard areas. By promoting those strategic locations, private investment can be guided into those areas of the community that are not in harm’s way. It may also be desirable to discuss the importance of the development of recreation opportunities and facilities within the community – especially if they would utilize land that is otherwise unsuitable for intense development. For example, if recreational areas are developed in the floodplain, that land is taken out of the development cycle – thus lowering the community’s risk and vulnerability to flooding. However, the new riverfront recreational areas, if properly marketed, could serve as magnets for attracting local and regional tourists to the community – thus putting the community in a “win-win” situation. (A well advertised canoe livery, bike path, or ski trail, for example, can provide much needed economic benefit to the community from otherwise hazard prone land.) Beachfront property offers the same example. Beachfront property used for private residences is beachfront property that will not attract tourist dollars to the community. The little property tax money that is generated from these properties would, in all likelihood, be more than offset by increased tourism revenue if the land were open and available to community residents and the traveling public.

### ENERGY ELEMENT



#### **Vision Statement\***

**\*Note:** Energy and hazard mitigation are necessarily intertwined, as reliable, uninterrupted energy supplies are vital to a “sustainable” community. Severe storms, high winds, flooding, snow and ice, freezing temperatures, ground collapse, and fire can all wreak havoc on electrical and gas transmission lines and related infrastructure. When that occurs, energy supplies are disrupted – sometimes for days or even a week or more at a time. Those disruptions are especially problematic (sometimes even life threatening) when critical facilities are involved – water and wastewater treatment plants, hospitals, police and fire stations, emergency medical services, and nursing homes, to name just a few. Therefore, it is critically important that a community take whatever steps are practical and appropriate to ensure a reliable, uninterrupted supply of energy for critical facilities, business establishments, and private residences. The Vision Statement for Energy should articulate that need and make it a priority in the community’s overall energy plan and strategies. A community that is not secure in its energy supply cannot be considered a “sustainable” community.

#### **Energy Policy and Action Plan\***

**\*Note:** Policies relating to energy should focus on maintaining a reliable, uninterrupted energy supply for the community. Emphasis should be placed on strengthening electrical lines and infrastructure to make them more resistant to harmful natural forces such as wind, water, lightning, snow, and ice, as well as human-induced hazards such as sabotage. If a community has a public power utility, that responsibility falls on the community. If a private utility serves the community, the community must ensure that it works closely (and continuously) with the utility to see that appropriate mitigative actions are taken. In either case, the most probable and effective actions include: 1) regular line and equipment maintenance and replacement programs; 2) underground burial of critical lines and strengthening of critical equipment; 3) regular tree trimming around overhead lines; 4) lightning protection for critical system links and nodes; 5) installation of emergency generators at critical public facilities; and 6) public education regarding home landscaping around power lines.

## **IMPLEMENTATION PLAN\***

**\*Note: Implementation of a Comprehensive Plan with integrated hazard mitigation policies and strategies is necessarily accomplished via a wide variety of methods, including:**

- **Regional Cooperation**
- **Public / Private Partnerships**
- **Inter-Departmental / Agency Collaboration**
- **Technical Studies / Sector Plans**
- **Zoning Ordinance**
- **Subdivision Regulations**
- **Capital Improvements Program**
- **Building Codes**
- **Special Program and Project Implementation**



Following are examples of the ways in which hazard mitigation policies and strategies can be implemented using the aforementioned methods:

### **Regional Cooperation**

Cooperation between the State, the federal government, neighboring municipalities, regional entities, and the private sector is essential for successful plan implementation. Pooling resources makes regional solutions more cost efficient and effective. For example, solutions to flooding are often best addressed at the regional (watershed) level – although in some cases that may not be possible. Likewise, mitigation issues pertaining to wildfires, hazardous materials, dam failure, and other hazards require, by their very nature, regional coordination and cooperation in policy / strategy development and implementation.

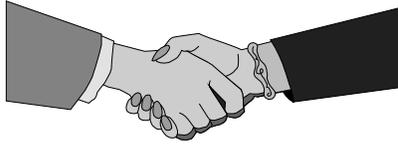
Regional entities that may provide assistance with hazard mitigation include:

- Regional Planning Commissions
- Fire Associations
- Watershed Councils
- Parks and Recreation Districts / Authorities
- Local Emergency Planning Committees (LEPCs)
- Forest Management Districts
- Soil Conservation Districts
- Drainage Districts
- Etc.



### **Public / Private Partnerships**

Combined efforts of public and private partners is another way to implement the mitigation policies / strategies in this Plan. Public / private partnerships are the hallmark of the Federal Emergency Management Agency's "Project Impact" initiative, which seeks to develop disaster resistant communities by encouraging communities to develop public / private partnerships for hazard identification and risk / vulnerability reduction purposes. Community based public / private partnerships work best, since the private sector entity has a vested interest in the future sustainability of the community. In Michigan, many communities have worked successfully with local financial institutions, private non-profit organizations, business and industry, and philanthropic foundations to reduce or eliminate their vulnerability to hazards through implementation of hazard mitigation policies and strategies. If the desired partners are involved in the development of the mitigation policies and strategies outlined in the Comprehensive Plan, they will, in all likelihood, be much more willing to enter into implementation partnerships that involve the commitment of time, personnel resources, and money.



### **Inter-Departmental / Agency Collaboration**

Coordination and partnerships must extend to local governmental departments / agencies as well. Collaboration is a hallmark of successful implementation of mitigation policies, strategies, and projects. Rarely are mitigation projects implemented by one single agency; rather, collaborative efforts are the rule rather than the exception. One of the best ways to foster and promote collaboration is to form a local or regional Hazard Mitigation Coordinating Council, similar in composition and function to the Michigan Hazard Mitigation Coordinating Council. Such a body could be a subcommittee of the local Planning Commission, or it could be an independent entity that makes specific recommendations on mitigation policy, strategy, and project implementation to the Planning Commission. Ideally, all local agencies and community organizations that will be involved in mitigation activities would be represented, although that may not always be logistically possible. The Policy / Action Plans at the end of each plan section also foster and promote a collaborative implementation “culture”, as most policies, strategies, and projects require the involvement of more than one department, agency, or community organization.

### **Technical Studies / Sector Plans**



The mitigation policies, strategies, projects, and actions recommended in each of the plan sections originated from public input, past experiences, technical information, and thorough analysis of relevant data. The local Hazard Analysis, which identifies and quantifies all hazards pertinent to the community, provides the foundation for the community’s mitigation efforts. Ideally, the Hazard Analysis or Hazard Analysis Summary will be included as an attachment to the Comprehensive Plan. Completion of the local Hazard Analysis is the first step in the hazard mitigation planning process. Relevant mitigation policies, strategies, and projects cannot be formulated until that vital document is completed.

Other technical studies or sector plans may be of help in the community’s mitigation efforts. For example, inventories / surveys of all public buildings and their condition could be used to determine the need for application of specific mitigation measures on those buildings. Historic preservation surveys / studies can help determine what structures are at risk from damage, and the “acceptable limits” for any mitigation measures being considered (i.e., so as to not alter the historic characteristics of the structure). Downtown or neighborhood development plans might pinpoint recurring problems related to specific hazards and recommend specific mitigation measures to reduce or eliminate those problems. Watershed studies and river management plans may identify problems relating to flooding and propose solutions. Response plans developed by the Local Emergency Planning Committee (LEPC) help identify the vulnerability zones around each SARA Title III / Section 302 site in the community, enabling the community to devise appropriate mitigative measures to reduce potential impacts on nearby residents. Etc.

### **Zoning Ordinance**



A Zoning Ordinance is probably the most effective measure a community has for guiding and regulating development and the land use pattern, and it can be very effective in mitigating hazard exposure, risk, and vulnerability. The Zoning Ordinance provides a mechanism for implementing the policy decisions articulated in the Comprehensive Plan concerning the desired locations of

various land uses and public facilities. The Zoning Ordinance is based on the Comprehensive Plan and therefore is developed and adopted after formal adoption by the community of the Comprehensive Plan. One major difference between the two mechanisms is the timeframe upon which they are based. Generally, the Comprehensive Plan is designed to guide development for the next 15-20 years or more, whereas the Zoning Ordinance will typically be adopted on the basis of a 7-10 year land use development need projection.

A Zoning Ordinance typically addresses 3 primary areas: 1) the use of land and structures and the height and bulk of structures; 2) the density of population and intensity of land and structural use; and 3) the provision for space around structures (i.e., requirements for side yards, rear yards, open space, building setback lines, etc.)

Some Zoning Ordinances may specifically address potential hazards to life and property, although there is not a strict requirement to do this. The ordinance itself consists of a map or maps delineating the zoning districts in the community where various land uses will be allowed, and an accompanying set of administrative procedures, standards and methods for enforcing the zoning regulations. Zoning districts typically include various types of industrial, commercial, residential, agricultural, and public facility uses. Specific zoning districts are tailored to the particular needs of the community. For example, communities that have a significant amount of lakefront properties may have a special zoning district for residential development around lakes.

Although there are a variety of standard zoning districts, there are no formal legal requirements regarding the specific types of districts that must be included in a Zoning Ordinance. Obviously, the ordinance must allow sufficient uses to be legally defensible if challenged in court. Each Planning Commission must determine the type of zoning districts that are appropriate for the community, based on its unique characteristics. For hazard mitigation purposes, establishing special zones for such hazardous areas as floodplains, urban / wildland intermix areas, high risk Great Lakes shoreline flooding / erosion areas, steep / fragile slope areas, areas within the identified hydraulic “shadow” of a high or significant hazard dam, areas prone to subsidence, etc. may be necessary and desirable to ensure the public health, safety and welfare is adequately protected. Such zones would not necessarily preclude development in these areas, but would require that specific standards are met for structures and land uses within the zones.

## Subdivision Regulations



Subdivision regulations are the legally established standards of design and construction for dividing a land parcel into smaller ones for the purpose of selling or leasing the property. The Land Division Act (288 PA 1967, as amended by 591 PA 1996 and 87 PA 1997) governs the subdivision of land in Michigan. The Act requires that the land being subdivided be suitable for building sites and public improvements, that there be adequate drainage and proper ingress and egress to lots, and that reviews be conducted at the local, county and state levels to ensure that the land being subdivided is suitable for development. The Act also requires conformance with all local planning codes. From a hazard mitigation standpoint, that point is important because it gives the local Planning Commission the authority to approve subdivision development in accordance with the local Comprehensive Plan and regulatory standards.

Subdivision regulations can be an effective tool in reducing exposure, risk and vulnerability to certain hazards, such as flooding and wildfires, if mitigation factors are incorporated into the subdivision process through mechanisms such as local planning codes. For example, a community may allow a subdivision to be placed in a heavily wooded area susceptible to wildfire if proper engineering measures are taken regarding lot size and ingress and egress, thereby providing an adequate level of protection to developed home sites and the residents occupying those home sites.



## Capital Improvements Planning



The value of public land, buildings, and infrastructure in a community of moderate size typically is worth tens to hundreds of millions of dollars. To protect those assets and assure the continuation of essential services, the community must maintain its existing facilities, upgrade them to meet community interests and needs, and expand them as the community grows.

A Capital Improvements Plan (CIP) is the mechanism through which a community identifies, prioritizes, and establishes financing methods for needed public improvements such as new or improved public buildings, roads, bridges, treatment plants, water and sewer infrastructure, etc. Planning Commissions are required by statute to annually prepare and adopt a CIP and recommend it to the legislative body for their use in considering public works projects. Generally, public improvements included in the CIP are those that require a substantial expenditure of public funds. (Each jurisdiction must decide what constitutes a substantial expenditure.) The CIP can be an effective implementing mechanism for the community's Comprehensive Plan and Zoning Ordinance because it dictates the nature and timing of public facility expenditures. Normally, the CIP is established for a six-year period. The first year of the CIP becomes the year's capital budget and is the basis for making appropriations for capital improvements. As a result, the annually approved items are the highest priority public improvements to be built in planned areas.

For the CIP to be an effective mechanism for implementing the Comprehensive Plan and Zoning Ordinance, public improvements must be targeted for those areas of the community where growth or certain types of land uses are desirable. Public improvements should not be put in those areas where growth or development is not desired. In that sense, the CIP should mirror the Comprehensive Plan and Zoning Ordinance (otherwise, the three mechanisms may work at cross purposes – i.e., public expenditures in a non-desirable area may spur unwanted development). On the other hand, if desirable private development occurs or is proposed, the CIP may have to be adjusted somewhat to coordinate public investment with the desired private development.

Each year, the Planning Commission must extend the CIP one more year through the established local planning process. As part of that process, the Commission will reevaluate project proposals in light of any developmental changes that might necessitate revision in public improvement priorities. Each year becomes the beginning of a new CIP.

From a hazard mitigation perspective, the CIP, if coordinated with the community's Comprehensive Plan and Zoning Ordinance, can be an effective mechanism for creating a desirable, less vulnerable land use and development pattern. Planning Commissions, because they create and adopt each of the three mechanisms, are instrumental in ensuring that public investment is done in such a way that it helps reduce or eliminate community exposure, risk, and vulnerability to hazards.



## Building Codes

Building Codes are designed to ensure that a building or other structure will be constructed in such a manner as to be safe for occupancy and use. These codes also regulate health and sanitation requirements for water, ventilation, plumbing, electricity, mechanical equipment, heating and air conditioning, and they contain minimum construction standards for natural hazard resistance.

All communities in Michigan must have a Building Code. Local Building Codes must conform to the State Construction Code (230 PA 1972, adopted November 5, 1974 and recently amended by 245 PA

1999), which establishes general minimum construction standards for buildings and structures in all Michigan municipalities.

(Background Note: Under 230 PA 1972, communities had the option of adopting the State Construction Code – the National Building Officials and Code Administrators (BOCA) Code with State amendments – or they could adopt any other nationally recognized Building Code such as the Uniform Building Code (UBC) or the Council of American Building Officials (CABO) Code for one and two family dwellings. Approximately 40% of Michigan communities adopted the State Construction Code and 50% followed the National BOCA Code. The remaining 10% adopted the UBC.)

Under 245 PA 1999, all Michigan communities will now be subject to the State Construction Code, which is a compilation of the International Residential Code, the International Building Code, the International Mechanical Code, and the International Plumbing Code published by the International Code Council, the National Electrical Code published by the National Fire Prevention Association, and the Michigan Uniform Energy Code with amendments, additions, or deletions as the Michigan Department of Consumer and Industry Services determines appropriate. Michigan is currently embarking on adoption of the Code with the desired goal of implementation during 2001. The new State Construction Code will provide for statewide uniformity of application and implementation of rules governing the construction, use, and occupancy of buildings and structures.

Provisions of the State Construction Code and other Building Codes are enforced through authorized local building inspection agencies and state inspectors. In Michigan, there are 2,600 registered local inspectors and 80 state inspectors. In communities where comprehensive planning is not done, the Building Code is often the only land use regulatory measure available.

Building Codes, used in concert with other available land use / development guidance measures (and if properly enforced), can be effective in reducing or eliminating damage caused by several types of hazards. For example, proper adherence to wind load requirements for roof systems can substantially reduce damage to structures from straight-line and tornadic winds. (Also, by securing the “envelope” of a structure, water-related damage from rainfall can also be greatly reduced. Many times, that makes the difference between a home that suffers minimal or no damage and one that suffers major damage or is a total loss.) Enforcement of basic Building Code provisions can also reduce damage caused by fire and flooding.

(Background Note: The new State Construction Code, if promulgated with the 1-foot “freeboard” provisions from the current version of the State Construction Code, will be more stringent in addressing new construction in floodprone areas. As an example, the BOCA National Code/1996 required that all new residential buildings or structures erected in a flood hazard zone be elevated so that the lowest floor is located at or above the 100-year (base) flood elevation. All basement floors had to be located at or above the base flood elevation. The UBC also had similar requirements. The new State Construction Code is more stringent than BOCA, as it requires that all residential buildings in the flood hazard zone have the lowest portion of all horizontal structural members supporting floors (such as floor joists) be located at or above the 100-year flood elevation. Thus, under the new State Construction Code, the lowest floor surface would be about 12 inches (the thickness of the floor joist and flooring) higher than was required under BOCA and UBC. The Code also requires that utilities and mechanical equipment be elevated above the 100-year flood elevation or protected so as to prevent water from entering or accumulating within the components during the occurrence of a 100-year flood. Non-residential structures may be elevated or watertight floodproofed. Non-residential buildings using the watertight floodproofing option must be designed and certified by a registered architect or professional engineer.)

By properly enforcing the flood resistant construction provisions of the State Construction Code, inspectors will help ensure that new construction within floodprone areas will be built in such a manner as to minimize future flood losses.

## Special Program and Project Implementation

Many of the hazard mitigation strategies specified in the Comprehensive Plan require action of the community's various departments and agencies in the continuous implementation and administration of special programs and projects. Typically, these programs and projects are aimed at protecting the environmentally sensitive or other special use areas, regulating the appearance of the community, or ensuring the structural and operational integrity of public facilities and infrastructure through proper application of engineering standards and "best practices". Examples of special area, use and design regulations that might be pertinent to the implementation of mitigation strategies within Michigan communities include:

- local floodplain management ordinances
  - coastal zone management regulations
  - watershed management regulations
  - special infrastructure design standards and regulations
  - drainage regulations
  - housing regulations
  - urban forestry programs
  - wetland protection regulations
  - natural rivers protection regulations
  - farmland and open space protection regulations
  - endangered species / habitat regulations
  - urban design regulations
  - historic preservation regulations
- Etc. (This list is certainly not all inclusive.)



These regulations and standards are typically administered by or fall under the oversight of a state or federal agency and are carried out by local officials. Most are designed to regulate a certain aspect of the natural or built environment to ensure protection of the public health, safety and welfare, and/or the environment. They can be mechanisms for achieving hazard mitigation, in addition to their intended basic purpose.

The major provisions of these regulations, where pertinent, should be included or addressed in the Comprehensive Plan and primary implementing mechanisms such as the Zoning Ordinance, Capital Improvements Plan, etc.

## **PLAN EVALUATION / MAINTENANCE\***



**\*Note:** The hazard mitigation strategies and policies specified in the plan should be evaluated on a continuous basis, along with the other plan elements. Ideally, plan evaluation will be done by a Hazard Mitigation Coordinating Council or similar appointed body – serving either as a subcommittee of the Planning Commission or acting as an independent entity apart from but coordinating with the Planning Commission and community's professional planning staff. This continuous evaluation is important because the community's hazard base and hazard exposure, risk, and vulnerability are constantly changing due to development, changing weather patterns, industrial activity, technological advances, and changes in local, state, national, and world conditions. The revised local Hazard Analysis should serve as the primary basis for re-evaluation and modification of community hazard mitigation strategies and policies within the Comprehensive Plan. Other factors to consider in the evaluation process include recent disaster experiences, fiscal constraints, public input, technology changes, and changes in federal, state, or local policy affecting an aspect of the natural or built environment that impacts hazard vulnerability reduction efforts.

## ONGOING COMMUNITY PARTICIPATION\*



**\*Note:** A portion of the mitigation strategies and policies specified in the Comprehensive Plan undoubtedly were shaped by the concerns of the community's citizens and business community. That public participation process does not end with the development of the Comprehensive Plan. The community must continue to seek advice from the public and monitor public opinion through whatever methods will ultimately prove to be most successful in obtaining meaningful feedback on the community's mitigation strategies and policies. Community participation ideally will be tied into a community hazard education effort that could include such activities as:

- a community hazards module in local elementary, middle school, and high school curriculums;
- local hazard awareness campaigns that coincide with the State's hazard awareness campaigns;
- public education / input sessions at Hazard Mitigation Coordinating Council and/or Planning Commission meetings;
- written survey questionnaires that inform the public about community hazards and solicit public opinion on a variety of mitigation issues;
- newspaper articles that discuss pertinent mitigation topics and suggest ways for the public to provide input on the hazard matter in question; and
- local television coverage that focuses on hazard issues, with opportunity for public feedback.

## RELATIONSHIP TO OTHER PLANS / PROCESSES\*



**\*Note:** Community growth and development and its associated impacts – both positive and negative – does not always neatly follow jurisdictional boundaries. Actions and impacts from Community A will eventually affect Community B, and vice versa. For that reason, it is incumbent on every community to look beyond its borders when developing and revising its Comprehensive Plan. This is especially true when it comes to instituting hazard mitigation strategies and policies within the plan, as hazards also do not recognize community borders in inflicting their negative impacts. So, for example, if Community A is proposing open space land use in the floodplain on one side of the border, and Community B upstream is proposing intensive residential and commercial development in that same floodplain, the negative impacts from that increased development concentration will clearly fall more heavily on the shoulders of Community A. Similarly, if Community A is proposing high density residential land use on one boundary with Community B, while just over the border Community B is proposing heavy industrial land use, the potential negative impacts from that industrial activity will affect the residents of Community A. Although these issues of incompatible land uses are often the result of historical growth and land use patterns and cannot always be resolved to everyone's satisfaction, the potential negative impacts can at least be anticipated and hopefully addressed through appropriate mitigation strategies and policies in appropriate places within the Comprehensive Plan.

A border analysis, then, should be a standard comparative tool used in the development of the Comprehensive Plan. Major transportation arteries and systems should also be analyzed for their potential impacts in terms of hazardous material transport within the community, and the potential for catastrophic passenger transportation accidents. Neighboring and regional economic development activities, such as major commercial centers or the development / growth of certain industries, can also directly impact a community's exposure, risk, and vulnerability to hazards and

**the quality of the environment. These and many other similar issues must be continuously examined as part of the Comprehensive Planning process.**

## **SUGGESTED HAZARD MITIGATION ATTACHMENTS\***

**Community Hazard Analysis (or Hazard Analysis Summary)**