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EMERGENCY MANAGEMENT AND
HOMELAND SECURITY DIVISION
Michigan Department of State Police

Michigan Hazard Mitigation Plan
(Updated April 2019 edition)

Reducing hazard risks and vulnerabilities through education, planning, physical improvements, early warning, and coordination of programs and resources.

Prepared by:

Emergency Management and Homeland Security Division
Michigan Department of State Police

And

The Michigan Citizen-Community Emergency Response Coordinating Council

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Michigan Hazard Mitigation Plan
(2019-2024 Edition)

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Official Promulgation Letter – Department of State Police

MICHIGAN HAZARD MITIGATION PLAN

This plan, developed and maintained pursuant to 1976 PA 390, as amended, and the federal Disaster Mitigation Act of 2000 (PL 106-390), and its implementing regulations found in 44 CFR Part 201, is hereby adopted for the State of Michigan. All participating state departments and agencies will work in conjunction with the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC) and the Michigan Department of State Police Emergency Management and Homeland Security Division (MSP/EMHSD) to implement those goals and objectives contained in the plan that are applicable to their respective department or agency. In addition, the State of Michigan will, in accordance with 44 CFR 13.11 c, comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding for hazard mitigation. Further, in accordance with 44 CFR 13.11 d, the State of Michigan agrees to amend this plan whenever necessary to adequately reflect new or revised federal statutes or regulations, or material changes in state law, organization, policy, or state department or agency operation.

Capt. Emmitt McGowan, Deputy State Director of Emergency Management and Homeland Security and Chairperson of the Michigan Citizen-Community Emergency Response Coordinating Council

4-19-19
Date

Col. Joseph Gasper, State Director of Emergency Management and Homeland Security And Director of the Michigan Department of State Police

4-19-19
Date

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Official Promulgation Letter – Governor's Office

MICHIGAN HAZARD MITIGATION PLAN

This plan, having been approved by the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC), the State Director of Emergency Management and Homeland Security (Colonel Joseph Gasper), and the Deputy State Director of Emergency Management and Homeland Security (Captain Emmitt McGowan), is hereby officially adopted for the State of Michigan in accordance with the federal Disaster Mitigation Act of 2000 (PL 106-390) and its implementing regulations found in 44 CFR Part 201.

Gretchen Whitmer, Governor

4/22/19

Date

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Michigan Hazard Mitigation Plan:
1. Introductory Information

What is Hazard Mitigation?

Hazard mitigation is defined as any action taken before, during, or after a disaster or emergency to permanently eliminate or reduce the long-term risk to human life and property from natural, technological and human-related hazards. It is an essential element of emergency management, along with preparedness, response and recovery. When successful, hazard mitigation will lessen the need for a community to respond to subsequent hazard events, for some incidents may remain as mere incidents and not become disasters. Similarly, disaster events should involve lesser levels of impact than they otherwise would have. Hazard mitigation strives to reduce the impact of hazards on people, property, the environment and economy, and continuity of services, through the coordination of available resources, programs, initiatives, and authorities.

Agency Roles

Federal, state, and local agencies have vital roles to play in this effort. Laws and processes governing the use of land and development of property originate at the state level, but are administered at a local level. State agencies administer a wide variety of programs that originate in federal government, including ones that affect, either directly or indirectly, the development and use of land within hazard-prone areas. Higher levels of government are the logical points for the origination of various hazard mitigation measures that have widespread applicability and implications, but local levels of government tend to deal with the implementation details within their area of jurisdiction.

Organization of This Document

This document has been thoroughly reorganized from its 2014 predecessor. Hundreds of updated pages appear in an attached volume labeled as the Michigan Hazard Analysis. The contents of the main volume of this plan have been consolidated into ten distinct chapters, each of limited size, with the most detailed passages placed into appendices in an effort to make the plan's contents more coherent and readily accessible to readers. Lengthy attachments from the 2014 document have been partially pared down and then integrated into this new format. The 950-page edition that had been completed in April 2014 is now shorter and consists of two volumes: this more concise plan and its attached Michigan Hazard Analysis.

After this introductory chapter, this plan begins with a brief profile of Michigan and a chapter that describes the roles of ordinary citizens, plus three levels of government. A chapter then describes the **processes** used to update the Michigan Hazard Mitigation Plan (rooted in the newest revision of the Michigan Hazard Analysis), to reorganize the plan into a new draft, to provide outreach to the whole community to invite their review and feedback in accordance with a Presidential Policy Directive, and to finalize the document.

A chapter then summarizes Michigan's risks, presenting information from the Michigan Hazard Analysis. ***Readers are strongly encouraged to seek out and peruse the contents of the* Michigan Hazard Analysis*, which is an attachment to this document.*** A subsequent chapter then describes general methods of hazard mitigation, with subsequent chapters narrowing these concepts into specific strategies that were evaluated and selected from to form the Action Plan for 2019-2024. A final chapter describes future activities involving the implementation, monitoring, and maintenance of this plan and its prioritized hazard mitigation actions. Throughout these ten core chapters, readers are referred to the contents of 16 associated appendices, where they can find additional detail covering all of the main topics and steps in this planning process.

Plan Purpose

This plan and the recommendations made herein are intended to provide the framework and foundation for hazard mitigation activities within the State of Michigan, in accordance with the planning requirements set forth in the federal Disaster Mitigation Act of 2000 (and in subsequent regulations and FEMA policies). Implementation of this plan should result in greater protection of human life, property, and the environment, and lessened amounts of physical, economic, and social disruption to communities and residents from natural, technological, and human-related hazards.

The ideal end-state is a complete integration of hazard mitigation activities, programs, capabilities, and actions into normal, day-to-day governmental and private sector functions and business management practices, at all levels of organization (including ordinary citizens), across jurisdictional boundaries, and across all phases of emergency management.

Plan Scope

This plan takes a broad perspective in examining natural hazard mitigation activities and opportunities in the state of Michigan. Special emphasis has been placed on those hazards that have actually caused or could potentially create disastrous or emergency conditions posing significant threats to public health, safety and welfare, and the social, economic and physical conditions in Michigan communities. The plan:

- Identifies and summarizes the analysis of the primary hazards that have impacted the state, or have the potential to impact the state, as presented in the Michigan Hazard Analysis document;
- Analyzes Michigan's vulnerability to those identified hazards in terms of the impacts upon local jurisdictions and state owned/operated critical facilities, including average and potential losses expressed in terms of recent or current dollar values (note: confidential details of the latter are withheld from public distribution);
- Incorporates hazard mitigation into a broad framework of interagency and interdisciplinary coordination, including land use and comprehensive planning activities, emergency management mission areas, and military and homeland security considerations, and draws upon those frameworks for additional evaluation of technical, theoretical, and practical feasibility of the proposed activities;
- Assesses the current strengths and weaknesses of hazard mitigation and emergency management capabilities and resources in Michigan;
- Achieves a greater level of integration and coordination between state and local planning documents and activities;
- Examines specific hazard mitigation measures that have been taken (and that can be considered) to address Michigan's current hazards;
- Documents existing federal, state, local, quasi-public, and private programs and initiatives that can directly or indirectly promote hazard mitigation; and
- Recommends both short-term and long-term hazard mitigation opportunities that the state of Michigan, local governments, private industry, non-profit agencies, and individual households should consider implementing.

Most of the measures ultimately recommended are statewide or regional in nature and application. Local hazard mitigation plans developed throughout Michigan contain strategies that are specific to many additional local agencies and sites. Potential resources and methods for implementing recommended measures are also identified. The hazard mitigation opportunities outlined in the plan were identified from a number of sources, including:

- Post-disaster hazard mitigation strategies from past federally declared disasters in Michigan;
- Hazard mitigation projects funded or applied for under various federal and state mitigation programs, in Michigan and in other states;
- The Michigan Hazard Analysis and Local Mitigation Planning Workbook documents published and maintained by the Michigan State Police, Emergency Management and Homeland Security Division (MSP/EMHSD);
- Local hazard analyses, hazard mitigation plans, and land-use/comprehensive plans throughout Michigan;
- Disaster case studies and after-action reports from recent disasters in Michigan and other states;
- Hazard mitigation plans for the adjacent states of Ohio, Indiana, Wisconsin, and the Emergency Management Strategy for Canada.
- Hazard mitigation guidance documents, such as MSP/EMHSD Pub. 207, FEMA guidance, special studies, and other academic, theoretical, and scholarly literature, and reference materials;
- Emergency management communications (e.g. Law Enforcement Information Network, E-Team, MI-CIMS, National Weather Service, Emergency Alert System) and media reports of recent emergency events or threats; and
- Specific recommendations made by federal, state and local agencies, private industry, and other sources of feedback during this planning process.

Glossary

A glossary appears later in this document, to help readers understand terms and programs that are relevant to this plan. **Please refer to Appendix 1 to see a glossary of terms and programs.**

Legal Authority

This plan is developed under the authority of 1976 PA 390, the Michigan Emergency Management Act, as amended. This Act and its subsequent Administrative Rules provide the Department of State Police with broad authority to carry out the emergency management activities of mitigation, preparedness, response and recovery within the state of Michigan. In addition, it empowers each state department to carry out the emergency tasks assigned to it by the Department of State Police in the Michigan Emergency Management Plan (MEMP) or other means—which include the planning, development, and implementation of hazard mitigation measures.

If a disastrous event in Michigan results in a federal major disaster declaration under Public Law 93-288 (Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by the Disaster Mitigation Act of 2000), **this plan will serve as the state hazard mitigation plan required under Section 322 of the Act as a condition of receiving federal disaster relief assistance.**

The MHMP also provides assurances that the state will continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in state or federal laws and statutes, as required in 44 CFR 13.11(d). (Please refer to the end of chapter 10 for details of hazard mitigation grant applicant assurances.)

Note on Departmental Name Changes

Aside from historical sections, references to governmental departments within this document are generally presented as those departments were named when this publication was being finalized in early 2019. If any departmental names have changed since this time, such changes will be reflected in the next planned full update for this publication.

An exception involves the Michigan Department of Environmental Quality (DEQ), which was renamed to the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Present day and forward-looking references to DEQ were substituted for EGLE in 2022 as part of amendatory language added to this document (see Appendix 17).

References to any department's past name may also be left unchanged where they occur within a context of a historical section or past record.

Michigan Hazard Mitigation Plan:
2. State Profile

Brief Profile of the State of Michigan

Michigan has a land area of 58,216 square miles and a population of about 9.9 million persons. Its 83 counties include numerous urbanized areas, including Metropolitan Detroit. Most Michigan residents live within these urbanized areas, which are mainly located in the southern portion of the State. Michigan is completely covered by local, incorporated government entities—every inch of the State is part of a township, city, or village, and all residents of these minor civil divisions are also residents within one of Michigan's counties. This constitutes a general political and taxation structure for Michigan's many communities, although additional districts overlay these areas as well, such as school districts, village boundaries, congressional districts, and special assessment districts.

Located in the midst of four of the Great Lakes, Michigan's fundamental geographic feature is its division into Lower and Upper Peninsulas. The Lower Peninsula encompasses approximately 70% of Michigan's total land area, and the Upper Peninsula accounts for the other 30%. The two peninsulas are divided by the Straits of Mackinac, which allow Lake Michigan to drain into Lake Huron. The southern half of the Lower Peninsula has a level to gently rolling surface, with hills rising to elevations between 1,000 and 1,200 feet. (Lakes Michigan and Huron average about 577 feet above sea level, so these hills amount to about .) The northern half of the Lower Peninsula has higher elevations, with hilly belts of glacial origin reaching elevations of 1,200 to 1,700 feet. The eastern half of the Upper Peninsula is relatively level and often swampy. The western half is higher and more rugged. Michigan has borders on four of the five Great Lakes and has the longest shoreline of any inland state—about 3,200 miles. Michigan also has over 10,000 inland lakes and 36,000 miles of streams.

Michigan has a diversified economy based on agriculture, manufacturing, tourism, services, and professional trades. More automobiles and trucks are produced in Michigan than in any other state. Michigan is the nation's top producer of office furniture, a major source of information technology and software, and a national leader in machine tools, chemicals, and plastics. Michigan is also one of the nation's leading agricultural producers, consistently ranking number one in several product categories. Michigan has a well-developed, multi-modal transportation system that supports the state's diversified economic activities. The highway system consists of a network of interstate, federal, state, and local routes that connect Michigan communities to major metropolitan areas and economic markets around the country. Michigan has 19 airports that offer commercial passenger jet service to major domestic and international destinations. Freight railroad lines link Detroit and other metropolitan areas with Chicago and other major manufacturing and business centers in the United States and Canada. Michigan also offers 40 Great Lakes ports to facilitate waterborne commerce. Each year, Michigan's transportation system helps move 240 million tons of cargo by truck, rail, air, and ship.

Due to its geography and location, Michigan will always be threatened by natural hazards. The State of Michigan and local governments must always be prepared to manage those types of events when they occur. The principal natural hazard threats to Michigan are floods, thunderstorm winds and lightning, tornadoes, hail, ice/sleet storms, drought, severe winter weather, wildfires, invasive species, extreme temperatures, and geomagnetic storms.

Michigan's principal technological hazard threats include hazardous material incidents, petroleum and natural gas pipeline accidents, other infrastructure failures, structural fires, and major transportation accidents. (It should be noted that many of these threats are a direct or indirect result of the state's position as a major national and international manufacturing and business center. The technological threats present in Michigan are not unlike those present in other industrialized states of similar size and character.) Michigan's principal human-related hazards include public health emergencies, cyber-attacks, weapons of mass destruction, civil disturbances, and terrorism (and similar criminal activities).

Please refer to the **Michigan Hazard Analysis** for a more complete profile of the State of Michigan, approximately three dozen chapters describing a full array of Michigan's natural, technological, and human-related hazards, and corresponding lists of programs, resources, and initiatives for each type of hazard. These materials within the

Michigan Hazard Analysis provide a substantial factual basis for the discussion of hazard mitigation activities that appears within this 2019 Michigan Hazard Mitigation Plan. Only a small fraction of the information from the Michigan Hazard Analysis has been reprinted within this 2019 Michigan Hazard Mitigation Plan, beginning with the following map that provides a profile of Michigan's general population concentrations and geographic regions.

The Michigan Profile Map defines four general geographic divisions, which were defined specifically for the purpose of analyzing Michigan's hazards on the basis of trends in land use and population density. Within all four geographic areas—the Upper Peninsula, the Northern Lower Peninsula, the Southern Lower Peninsula (except for Metro-Detroit), and finally a five-county Detroit Metropolitan Region—all of Michigan's townships and cities have been marked on this map, using distinct shadings that classify them into five types of municipality, from rural to the oldest and densest urban centers. Within the rural areas of the northern areas of the state, the Michigan Profile Map also notes the official location of State and National Forest Areas, further distinguishing between (1) natural areas that are predominantly owned and maintained by the government, and (2) rural areas and their associated towns that are predominantly owned by private citizens engaged in various professions and industries such as agriculture, extraction, tourism, services, and manufacturing. Here are brief descriptions of these map features and classifications:

The Michigan Profile Map presents a selective overview of the general characteristics of Michigan's present settlement, land use, and production patterns. Since many of these patterns correspond with differences in climate and vegetation, it was deemed useful to designate four general geographic divisions within the state:

Geographic Division	Number of Counties	Population (2010 census)	Percent of State Total
1. The Upper Peninsula	15	311,361	3.2%
2. Northern Lower Peninsula	29	717,977	7.3%
3. Southern Lower Peninsula	34	4,464,620	45.2%
4. Metropolitan Detroit	5	4,389,682	44.4%
STATE TOTAL	83	9,883,640	100%

Geographic Divisions 1 and 2 are predominantly rural, with great quantities of designated forest lands and a fairly specialized scope for its agricultural production, it tends to fall within the Köppen Dfb climate category (humid continental, with generally cooler and shorter summers). Geographic Divisions 3 and 4 tend to fall into a slightly warmer climate category (Köppen Dfa) and to contain a larger scale of agricultural production in closer proximity to major cities than is possible within the colder and less-populated northern areas. Area 4 originally had a swampier nature than other parts of southern Michigan, but today is most distinctive because it is dominated by the Detroit Metropolitan Area, which is an order of magnitude larger than any other urban area in Michigan, and larger than any other Midwestern metropolitan area except for Chicago.

It must be emphasized that these divisions are not meant to correspond with existing planning regions, emergency management districts, Urban Area Security Initiative areas, or census economic areas. The "Community Classification" categories on the map need to be thoroughly explained, in order to fully understand how the map was designed (and how the general geographic divisions were defined). It is worth noting at the outset that some communities may include limited areas that better resemble the description for a different category (e.g. a large park may have a rural character within a large central city), and this map doesn't attempt to include such local detail. These classifications are meant only to provide an overview of the state, rather than to precisely indicate local land use patterns.

Profiles of Each Geographic Division

The following pages describe each geographic division's characteristics that are considered to be most relevant for an analysis of risks and hazard impacts. Where information is provided about population centers, the 2010 census has been the source of information used. The "urban areas" designated by the U.S. Census have tended to be presented here as the most relevant means of conveying information about most of Michigan's populated areas, since they are defined in terms of specific land use patterns rather than broad political boundaries. Some of the official urban areas are treated as part of a larger metropolitan area (e.g. Howell and Detroit), as noted in the descriptions that follow. The lists include all the urbanized areas, recognized "urban clusters," and comparable cities over 2,500. Since this is just an overview, it focuses upon distinct urban areas in order of population, by geographic division. Emphasis is placed upon regional social communities (urbanized areas, urban clusters) rather than each individual political jurisdiction. (Note: In cases where the city population is larger than the urban cluster population, the city's statistic is used here.) The following summaries also include lists of hazards that have been identified as significant within each geographic division. As explained in the rest of this document, hazards are still possible even not commonly prioritized as most significant, but the following references merely provide a rough overview of the different kinds of events that are

typically identified as a major threat within local and regional hazard analyses across the State's different geographic areas.

1. The Upper Peninsula (15 counties)
As shown on the Michigan Profile Map, most of the Upper Peninsula is covered with forest lands, and most inhabitants live in small cities, villages, and towns in the midst of these forests. These communities are often very historic. The Upper Peninsula used to have a huge timber and mining industry, during the 19th Century, and had lost most of its population during the 20th Century after these industries had declined in size. (In 1910, Calumet-Laurium used to be one of Michigan's most populous communities—Houghton County had a population of 88,008 and Calumet Township's population of 32,845 was comparable to that of Jackson, Kalamazoo, or Lansing at the time, but today the township only has 6,489 residents.) The Upper Peninsula's historic mining industry makes certain portions of it more vulnerable than the rest of the State to large-scale ground subsidence risks (the "subsidence" chapter provides more detail). The western U.P. has large areas covered by the Ottawa National Forest, the eastern U.P. has two large areas that together compose the Hiawatha National Forest, and there are seven MDNR State Forest Districts covering the entire U.P. Isle Royale is Michigan's only National Park area.

The Upper Peninsula is predominantly rural, and every one of its counties has a population density that is well below the State's average. Because the area developed during the 1800s, most of its cities have areas that date from that time period. The Upper Peninsula is adjacent to Wisconsin and Ontario, Canada, and some cities are part of urban areas that cross over state (and national) borders. These cross-border urban areas include Sault Ste. Marie (Ontario and Michigan), Iron Mountain-Kingsford (Michigan and Wisconsin), and Marinette-Menominee (Wisconsin and Michigan).

Taking into account the broader metropolitan areas, then, the city of Sault Ste. Marie might be considered the most significant for the Upper Peninsula. Although the Michigan portion of this area has only about 14,000 people, the much larger Canadian city of Sault Ste. Marie dominates an urban area of nearly 100,000 total population. All marine traffic going from Lake Huron to Lake Superior passes through the Soo Locks, in this area. This includes marine traffic traveling to and from major ports such as Duluth (Minnesota) and Thunder Bay (Ontario, Canada). The only Interstate Highway in the Upper Peninsula (I-75) goes through this city and crosses the International Bridge into Canada. The Mackinac Bridge is another vital element of Michigan's infrastructure, providing a highway connection between Michigan's Upper Peninsula and its Lower Peninsula. Several high-quality surface highways cross the Upper Peninsula and provide the main routes for its truck traffic. Along with freight trains, these highways pass through large areas of State and National Forest Lands, which means that wildfires are one of the most significant threats in the area.

The following hazards are most frequently identified as significant within the Upper Peninsula's local and regional plans:
Natural Hazards: Thunderstorms, Severe Winter Weather, Severe Winds, Tornadoes, Extreme Temperatures, Flooding, Shoreline Hazards, Dam Failures, Drought, Wildfires, Invasive Species, Subsidence.
Technological Hazards: Structural fires, Infrastructure Failures.
Human-Related Hazards: Civil Disturbances, Nuclear Attack, Public Health Emergencies, Terrorism.

The Upper Peninsula includes the urban areas of Sault Ste. Marie (Ontario-MI), Marquette, Escanaba, Marinette-Menominee (WI-MI), Iron Mountain-Kingsford (MI-WI), Houghton, and Ishpeming-Negaunee.

Compared to other areas of the state, the Upper Peninsula has a larger percentage of its workforce engaged in the following economic sectors: agriculture, forestry, fishing, and hunting; mining, quarrying, and oil/gas extraction; utilities, construction, health care and social assistance; arts, entertainment, and recreation; and accommodation and food services. The total market value of agricultural products in the Upper Peninsula is estimated to be 1.2% of Michigan's total agricultural production, based upon 2012 Census of Agriculture information. More specifically, the value of the Upper Peninsula's production of livestock, poultry, and their products constitutes about 2.0% of the state total, while its value-share of crops (including greenhouse and nursery products) is only about 0.7%. The Upper Peninsula has nearly 490,000 acres of farmland, or 4.9% of the state's total. These values are consistent with principles of economic geography, in which useful agricultural products that produce a lesser return per acre tend to be

located farther from urban areas, where larger-sized farms are more affordable. The Upper Peninsula specializes in the following agricultural products, in terms of having a greater percentage of its farmland dedicated to their production: barley, oats, hay/grass/silage/greenchop, and sunflower seeds.

2. The Northern Lower Peninsula (29 counties)

This area is predominantly rural in nature, and (as shown on the Michigan Profile Map) is widely covered with forest lands, but includes significant resort and tourist areas, and profitable groves of fruit-growing trees. It is a popular area for hunters, and has a large proportion of its housing units dedicated to seasonal and recreational uses (e.g. hunting lodges, summer cabins). This part of the state includes the Huron National Forest in the east and the Manistee National Forest in the west, along with eight State Forest Districts of the MDNR. Many small cities, villages, and towns are located throughout the area's 29 counties. A generally good system of surface highways connects the area. Trains are limited to freight uses, rather than passenger travel. A few airports and passenger ferries are in operation within the area, and there are some excellent ports for handling marine traffic.

The following hazards are most frequently identified as significant within the Upper Peninsula's local and regional plans:

Natural Hazards: Thunderstorms, Severe Winter Weather, Severe Winds, Tornadoes, Extreme Temperatures, Flooding, Shoreline Hazards, Dam Failures, Drought, Wildfires, Invasive Species.

Technological Hazards: Structural fires, Scrap Tire Fires, Oil and Gas Well Accidents, Infrastructure Failures.

Human-Related Hazards: Nuclear Attack, Public Health Emergencies, Terrorism.

The urban areas in the Northern Lower Peninsula include Traverse City, Alpena, Cadillac, and Ludington.

The Northern Lower Peninsula has a larger percentage of its workers in retail trade than other parts of the state do. The total market value of agricultural products in the Northern Lower Peninsula is estimated to be 9.2% of Michigan's total agricultural production, based upon 2012 Census of Agriculture information. More specifically, the value of the area's production of livestock, poultry, and their products constitutes about 12.8% of the state total, while its value-share of crops (including greenhouse and nursery products) is about 7.1%. The Northern Lower Peninsula contains nearly 1,600,000 acres of farmland, or 16.0% of the state's total. These values are consistent with principles of economic geography, in which useful agricultural products that produce a lesser return per acre tend to be located farther from urban areas, rather than intensely competing with non-agricultural economic sectors over land prices. The Northern Lower Peninsula specializes in the following agricultural products, in terms of having a greater percentage of its farmland dedicated to their production: orchards, sunflower seeds, hay/grass/silage/greenchop, oats, sorghum, barley, and vegetables.

3. The Southern Lower Peninsula (excluding Metro Detroit) (34 counties)

This area contains many medium-sized urban areas and most of Michigan's traditional farming and livestock grazing lands. It is adjacent to the States of Indiana and Ohio, and the Canadian province of Ontario. Some out-of-state metropolitan areas extend into this part of Michigan, such as South Bend, Elkhart, Michigan City, Toledo, and Sarnia. This part of the state is extremely well-served by the Interstate Highway System, and many colleges and State universities are found throughout the area. Many features of historic and scenic interest draw tourists from other parts of the state and country. University sports venues, the Michigan International Speedway, minor league baseball, many different museums, zoos, professional theaters, historic sites, and well-known manufacturing facilities (e.g. Kellogg breakfast cereals) are numbered among the area's many cultural attractions.

The following hazards are most frequently identified as significant within the Upper Peninsula's local and regional plans:

Natural Hazards: Thunderstorms, Severe Winter Weather, Severe Winds, Tornadoes, Ice/Sleet Storms, Extreme Temperatures, Flooding, Shoreline Hazards, Dam Failures, Drought, Invasive Species, Earthquakes.

Technological Hazards: Structural fires, Scrap Tire Fires, Hazardous Materials Incidents, Nuclear Power Plant Emergencies, Pipeline Accidents, Oil and Gas Well Accidents, Infrastructure Failures, Energy Emergencies, Transportation Accidents.

Human-Related Hazards: Civil Disturbances, Nuclear Attack, Public Health Emergencies, Terrorism.

The largest urban areas connected with the Southern Lower Peninsula (outside of Metropolitan Detroit) are Grand Rapids, Toledo (OH-MI), Flint, Lansing-East Lansing, South Bend (IN-MI), Kalamazoo, Sarnia-Port Huron (ON-MI), Muskegon, Elkhart, IN-MI, Saginaw, Holland, Jackson, Battle Creek, Bay City, Michigan City-LaPorte (IN-MI), Benton Harbor-St. Joseph, Midland, Monroe, Adrian, Mt. Pleasant, Owosso, Alma-St. Louis, Coldwater, Ionia, Big Rapids, Lapeer, Sturgis, Charlotte, Hillsdale, Paw Paw Lake-Hartford, and Three Rivers.

The Southern Lower Peninsula (outside of Metro Detroit) has a larger proportion of its workers in the manufacturing sector than other parts of the state. Its percentages employed in educational and other services are significantly larger than for Michigan as a whole. It has many colleges and universities. Lansing is the state capital and contains many government agencies. Among the many recreational and cultural attractions are large stadiums and performance venues, which tend to require special preparation and management when it comes to protecting attendees from threats and hazards. Various convention centers and downtown areas tend to regularly attract large numbers of persons, who similarly may require special planning to protect them from threats and hazards.

The total market value of agricultural products in the Southern Lower Peninsula (outside of Metro Detroit) constitutes 86.6% of Michigan's total agricultural production, based upon information within the 2012 Census of Agriculture. More specifically, the value of the Southern Lower Peninsula's production of livestock, poultry, and their products constitutes 83.6% of the state total, while its value-share of crops (including greenhouse and nursery products) is 88.3%. The Southern Lower Peninsula (outside of Metro Detroit) has nearly 7,500,000 acres of farmland, or 75.3% of the state's total. These values are consistent with principles of economic geography. Contrary to popular belief, the most intense areas of high-value agricultural production in Michigan tend to be located within ready driving distance of large urban markets and transportation hubs. This location allows more perishable commodities to quickly reach high-population markets before spoilage can occur. In addition, agricultural products that produce a higher return per acre are able to be located closer to urban areas, even if competing forms of land use have driven up land prices a bit. The Southern Lower Peninsula (outside of Metro Detroit) specializes in the following agricultural products, in terms of having a greater percentage of its farmland dedicated to their production: sugar beets for sugar, dry edible beans, soybeans, wheat, and corn. This is the only one of the 4 main geographic areas whose share of Michigan's agricultural market value is greater than its share of the state's farmland, indicating a higher average agricultural productivity.

4. Metropolitan Detroit (5 counties)

This area contained the first large Michigan settlements, which developed into the expanding City of Detroit throughout the industrial revolution and then became world-famous as "The Motor City." The largest American automobile companies tended to develop in this area of Michigan, and eventually became "the big three"—Ford, General Motors, and Chrysler, with their world headquarters located in Dearborn, Detroit, and Auburn Hills, respectively. Although the area's population increased by the greatest amount during the first half of the 20th Century (Detroit's peak census population was in 1950, at 1,849,568 persons), the metro area continued to increase slowly for 50 years thereafter—until the most recent census revealed the effects of various economic challenges, which registered an overall decline of modest proportions (while most of the metropolitan counties continued to grow at a decent rate).

The following hazards are most frequently identified as significant within the Upper Peninsula's local and regional plans:

Natural Hazards: Thunderstorms, Severe Winter Weather, Severe Winds, Tornadoes, Ice/Sleet Storms, Extreme Temperatures, Flooding, Shoreline Hazards, Dam Failures, Drought, Invasive Species.

Technological Hazards: Structural fires, Scrap Tire Fires, Hazardous Materials Incidents, Nuclear Power Plant Emergencies, Pipeline Accidents, Infrastructure Failures, Energy Emergencies, Transportation Accidents.

Human-Related Hazards: Civil Disturbances, Nuclear Attack, Public Health Emergencies, Terrorism.

The largest urban areas in the Detroit Metropolitan region are Detroit (adjacent to 319,246 persons in the Windsor area in Ontario) and Ann Arbor-Ypsilanti.

The area employs a larger percentage of its workforce in certain economic sectors than other parts of Michigan do. These sectors include wholesale trade, transportation and warehousing, information, finance and insurance, real estate and rental and leasing; professional, scientific, and technical services; management of companies and enterprises, and administrative support and waste management and remediation services. The total market value of agricultural products in Metropolitan Detroit is 3.1% of Michigan's total agricultural production, based upon 2012 Census of Agriculture information. More specifically, the value of Metro Detroit's production of livestock, poultry, and their products constitutes 1.6% of the state total, while its value-share of crops (including greenhouse and nursery products) is 3.9%. Metro Detroit has about 370,000 acres of farmland, or 3.7% of the state's total. These values are consistent with principles of economic geography, in which more perishable agricultural products need to be located closer to urban areas, for quick access to markets and transportation hubs. The Detroit metropolitan area specializes in the following agricultural products, in terms of having a greater percentage of its farmland dedicated to their production: sunflower seeds, soybeans, wheat, and vegetables.

Economic Sectors

The following table presents selected economic information for Michigan and its four geographic divisions (as defined in this document). Various economic sectors have been listed, along with their shares of annual employment within each region or the state (using 2015 County Business Patterns information). It has been possible to improve this table from that within the 2014 plan by including reasonable estimates for data that had been removed to preserve confidentiality at the local level. The result is to have all columns (regions) now neatly total 100% and to allow a direct comparison of regional production specializations across Michigan.

Although employing only a small percentage of Michigan workers, its agricultural production sector is large and very important to the state's economy. Michigan's total land area encompasses about 37 million acres, and about 26.7% of that was reported as farmland within the 2012 Census of Agriculture. Of this farmland, over a quarter involves corn production. Michigan's other dominant crops include soybeans (about 20% of farmland), hay, grass, silage, and greenchop feed (about 10.7% of farmland), and wheat (about 5.4% of farmland). Regional specializations had already been described within the section on Michigan's general geographic areas. Overall, 63.5% of Michigan's agricultural market value is from crops and nursery/greenhouse products, while 36.5% is from livestock, poultry, and their associated products.

Michigan's position as a national and international manufacturing and business center means that the state is susceptible to hazardous material incidents and other technological hazards. Extensive planning and preparation has been done to aid in responding to these types of events, and that work must continue and perhaps even be expanded as the number and potential impacts of technological hazards continues to grow.

2015 County Business Patterns		MICHIGAN	U.P.	N.L.P.	S.L.P.	Metro
NAICS code	**2015 NAICS code description**	**% of MI workers**	**% of UP workers**	**% of NLP workers**	**% of SLP workers**	**% of Metro workers**
------	Total for all sectors	100.0%	100.0%	100.0%	100.0%	100.0%
11----	Agriculture, forestry, fishing and hunting	0.1%	1.1%	0.5%	0.1%	0.0%
21----	Mining, quarrying, and oil and gas extraction	0.1%	1.7%	1.0%	0.1%	0.0%
22----	Utilities	0.6%	0.8%	0.7%	0.7%	0.5%
23----	Construction	3.7%	5.2%	5.0%	3.7%	3.4%
31-33	Manufacturing	15.7%	13.0%	16.5%	19.4%	12.6%
42----	Wholesale trade	4.8%	2.7%	3.2%	4.8%	5.0%
44-45	Retail trade	12.9%	17.5%	17.8%	13.3%	11.8%
48----	Transportation and warehousing	3.1%	2.7%	2.4%	3.1%	3.2%
51----	Information	1.9%	1.6%	1.2%	1.4%	2.4%
52----	Finance and insurance	4.1%	4.0%	3.3%	3.8%	4.4%
53----	Real estate and rental and leasing	1.4%	1.2%	1.5%	1.2%	1.6%
54----	Professional, scientific, and technical services	6.9%	3.1%	2.9%	3.8%	10.2%
55----	Management of companies and enterprises	3.3%	0.5%	1.2%	2.8%	4.2%
56----	Administrative & Support & Waste Management & Remediation Services	6.8%	2.9%	3.8%	6.4%	7.6%
61----	Educational services	2.0%	1.2%	1.0%	2.7%	1.6%
62----	Health care and social assistance	16.6%	20.6%	18.5%	16.5%	16.3%
71----	Arts, entertainment, and recreation	1.3%	1.5%	1.3%	1.2%	1.4%
72----	Accommodation and food services	10.3%	14.2%	13.8%	10.3%	9.7%
81----	Other services (except public administration)	4.4%	4.7%	4.4%	4.7%	4.0%
99----	Industries not classified	0.0%	0.1%	0.1%	0.0%	0.0%

The percentages that are shaded within this table show which geographic division has the highest percentage of its workers involved in each particular economic sector. For example, the Upper Peninsula has the highest proportion of workers involved in the agriculture, forestry, fishing, and hunting sector (NAICS code 11).

Land Use Patterns

The Michigan Profile Map includes a general classification that suggests the predominant form of land use and development patterns for each township and city in Michigan. The following descriptions provide information about these classifications, from an Emergency Management perspective.

Urban Centers

Michigan has many cities located across its lands, from the very small (Omer, population 313) to the very large (Detroit, 2010 population 713,777), and many of these date back to the 1800s as official corporate entities. These historical cities appear in black on the map, representing areas that tend to have the greatest densities in population, infrastructure, and the built environment. Only cities have been included in this classification (not villages or townships), but not all cities have been designated as urban centers. Because of the different forms that urban development took on in the post-WWII period, in which automobile accommodations had become the norm, only cities that had incorporated before the end of World War II have been included in this category as "urban centers."

Most of these cities contain a traditional downtown area that has long attracted people from outlying areas to engage in commercial or recreational activities, meet with government representatives, visit hospitals, or meet with others in social, civic, or religious activities. Some of the most historically significant structures in Michigan are located within

these cities, and they also contain a vast amount of Michigan's vital government facilities, hospitals, police and military resources, large educational institutions, and major industrial firms. Some of these "urban center" cities contain relatively small downtowns, in cases where they function as "suburbs" near a larger central city, but they have still been classified here as urban centers because their initial formation conformed to a particular style of development that was predominant before World War II. For example, the streets tended to be laid out in the form of a grid, urban designs tended to focus upon regular access to a thriving central downtown district, and much less accommodation was made for the use of private automobiles by residents.

Dense development patterns and an emphasis upon efficiency characterized most urban center construction projects. Historically, it was to the advantage of most residents and businesses to locate as close as possible to shared transportation and utility resources, and these were designed to accommodate the needs of the persons using them at their time of construction. Many of these designs (for example, combined sewer systems that handle both sanitary and storm drainage functions) are still being changed even today, to accommodate the needs of a larger population that is more productive, enjoys a higher standard of living, and uses more energy to power its higher-technology devices, buildings, and industries. The systems present in these urban centers tend to be the most complex found in the state, and although the capacity to repair most breakdowns in these systems is usually readily available within the larger cities, the complexity and corollary impacts of such breakdowns are also likely to be greater. For example, if a power failure causes traffic signals to fail, this will have a smaller impact upon roadway congestion in a rural area than it would in a central city. Despite the great population density within large urban centers, these communities tend to have a large number of roadways available for use, and the traditional "grid" pattern of street design has long offered a huge number of alternative routes by which people could evacuate an area by car (at least for short distances).

Surrounding Urban Areas

Since World War II, most of the urban functions that had historically been contained within the urban centers quickly grew beyond the boundaries of those cities. It used to be that the costs of transportation, construction, and urban utilities had required most developments to take place within a city. After World War II, the widespread availability of affordable automobiles, and an increased capacity to affordably build and supply utilities in outlying areas, meant that new projects of all kinds could be built in many possible locations beyond the existing central cities. For many businesses and residents, it still made sense to be located near the central city, but many decided not to stay within the political boundaries of the existing cities. A great many new cities incorporated near the older central cities after World War II, typically by converting part or all of an existing township into a city, through a special voting process. Some recent geography texts refer to these areas as "the outer city" (with central cities termed as "the inner city").

Even though some of these new cities (e.g. Southfield) grew to include impressive high-rise office buildings and major expressway interchanges, they still tend to be distinguished from the older urban centers by having a lower average density of population, more widely spaced and modern buildings and infrastructure, and transportation arrangements that are focused upon the predominance of private automobiles. In these locations, it is harder for a resident to choose a residence that allows convenient access to public transit, places of work, hospitals, government offices, and shopping areas unless a car is used to access them. For some types of hazards, the less-dense design of these cities is very helpful. For example, contagious illness is much easier to control when people do not need to use public transit systems, and do not live in very crowded residential patterns.

The function of these areas within a broader metropolitan area becomes clearer when looking at the overall land development patterns, as shown on the Michigan Profile Map, rather than focusing only upon the political boundaries between adjacent cities. Whereas large cities in the 19th Century tended to expand through the annexation of adjacent lands, and to contain numerous wards (districts) within them, the 20th Century tended to instead favor urban expansion across a contiguous array of politically (and fiscally) independent cities and townships. On the positive side, this development pattern provided a greater amount of political control by residents over their local governments. On the negative side, certain parts of each urban area tended to become increasingly worse off in fiscal terms, since local taxes were no longer shared throughout an entire urban area. Similarly, various types of infrastructure and services sometimes became increasingly difficult to coordinate across municipal boundaries, and the functions and services provided by urban centers were sometimes not adequately compensated for by users who lived outside of the providing city. Neighboring cities would often spend money on redundant services and facilities, rather than pooling their funds together into combined systems that could benefit from an economy of scale. From an emergency management

perspective, though, these redundancies of services and infrastructure can actually increase local resilience—the seeming inefficiencies of duplicate systems and services can sometimes mean that an infrastructure breakdown in one city remains limited in scope, while infrastructure continues to function normally in adjacent areas.

Any city known to have incorporated after World War II has been included in the "surrounding urban area" category instead of being classified as part of an urban center. However, some heavily populated townships have also been classified in this category, as urban. (In many cases, there is little practical difference in the character of such townships based upon whether they stayed as townships or officially become cities.) Any Michigan township with a population density of at least 1400 persons per square mile of land area has been classified within this category, as "urban." These communities (whether townships or cities) often may not contain traditional downtown districts, but frequently do have specialized areas for shopping (shopping malls), conducting business (office complexes), and manufacturing products (industrial parks). Although these highly separated land uses may sometimes appear to be inconvenient from the perspective of transportation access, economic efficiency, and design regulations, there is often an economic logic underlying their design, which can resemble the outer, more specialized areas on the outskirts of a typical central city. There can also be emergency management benefits realized from this design, in that a disaster in one location (e.g. an industrial explosion or hazardous materials spill) might only affect one element of an urban production system, leaving other locations and activities intact because they were too far away to be impacted.

In terms of evacuation potential, most of these cities have very few local roads that were laid out in the traditional "grid" pattern, but there still tend to be a limited number of alternative routes available. Many neighborhoods might seem maze-like at first, but may allow traffic to eventually wind its way to the other side. When modern navigational systems are working correctly, these designs may not form great obstacles to evacuating drivers. Many of these cities (and urban townships) do have a moderate number of "collector" roads that can relieve traffic congestion.

Suburban Areas

In this classification system, a suburb indicates only a township of moderate development and population density, located near an urban center. No cities are included in this classification. Townships with a population density between 277 and 1399 persons per square mile of land area have generally been given this classification as "suburban."

Many of these suburban areas are charter townships, and the main distinctions between a charter township and a city involve a cap on the township's tax rate, a charter township's acceptance of a pre-defined charter, and a self-imposed set of restrictions upon the types and densities of land uses permitted in the township. Although some of these land use restrictions might seem at first to be artificial and arbitrary to an observer, in many cases the restrictions are roughly in accordance with the level of development that would normally occur in the newest and most outlying districts of a city. Thus, in either city or suburb, a skyscraper will not normally arise in the midst of a low-density residential neighborhood, and there are many cases in which new factories or warehousing operations are built on a city's fringe, especially along rivers or railroad tracks that may be vital to those facilities. Indeed, one of the main trends from the 20th Century, continuing to this day, is the increased economic feasibility of building many types of projects in outlying locations. Some suburban areas contain very important industrial, office, shopping, and recreational facilities.

For emergency management purposes, the main distinction between the previous "urban" classification and the "suburban" one is that newer and lower-density development will be typical in the suburban areas. A disaster in a suburban area will tend to affect fewer people than a comparable disaster within an urban area. However, due to the limited extent of the area's road infrastructure, these suburban areas can be more vulnerable to transportation back-ups, to the point of making some areas excessively difficult to evacuate quickly. Few, if any, suburban neighborhood streets are laid out in "grid" fashion, and many limited developments may not provide any new through-roads, with cul-de-sacs and small looping-back roads instead forming a predominant pattern. Expressway ramps and bridges over rivers might be far too few in number and capacity, leading to excessive traffic backups on area expressway routes (and the few main streets that connect with it), if one of those ramps or bridges becomes unusable. The community's main (arterial) roads are often just slightly revamped versions of the original "country roads" that existed before all the new suburban growth. Often, the addition of occasional turn lanes have been the only upgrades that have taken place during the community's recent decades of development, and these fundamentally two-lane roads can quickly become clogged with slow traffic when an accident occurs or an evacuation is attempted.

SPECIAL NOTE: All of Michigan's lands are located not merely within Michigan's 83 counties, but are also considered to be part of a "minor civil division" (a city, village, or township). The United States census tends to treat villages more like special taxation areas within townships, rather than as small cities, but Michigan also has a great number of small communities that are neither villages nor cities. In this document, these communities will be called "towns," with the understanding that this word has a distinctive meaning to refer to communities located within Michigan's townships. The Michigan Profile Map shows the boundaries of all of these many townships, but does not show all the small villages and "towns." Most rural areas include such "towns," and although some are mere hamlets, barely distinguished from the rural areas around them, others may be quite sizeable (e.g. Houghton Lake). Such "towns" tend to include either their own post office or school district, and thus may be called by a completely different name than the surrounding township (or may cross over the borders of adjacent townships).

Exurban Areas

The term "exurb" refers to a fairly low-density township with many residents who regularly commute to a larger area for many or most of their major needs. Suburbs tend to provide a moderate number of urban amenities, including employment, to their residents, but exurbs tend merely to provide residential housing areas and a selective few basic services and provisions. In many cases, standard groceries are obtained from a traditional village, "town," or small city that had existed before a commuter population had moved into the area. Exurbs do not contain enough employment opportunities for all the residents who live there, and so in addition to residents who choose to commute long distances to work (or who are able to "telecommute"), exurbs may also be home to a large proportion of retirees. Exurbs are generally low in population and development density (except for the central villages or small urban centers that tend to serve them). Various services (including health care) tend to be very limited in these areas.

Townships with a population density between 139 and 276 persons per square mile of land area have generally been classified here as exurbs. Some exceptions were granted, such as Breitung Township (near Iron Mountain), in which part of the very large township (67.7 square miles of land area) functioned as a suburb, while another part was quite rural. Another exception was made for the City of Mackinac Island, since its overall population density was rural (it has one of the smallest populations among Michigan cities) and it is generally only accessible by ferry or airplane. Although most suburbs exist on the farthest fringes of urban areas, a few additional types of areas also received this classification, such as communities that are not connected with cities, used for resorts, retirement living, or seasonal homes. An example is Houghton Lake, in Roscommon County, which has a "town" around the lake's shores, but is not actually a city. Some communities were designated as exurbs merely because its center was a "town" or village rather than a city. The United States census tends to treat villages as a special taxation zone within a township, and the Michigan Profile Map was predominantly based upon census data.

Rural Areas

Most of Michigan has been classified as "rural" on the Michigan Profile Map. This does not in any way indicate that these areas are unimportant! In addition, it must be noted that a great number of villages and "towns" exist throughout these rural areas, but are not marked on the map, due to their comparatively small sizes. (Thus, the SPECIAL NOTE provided above, explaining the meaning of "town" within this document.)

Some of Michigan's most productive, famous, and important industries are found throughout its rural areas. For example, extraction industries have been quite important to Michigan, whether the mining that had once caused the Western Upper Peninsula to thrive, or the petroleum and natural gas deposits that are increasingly in demand worldwide, or even just Michigan's abundant supplies of fresh water. Logging, farming, the cattle industry, and facilities for renewable energy (e.g. wind farms or hydroelectric dams) are other important facilities and infrastructure that exist throughout many of Michigan's rural areas. Due to the limitations inherent in the use of only a single statewide map, these types of production were not represented graphically. However, more information is presented within the Michigan Hazard Analysis document.

Michigan Hazard Mitigation Plan:
3. Local, State, and Federal Roles

The Role of the Citizen

Each citizen or resident of Michigan has a role in disasters and emergency preparedness, which can help to protect lives during a serious event. The following list of preparedness actions should be studied by each person, with a consideration of the types of hazards covered in this plan.

1. Refer to the Michigan Hazard Analysis to become familiar with the large array of natural, technological, and human-related hazards that might damage your property or interfere with your quality of life. Many forms of hazard mitigation cannot and should not be imposed by government upon private property owners, but can voluntarily be implemented by individuals because of the protective benefits they receive by doing so.
2. Develop an emergency plan for your household—Even an informal draft plan is a useful starting point! Consider the ways to prepare for the various hazards that could occur in your area, and the ways that would be best to respond. Do you have a way to contact and meet your family members, if something prevents one or more of you from staying in or returning to your home? Do you know the most reliable evacuation route if you have to leave your community in an evacuation?
3. "If you see something, say something." The prevention of terrorism, fires, transportation accidents, public health emergencies, and other hazards often depends upon ordinary individuals recognizing that something is wrong and being willing to report the problem to others who have the capacity to take corrective actions. It is unsafe to assume that others have already reported a problem, because there are documented cases in which such an assumption has led to no one taking any action at all, even though actions were clearly necessary. Instead, it is better to be on the safe side and report suspicious behaviors or apparent dangers, rather than risk any delay in activating our trained responders. It is much safer and easier for staff to deal with duplicate calls and reports than it is to try to catch up with an emergency after a delayed notification and response. Don't be reluctant to report—be ready!
4. Keep a supply of food and water—Consider how many days it is possible for your home or community to be without power or other utilities during a disaster event. You should always possess a supply of fresh water (e.g. in bottles) and food (of a type that does not require refrigeration or cooking) in order to help you endure periods without your community's normal water supply, power supply, and services. In your preparation, include a consideration of the medicines that will be needed. Many emergencies cause a loss of power for 2 or 3 days, so your preparations should allow you to live independently for at least that long (preferably longer).
5. Equip your home and vehicle—At a minimum, some useful items to enable survival during a disaster would include a first aid kit, flashlight with batteries, a battery-operated radio, and adequate clothing and blankets. Basic training in first aid may be vital to allow the effects of injuries and weather to be dealt with.
6. During a disaster, use your available communication devices (battery operated radios and phones) to listen for instructions from official sources, and do what you can to obey those instructions. Be prepared to change your evacuation route, for example, if you learn that your original route is unavailable. Consider various alternatives that you could evacuate to (such as friends and family who live in different areas that may be less seriously affected by the emergency).

Most of this document addresses the <u>mitigation</u> of hazards that could have a serious impact upon Michigan or some of its communities. However, this small section describes personal and household <u>preparedness</u> actions that may become more directly important to your safety during a disaster than general governmental efforts.

Local Government Role

The implementation of hazard mitigation measures is inherently a local government function since that is the level at which land development occurs, and most of the land use and development mechanisms available to implement hazard mitigation measures are applied at that local level. Therefore, successful implementation of a program to reduce Michigan's vulnerability to hazards will, out of necessity, be a joint cooperative effort between the state, local governments, and the private sector (since most land development is undertaken by private entities).

Development Pressures and Trends

In the 2008 edition of the Michigan Hazard Mitigation Plan, a new method for considering development trends and pressures was presented, and has been retained in subsequent plan updates. It was found to be useful, rooted in the premises that there are two general sources of development pressure—one rooted in population growth and the other rooted in population decline. Although growth-related development pressure is well-known, in the reverse situation, a community that has experienced a significant decline in population, the concern is that project standards might slacken to allow risk-prone development or re-development to occur, due to a perceived need by the community to halt its decline through such projects. Development pressures from both sources are likely to continue, and mandate caution toward new developments (or re-developments) in any areas that are too hazard-prone (especially well-defined areas such as floodplains). A third circumstance was also identified—communities that are large enough that a significant population shift (either an increase or a decrease) is likely to occur in certain parts of the jurisdiction, even when its overall population has not significantly changed. Municipalities above a certain size are presumed to have some minimum level of development pressure that they face, and both forms (stemming from growth or decline) may be felt simultaneously in a jurisdiction that is large enough to have sizeable sections of markedly different character, some of which may experience growth pressures while others experience decline pressures. Since official census counts will not be made until next year, this 2019 plan retains the assessment that had been performed for the 2014 plan, based upon official information from 2010. It includes a list of communities likely to be experiencing all three types of development pressures. **Please refer to Appendix 2 for this detailed assessment of development trends and their implications.**

State Support for Local Hazard Mitigation Plan Development

Provision of Direct and Technical Assistance

The MSP/EMHSD supports the development of local hazard mitigation plans through the provision of technical assistance (including on a request basis) and through the funding of local mitigation plan development under the Hazard Mitigation Assistance program, which includes the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. The latter two components provide annual funding for plan development (although FMAP applies only to the flood portion of a plan), while the Hazard Mitigation Grant Program makes funds available after a federally declared disaster. Most of the initial planning funds in Michigan stemmed from HMGP-DR1346 funds. (See the section below titled "Statewide Hazard Mitigation Planning Project.") **Please refer to Appendix 3 for a detailed description and timeline of Michigan's state-level support for local hazard mitigation planning.**

Cooperating Technical Partners Program (NFIP Floodplain Mapping and RiskMAP Programs)

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) provides technical assistance to local communities in developing floodplain maps through its "Cooperating Technical Partner" (CTP) Program. Under the CTP Program, states and local communities with demonstrated resources and expertise are delegated the authority to review and publish National Flood Insurance Program (NFIP) studies without the need for further federal review. The state and local communities, as CTPs, may also process revisions to existing NFIP studies and then re-map the floodplain. Local community resources may include, but are not limited to, labor, funding, in-house information, the gathering of field data, and providing technical expertise to print the floodplain maps. They also devote staff time and technical expertise to develop hydraulic models and produce the NFIP reports and associated digital floodplain maps which are then made available on EGLE and FEMA web sites. This information can help to inform communities as they proceed with floodplain management and hazard mitigation planning efforts. In addition, FEMA supports a series of "Planning, Assessment, and Mapping" activities through its RiskMAP program, a new effort to update the accuracy of maps and to integrate them into hazard mitigation actions.

Tribal Hazard Mitigation Planning within Michigan

Federally recognized Native American organizations have the option to either apply directly to FEMA for hazard mitigation planning funds and technical assistance, or to coordinate with the State of Michigan to apply for State-administered funds. In the former case, the Native American area would be treated as if it were a State, dealing directly with FEMA. In the latter case, the Native American area would follow the same procedure as Michigan's local governments, to obtain funds and produce plans. However, these plans do need to include some additional

requirements that are mandated for tribal plans to pass federal review. Since most of Michigan's townships, cities, and villages do not have their own separate emergency management programs, but instead have granted that function to a county-level emergency management office, most of these local units of government are covered under County-wide hazard mitigation plans (which are treated as multi-jurisdictional plans and reviewed differently to be certain that they adequately cover all participating communities). Some of Michigan's recognized Native American areas and organizations have participated in the hazard mitigation planning process of the county or counties in which they are located, and have then adopted that multi-jurisdictional plan so as to gain FEMA approval and grant-eligibility for hazard mitigation projects. One of the most interesting examples of this involved the Grand Traverse Band of Ottawa and Chippewa Indians, which participated in and adopted hazard mitigation plans for five counties in which their members reside, with the coordination of the Northwest Michigan Council of Governments. A few tribal organizations have developed their own separate hazard mitigation plans, and received full FEMA approval and project-grant eligibility for their jurisdictions as a result.

MSP/EMHSD offers and provides technical assistance to recognized tribal organizations just as it does to any of the counties or cities with their own emergency management programs. MSP/EMHSD has coordinated with the FEMA Region V Tribal Liaison as needed, to assist Native American areas and organizations.

Disaster-Resistant Universities

MSP/EMHSD has also supported the development of plans for colleges and universities (and their participation in local or multi-jurisdictional plans for the communities in which they are located). Many educational institutions have special planning needs and an unusual geographic layout within or across multiple communities and districts, and some of these have found benefit in developing their own distinct plans for hazard mitigation and emergency management. MSP/EMHSD has referred various communities, agencies, and institutions to the resources provided by FEMA for its Disaster Resistant Universities initiative. A few universities now have approved hazard mitigation plans, distinct from those of the communities in which they are located.

Statewide Hazard Mitigation Planning Project

Recognizing the need to support the process of developing local hazard mitigation plans, by the early 2000s, FEMA had authorized states to use up to 7% of allocated HMGP funds for the development of state, local, or tribal hazard mitigation plans. The MSP/EMHSD and MHMCC (now MCCERCC) took full advantage of that planning provision in December 2001 and allocated 7% of available HMGP funds under Federal Disaster 1346 ($2.3 million of the $33.2 million allocation total) to support the development of hazard mitigation plans in emergency management program jurisdictions in Michigan (all 83 counties plus selected municipalities over 10,000 in population). With the 25% local match factored in, the total funding available for mitigation plan development exceeded $3 million. Annual Pre-Disaster Mitigation Program funds (administered by the MSP/EMHSD) allowed the development of additional plans, primarily in the more densely populated areas of southern Lower Michigan, starting in 2002. A number of additional plans had been subsidized through the Flood Mitigation Assistance Program for about 12 years starting in 1996, although many of those plans covered only a single municipality rather than an entire county, as became standard with the other planning grants, but by 2008, the FMAP planning grants were allowed to be used only for the flood-portions of an all-hazard mitigation plan (the plan review standards for different programs were consolidated into a single set of all-hazard planning criteria and made a bit more strict than the standards used previously).

Through this statewide planning initiative, the vast majority of Michigan counties were able to develop an approved local hazard mitigation plan using these federal funding sources. Most of them have gone through one or more update processes since their original plans had been completed. A few encountered difficulties in completing the plans. As of early 2019, there were 5 counties whose planning efforts had not yet resulted in FEMA approval. When additional staff time is available, MSP/EMHSD has provided direct assistance to some of these counties, so that all parts of Michigan would have been covered by approved plans, but that assistance has taken a long time, and the pace of assistance slowed over time as a result of a gradual increase in emergency management responsibilities, planning, coordination, exercise, and program standards. Most plans have been completed through more normal processes—planners working on behalf of local jurisdictions to develop or update a plan that is submitted to MSP/EMHSD for review, perhaps revised if that is considered necessary, and then provided to FEMA with accompanying paperwork. Larger plans take longer to review, but are normally completed by MSP/EMHSD within a month, and the FEMA-review process is normally completed within 45 calendar days, according to FEMA guidance. If a disaster,

emergency, or other situation will cause a delay in the completion of the review, the local program and its planners are notified about this delay. In some cases, FEMA has been able to conduct its review using paperwork (see Appendix 16) provided by local planners rather than by MSP/EMHSD staff, to save some time and thus help to meet a deadline.

The map on the following page shows the cumulative results of this state planning initiative as of early 2019. (Since FEMA approval for each county plan only lasts for 5 years, a later map illustrates the more recent status of these communities, not all of whom have kept their plans updated every 5 years). The main point of this specific map is to illustrate how much of the state had been successful in developing at least an initial hazard mitigation plans at a local level. Of the counties that have been marked as having plans "not yet FEMA-approved," some are now much closer to meeting this objective. (Other plans, however, have since expired—see the subsequent map for January 2019.)

Plan Development Process and Status

As shown in the statewide map, as of January 16, 2019, only a handful of counties had not yet completed a FEMA-approved plan. With the encouragement and direct assistance of MSP/EMHSD staff, this number has gradually lowered over the years. Of the five counties that remain, two had not used federal funding under HMGP or PDMP (although Branch County had successfully applied, they later chose not to use the funds). MSP/EMHSD staff has gradually continued its efforts to eventually provide direct assistance to these remaining counties, unless they are able to make use of available FEMA funds. Draft plans have been developed for two of three northernmost of the uncompleted counties (Mecosta and Montcalm), and Ionia did have an approved plan in place for its county seat (the City of Ionia) in the past. Montcalm's plan is expected to be complete during early 2019, while this state plan is being finalized. As MSP/EMHSD staff time allows, similar encouragement, guidance, and direct assistance will be offered to Mecosta, St. Joseph, and Branch Counties.

A variety of methods were used for the initial development of local hazard mitigation plans, depending on the local desires, capabilities and circumstances of each participating community. Many counties made use of the professional planning expertise and services of Michigan's Regional Planning Offices to assist with local plan development (although the resources available to these offices do vary, and not all of them work on this type of plan). In addition, many county and local planning offices were also heavily involved, as were local emergency managers and some colleges and universities. Michigan State University, Western Michigan University, and Central Michigan University have especially been instrumental in aiding the development of several county plans. Numerous local and state agencies, and local business and industry were also involved, where appropriate. The MSP/EMHSD has gradually continued to provide direct planning assistance to those communities that require it, subject to staff and budget limitations. Each local mitigation plan has been (is being) developed using whatever methods were considered most appropriate for each community, and have usually resulted in the development of plans within the required timeframes of the HMGP and PDMP grants. As listed previously, there have been multiple occasions when direct assistance has been provided by MSP/EMHSD staff in the development of local hazard mitigation plans. In addition to these external meetings, MSP/EMHSD staff was available on a daily basis through phone and electronic communications, and numerous questions, advice, draft reviews, and other assistance were handled through those means.

FEMA requires all states to submit plans to their Regional FEMA Office for official review. For Michigan, this refers to the FEMA Region V office in Chicago. Plans are reviewed by MSP/EMHSD planning staff using their own review form, which is consistent with FEMA's revised plan review tool (a previous edition had been called a "crosswalk") but contains more explanatory detail. MSP/EMHSD's role is designated primarily as an advisory one in this regard, as a means of supporting/completing local planning activities and assisting with federal review, for only the FEMA review of a plan is considered official (for FEMA purposes, making communities eligible to receive or directly benefit from hazard mitigation project funds). Plans received by the MSP/EMHSD were reviewed (unless special circumstances required submission to FEMA instead) and when review criteria were met, the plans were forwarded to FEMA with the recommendation that they be approved. Such submissions were accompanied by documentation that the plan, in the judgment of the reviewer, met the local planning requirements of the Disaster Mitigation Act of 2000. If one or more review items were deemed inadequate, a (state-reformatted) "condensed plan review form" was returned to the community to convey the elements in which the plan's quality or content needed enhancement.

Local Hazard Mitigation Plan Status
1/16/2019

Plan Status

- Some draft materials were produced
- A plan was produced but is not yet FEMA-approved
- Has a plan that was FEMA-approved (but needs periodic updating)

Produced by:
Michigan State Police
Emergency Management and Homeland Security Division
January 2019

Comments or suggestions were included in reviews, describing corrections, additions or deletions that the reviewer believed to be necessary for official approval, plus any other recommendations the reviewer believed would help to improve the quality of the plan without undue burden to those involved in the process. The MSP/EMHSD staff thus worked with communities and coordinated with FEMA as needed until the plans met all the required elements and were officially approved by a federal review.

The 2019 map of previous planning accomplishments only provides a fraction of the information relevant to the local planning process, however, because communities are on a 5-year plan development cycle, and need to update their plans regularly after their initial plans had been completed. With respect to this process, a different map is presented on the next page, which shows that there have actually been a fair number of communities whose completed plans have expired. As will be described shortly, however, many of those (but not all) are currently making use of funds to update their plans and thus regain their eligibility to benefit from project grant funds. Each approved plan analyzes local hazards, risks, and vulnerabilities, and lays out potential actions to mitigate these; and then the community should apply for specific projects that support or accomplish the proposed actions in its plan. The need to keep local plans up-to-date is an extensive, ongoing activity at both the local and state level.

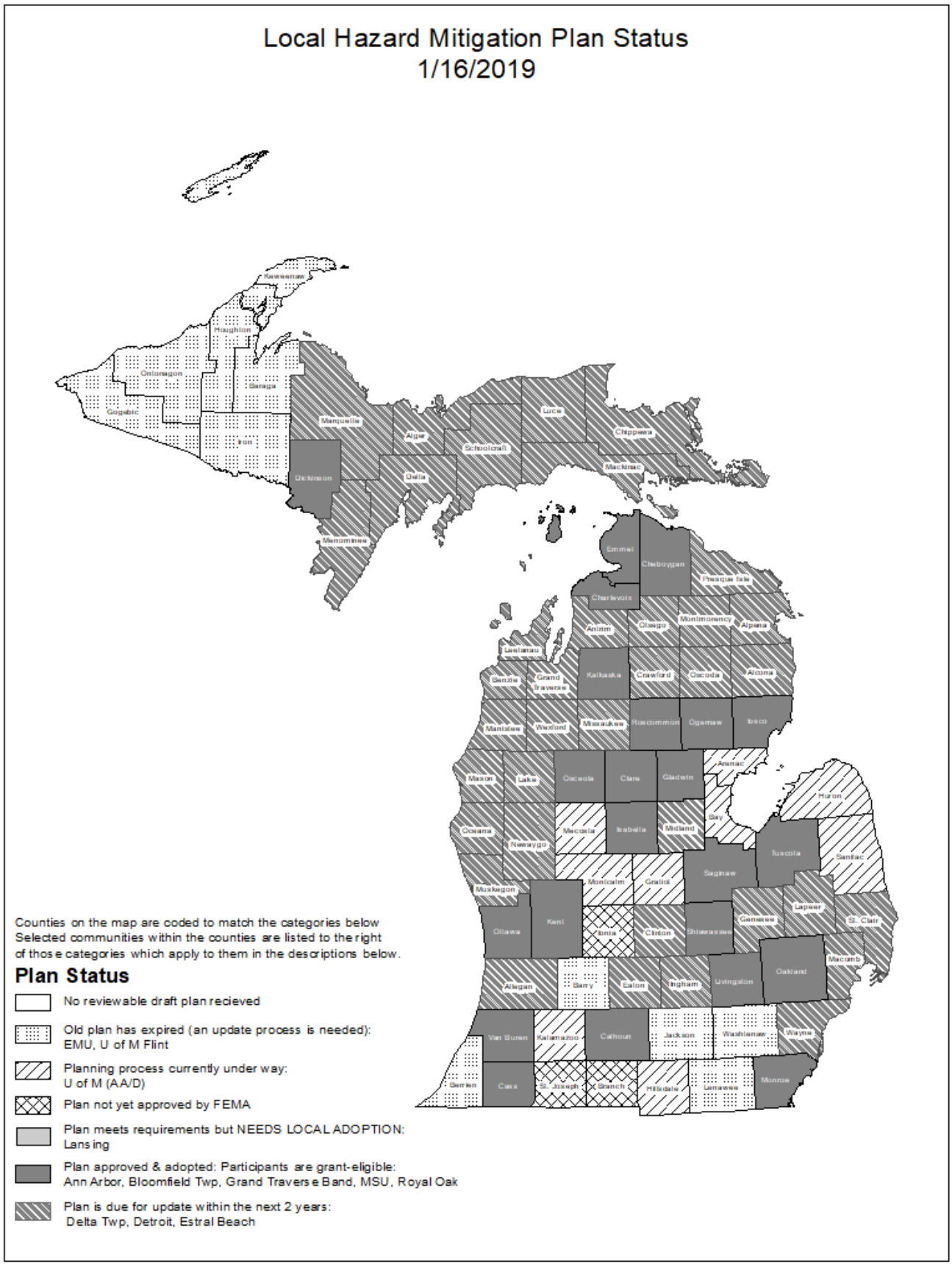
For a detailed critical assessment of resources, processes, and program capabilities, please refer to Appendix 4.

The map on the following page shows that a great amount of work needs to be done on an ongoing basis in order to keep local hazard mitigation plans updated on the required 5-year schedule. Sometimes, fewer funds are available through programs such as HMGP (i.e. during periods when Michigan has fewer disaster declarations) and therefore an alternative means of plan update must be considered and utilized. This challenge may also apply to communities for whom the use of grant money has not seemed to be economically feasible or politically desirable. In the few available cases where direct EMHSD assistance was used, the following descriptions provide an overview of such a process:

1. Since the core of a good hazard mitigation plan is its hazard analysis section, available staff can consider all convenient sources of hazard information, taking into account the strengths and weaknesses of alternative sources.
2. The most readily available information sources will be used to provide locally specific information that can be incorporated into community hazard mitigation plans. The focus will be upon procedures that do not require special expertise (i.e. funded assistance) to complete.
3. MSP/EMHSD staff determines the amount of direct assistance that it can provide to local planning efforts.
4. MSP/EMHSD staff inquires and determines which communities may have a greater need for assistance, and how EMHSD assistance will be prioritized for multiple communities that may have simultaneous competing needs for it.
5. MSP/EMHSD staff will meet or be in contact with local emergency managers as needed (e.g. by attending the MSP district coordinator meetings that occur regularly in multiple locations, through the scheduling of more customized meetings, or through regular phone calls and emails), and will present ideas for plan development and direct assistance procedures to the local emergency managers and MSP district coordinators.
6. Direct assistance with plan updates will then proceed by editing obtained information into a document that is judged to be able to pass FEMA plan review procedures. The process will account for priorities mutually developed and discussed, so as to more effectively and efficiently provide a customized plan that covers the communities that were considered to have the most pressing needs for planning assistance.

Current priorities have de-prioritized direct planning assistance, due to the expanded array of emergency management work that the state-level staff must accomplish. The following framework from 2014 is now relevant to only a handful of counties who had not yet completed any FEMA-approved plan.

1. Communities that have specific projects they have arranged to fund through the federal Hazard Mitigation Assistance program will be prioritized over those that do not have specific project ideas. (Rationale: HMA assistance requires a completed or updated local hazard mitigation plan to be in place and approved by FEMA. Communities with fewer immediate needs for federal mitigation funding would be expected not to suffer so much from any lapse that may occur in keeping their local plan up to date.)


Local Hazard Mitigation Plan Status
1/16/2019
Counties on the map are coded to match the categories below
Selected communities within the counties are listed to the right
of those categories which apply to them in the descriptions below.
Plan Status
No reviewable draft plan recieved
Old plan has expired (an update process is needed):
EMU, U of M Flint
Planning process currently under way:
U of M (AA/D)
Plan not yet approved by FEMA
Plan meets requirements but NEEDS LOCAL ADOPTION:
Lansing
Plan approved & adopted: Participants are grant-eligible:
Ann Arbor, Bloomfield Twp, Grand Traverse Band, MSU, Royal Oak
Plan is due for update within the next 2 years:
Delta Twp, Detroit, Estral Beach
Keweenaw
Houghton
Ontonagon
Baraga
Gogebic
Marquette
Iron
Alger
Luce
Chippewa
Schoolcraft
Dickinson
Delta
Mackinac
Menominee
Emmet
Cheboygan
Presque Isle
Charlevoix
Antrim
Otsego
Montmorency
Alpena
Leelanau
Benzie
Grand Traverse
Kalkaska
Crawford
Oscoda
Alcona
Manistee
Wexford
Missaukee
Roscommon
Ogemaw
Iosco
Mason
Lake
Osceola
Clare
Gladwin
Arenac
Huron
Oceana
Newaygo
Mecosta
Isabella
Midland
Bay
Tuscola
Sanilac
Muskegon
Montcalm
Gratiot
Saginaw
Lapeer
St. Clair
Ottawa
Kent
Ionia
Clinton
Shiawassee
Genesee
Macomb
Allegan
Barry
Eaton
Ingham
Livingston
Oakland
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw
Wayne
Berrien
Cass
St. Joseph
Branch
Hillsdale
Lenawee
Monroe

2. Communities with an active local emergency manager, who has a means by which the required local input/review process can take place for a plan, will be prioritized over those who do not. (Rationale: MSP/EMHSD planning staff can provide only so much direct planning assistance, but not the full local coordination that is required to bring a local plan to completion and get it adopted by local authorities. Therefore, and it makes sense to favor the provision of assistance to communities who can supplement it with their own efforts, without which a plan cannot be successfully completed. MSP/EMHSD work **alone** cannot cause a local plan to be successfully completed or updated. The update process goes beyond the mere revision of a planning document—it also requires a local review and input process, to guide and use information from an updated local hazard analysis and put it to work in updating a set of local hazard mitigation strategies to be implemented as a result of the plan.)
3. Communities that have more pressing needs, based either their history of emergency and disaster events, or based on the extent of vulnerabilities revealed by their local hazard analyses, shall be prioritized. (Rationale: Areas that are more vulnerable to damage or loss of life have more potential gains to be realized from efforts invested into hazard mitigation activities.)
4. Communities that have fewer alternative means of completing their hazard mitigation plans shall be prioritized for direct planning assistance by MSP/EMHSD planning staff. (Rationale: Limited MSP/EMHSD staff time is best used to serve those programs that have more limited capacities of their own. For example, local programs that have new emergency managers, EM programs that are part-time only, EM programs that are swamped with competing needs, those that are located in a region that is not as well-served by county/regional/university planning resources, or programs whose attempts to procure planning grants did not succeed, could all be perceived as having a greater need for direct assistance.)

State Government Role

The state of Michigan has been an active partner in hazard mitigation activities for many years, through the development and implementation of this plan and through extensive support for the development and implementation of hazard mitigation plans at the local government level. The first phase of local plan development came to an end as the vast majority of Michigan counties had completed FEMA-approved local hazard mitigation plans. This was a huge step in a large proactive effort to reduce the state's risk and vulnerability to hazards. The many local hazard mitigation plans need to be successfully updated as part of an ongoing 5-year cycle, with each update required to pass official FEMA review. This updated Michigan Hazard Mitigation Plan provides a foundation for these proactive and sustained hazard mitigation efforts in the state of Michigan, including the actual implementation of these hazard mitigation plans, as resources and circumstances permit. In addition to plan implementation, considerable work still needs to be done, assisted by the MCCERCC, to ensure that mitigation programs, plans, initiatives, resources, laws, rules and regulations are coordinated to work more smoothly and efficiently, and to meet state mitigation goals and objectives. Ongoing work must also be done to educate the public about the benefits of hazard mitigation at all levels of government and within the private sector. Greater coordination between public and private agencies at all levels, and between tribal, non-profit, and academic institutions should also be promoted.

This multi-hazard, state-level hazard mitigation plan is designed to promote and achieve better coordination among agencies, be grounded in an evidence-based assessment and prioritization of hazard mitigation actions at all levels, and to build and sustain awareness and education about hazard risks and vulnerabilities among all stakeholders and residents in Michigan. This plan has in many ways sought a unified approach to emergency management, although for the sake of greater coherence between state and local hazard mitigation plans, standards, and projects, this edition places a greater emphasis upon hazard mitigation proper (as defined by FEMA), rather than related concepts and strategies that are usually classified as "preparedness." Although recognizing that all activities are valuable that help to protect, sustain, and improve Michigan's people, property, environment, economy, and quality of life, it is also essential for this plan to focus upon the specific forms of hazard mitigation that FEMA and local planning standards must emphasize. In order to address some of the most important (and expensive) projects to protect Michigan's residents, infrastructure, and quality of life, this edition places a greater emphasis upon physical projects designed to prevent damage and protect lives. In the past several years, hazard mitigation planning processes at the state and local levels have not resulted in as many federal grant applications as was hoped for, to address the more expensive physical improvements and prevention methods that are difficult to finance using other methods. Despite the emphasis upon this type of hazard mitigation, this plan still recognizes the value of preparedness activities that more abstractly help to protect lives and property. This plan also has been designed to comply with the standards of the Emergency Management Accreditation Program, whose full accreditation Michigan had initially obtained in April 2011 and has

been renewing approximately every four to five years. It is widely recognized that all "mission areas," phases of emergency management, emergency support functions, core capabilities, etc. are valuable and should be integrated as well as possible into a coherent overarching system that involves the whole community, including public and private agencies, both for-profit and not-for-profit. Just as many of these missions, phases, functions, and agencies are covered by an array of specialized plans, this document must emphasize its own most distinctive subject matter, even while endeavoring to be part of an integrated whole that crosses over and integrates diverse types of efforts and organizations.

Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC)

Before the late 1990s, the lack of a central focus and coordinating element for hazard mitigation in Michigan had long hampered the development of an effective statewide program of hazard risk and vulnerability reduction. In response to that problem, Governor John Engler signed Executive Order 1998-5 on July 29, 1998, creating the Michigan Hazard Mitigation Coordinating Council (MHMCC) to fill the void of hazard mitigation coordination at the state level. The MHMCC existed for nine years and officially met a total of 31 times. The MHMCC had many noteworthy accomplishments, the most prominent of which included:

- The selection of over 160 hazard mitigation projects, totaling in excess of $45 million in project costs, for four federal hazard mitigation grant programs, including projects related to three federally declared disasters. (Please refer to **Appendix 11** for more information.)
- Assisting in the development of Michigan Executive Directive 2001-5 (State Flood Hazard Mitigation), signed by Governor John Engler on September 11, 2001. (Please refer to **Appendix 15** for more information.)
- Assisting in the development of the initial Michigan Hazard Mitigation Plan in 2004 (certified as federal Disaster Mitigation Act of 2000 compliant on March 23, 2005).
- Assisting in the development of Michigan's "Most Wanted Hazard Mitigation Measures" list as a component element of the Council's Annual Report of Activities to the Governor and Michigan Legislature.
- Assisting in the development of post-incident Hazard Mitigation Strategies for three federally declared major disasters (1346-DR-MI; 1413-DR-MI; and 1527-DR-MI). (Please refer to **Appendix 14** for more information.)
- The selection and coordination of four "Project Impact" communities in Michigan (the City of Midland in 1998; Ottawa County in 1999; the City of Dearborn in 2000; and Ingham County in 2001) as part of the federal Project Impact Initiative that existed from 1997 to 2002.
- Assisting in the development of a statewide local hazard mitigation planning project to develop plans covering all 83 counties (described earlier in this chapter).
- Assisting in the development of a statewide hazard mitigation marketing and education campaign for seven targeted professional groups.

On May 2, 2007, Governor Jennifer Granholm (in Executive Order 2007-18) replaced the MHMCC with the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC). The new advisory body combined the existing MHMCC responsibilities with those of the Michigan Citizen Corps Council and the Michigan Emergency Planning and Community Right-to-Know Commission (which were also subsumed within the Council) to form a single entity chaired by the Michigan Department of State Police. The MCCERCC became responsible for developing and implementing emergency response and hazard mitigation plans for the state. Initial MCCERCC membership was announced on August 29, 2007, and its first meeting was held on January 29, 2008.

<u>MCCERCC Vision Statement</u>

"To reduce, prevent, and prepare for emergencies or disasters"

<u>MCCERCC Mission Statement</u>

"To support and enhance Michigan's homeland security, community health, public safety, and all-hazards preparedness with responsible leadership and planning."

The MCCERCC is chaired by the Emergency Management and Homeland Security Division of the Michigan Department of State Police (MSP/EMHSD) and is (as of November 2018) composed of 17 representatives, including the Directors of (or a designee from) the Michigan Departments of State Police, Agriculture and Rural Development, Health and Human Services, Environmental Quality, Military and Veterans Affairs, and Transportation; the State Fire Marshal; the Michigan Community Service Commission; plus 11 other representatives that have been (or will be) appointed by the Governor. Provisions in the Executive Order allow for the hiring or retention of contractors, subcontractors, advisors, consultants, and agents, as required when specific issues are addressed that require specialized expertise or technical knowledge.

Executive Order 2007-18 charges the MCCERCC with four primary hazard mitigation responsibilities:

- Assisting in the development, maintenance, and implementation of a state hazard mitigation plan.
- Assisting in the development, maintenance, and implementation of guidance and informational materials to support the hazard mitigation efforts of local and state government, and private entities.
- Soliciting, reviewing, and identifying hazard mitigation projects for funding, including but not limited to federal funding under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 USC 5170c, and Sections 553 and 554 of the National Flood Insurance Reform Act of 1994, 42 USC 4104c and 42 USC 4014d.
- Fostering and promoting, where appropriate, hazard mitigation principles and practices within local and state government, and with the general public.

The MCCERCC committee structure includes a Hazard Mitigation Committee. The hazard mitigation committee was formed to oversee and focus on the Council's four hazard mitigation responsibilities. Both the committee and the council have been actively involved in the review and update of this 2019 Michigan Hazard Mitigation Plan.

Just as the MCCERCC has assisted in maintaining, and implementing three Michigan plans from 2008 through 2014, it has helped to update this 2019 plan, and will continue to support and promote hazard mitigation concepts, principles, strategies, and practices within governmental agencies and private sector organizations in Michigan, as well as the broader community or populace throughout the state. These can be accomplished in a variety of ways. A detailed description and assessment can be found in **Appendix 10**, but the principles generally include:

- Increased or improved use of available resources for hazard mitigation;
- Changes in governmental and business practices and processes;
- Amendments to laws, rules, regulations, plans, and procedures;
- Public education and awareness campaigns;
- The coordination of programs, information, initiatives and resources;
- The development of structural and non-structural projects to mitigate location-specific hazard vulnerabilities; and
- The establishment and maintenance of collaborative public-private partnerships to identify, develop, and implement specific hazard mitigation opportunities for local, regional, or statewide application.

The primary advantage of the MCCERCC is that it fosters improved coordination of ideas, expertise, talent, programs, laws, rules and regulations, philosophies, and material resources. Such coordination manifests itself in many ways, including but not limited to:

- Better and faster delivery of hazard mitigation programs and services (during disaster and non-disaster times);
- Less duplication of and overlap between actions and activities;
- Improved information flow among agencies, levels of government, and between public and private entities;
- Development and implementation of multi-objective projects with fewer resources expended;
- Greater understanding of mitigation issues and concerns (issues are addressed by multiple agencies with multiple perspectives); and
- Greater cost savings for taxpayers, due to reduced future damages from disasters and reduced response and recovery costs (and due to the reasons listed above).

With the leadership provided by the MCCERCC, this plan should continue to provide the structure and coordination mechanism necessary to bring together the many disparate, yet interrelated programs and activities that can promote hazard mitigation and reduce vulnerability throughout the state. Below is the list of MCCERCC members who were initially involved in updating the Michigan Hazard Mitigation Plan (MHMP), under Governor Rick Snyder. Some

members' terms were due to expire in the middle of the plan update period, and as of late November, two council vacancies (representatives of the American Red Cross and of the Michigan Association of Broadcasters) had not yet been refilled.

Michigan Citizen-Community Emergency Response Coordinating Council: 2018

(during the first part of this plan's update process)

- **Capt. Emmitt McGowan, CHAIR—**Deputy State Director of Emergency Management & Homeland Security. Designated representative from the Michigan Department of State Police.
- **Chief Deputy Michael Bradley—**Technical expert related to emergency response.
- **Mr. Marc C. Breckenridge—**Technical expert related to emergency response.
- **Mr. Brad Deacon—**Designated representative from the Michigan Department of Agriculture and Rural Development.
- **Mr. Jay Eickholt—**Designated representative from the Michigan Department of Environmental Quality.
- **Mr. Kenneth J. Gembel—**Technical expert related to emergency response. General Motors Corporation.
- **Mr. S. Tutt Gorman—**General public representative.
- **Ms. Virginia Holmes—**Designated representative from the Michigan Community Service Commission.
- **Chief Kerry J. Minshall—**Technical expert related to emergency response. City of Mason Fire Department.
- **Ms. Eileen Phifer—**Designated representative from the Michigan Department of Transportation.
- **Dr. Phillip D. Schertzing—**General public representative. Michigan State University.
- **Ms. Linda Scott—**Designated representative from the Michigan Department of Health and Human Services.
- **Mr. Kevin Sehlmeyer—**State Fire Marshal, Michigan Department of Licensing and Regulatory Affairs. Designated representative from the Michigan State Fire Marshal.
- **Capt. Brad Smith—**Technical expert related to emergency response. City of Dearborn.
- **Col. Sean Southworth—**Designated representative from the Michigan Department of Military and Veterans Affairs.
- **Ms. Sara Stoddard—**Technical expert related to emergency response. Oakland County Health Division.
- **Chief Michael Yankowski**—Technical expert related to emergency response. City of Lansing Police Department.

This list had changed by the beginning 2019, during the final portions of the plan update process. Governor Gretchen Whitmer took office on January 1, 2019, and some replacements and new appointments subsequently took place. Initially, the MCCERCC's Hazard Mitigation Committee included Mr. Deacon (MDARD), Ms. Phifer (MDOT), Mr. Schertzing (MSU), plus appropriate support staff from MSP/EMHSD. In early 2019, Jay Eickholt (EGLE) joined the committee and participated in the plan update process.

Michigan Citizen-Community Emergency Response Coordinating Council: Current Members (as of February 27, 2019)

- **Capt. Emmitt McGowan, CHAIR—**Deputy State Director of Emergency Management & Homeland Security. Designated representative from the Michigan Department of State Police.
- **Chief Deputy Michael Bradley—**Technical expert related to emergency response.
- **Mr. Marc C. Breckenridge—**Technical expert related to emergency response.
- **Mr. Brad Deacon—**Designated representative from the Michigan Department of Agriculture and Rural Development.
- **Mr. Jay Eickholt—**Designated representative from the Michigan Department of Environmental Quality.
- **Mr. Steve Frisbie –** Technical expert related to emergency response. Calhoun County Board of Commissioners.
- **Mr. S. Tutt Gorman—**General public representative.
- **Ms. Virginia Holmes—**Designated representative from the Michigan Community Service Commission.
- **Chief Kerry J. Minshall—**Technical expert related to emergency response. City of Mason Fire Department.
- **Ms. Eileen Phifer—**Designated representative from the Michigan Department of Transportation.
- **Dr. Phillip D. Schertzing—**General public representative. Michigan State University.

- **Ms. Linda Scott—**Designated representative from the Michigan Department of Health and Human Services.
- **Mr. Kevin Sehlmeyer—**State Fire Marshal, Michigan Department of Licensing and Regulatory Affairs. Designated representative from the Michigan State Fire Marshal.
- **Capt. Brad Smith—**Technical expert related to emergency response. City of Dearborn.
- **Col. Sean Southworth—**Designated representative from the Michigan Department of Military and Veterans Affairs.
- **Ms. Sara Stoddard—**Technical expert related to emergency response. Oakland County Health Division.
- **Chief Michael Yankowski**—Technical expert related to emergency response. City of Lansing Police Department.

Hazard Mitigation: National Perspective and Federal Government Role

Recent catastrophic disasters across the United States have resulted in new levels of devastation, suffering, and economic loss, suggesting that certain aspects of development strategy throughout the U.S. have been on a collision course with our natural environment. Increased development in hazard prone areas has put an ever-increasing number of people and structures in harm's way, exacerbating their risk and vulnerability to hazards. As a result, when disasters occur they still cause tremendous economic, social, and physical losses to the communities and people they affect, and some kinds of losses (e.g. wildfires, hurricanes, drought) appear to be on an upward trend in their devastating impacts. Fortunately, Michigan's less rapid rate of development currently offers many of its communities a chance to prevent many risks in the state from increasing with time, though appropriate plans and policies. (Michigan was the only state to decline in population between the previous U.S. censuses, although this trend did not bring a halt to ongoing trends of greenfield development patterns.) Michigan has also increased its coordination with federal agencies since the 2014 edition of this plan was adopted—especially through the creation of an official Michigan Silver Jackets charter and regular meetings and involvement with the (federal and other) agencies who are participants in that group (e.g. USGS, USACE, HUD, FEMA, NOAA/NWS). Many improvements in this updated 2019 plan have been made possible through the coordination and feedback obtained from these agencies.

National efforts to promote resilient communities and hazard mitigation have continued. Grant programs and updated guidance from the Federal Emergency Management Agency have supported the development of plans, nationwide, as well as various other forms of coordination and cooperation toward these important goals. The National Mitigation Strategy, National Pre-Disaster Mitigation Plan, National Flood Insurance Program (NFIP), Community Development Block Grants Disaster Recovery (CDBG-DR) grants, Hazard Mitigation Assistance (HMA) Program, and the Disaster Mitigation Act of 2000 are the most prominent of the federal government's current efforts to reduce or eliminate the nation's risk and vulnerability to hazards. FEMA's efforts are in partnership with federal agencies, the Congress, the states, local governments, academia, the private sector, and individual citizens. The approach is one that invites the participation of the whole community—public, private, non-profit, and the civil sectors. Michigan has sought to comply with these initiatives, which are consistent with the ideals and standards promoted by the Emergency Management Accreditation Program (EMAP), which has accredited Michigan as compliant for 5-year periods (starting in 2011 and renewed in 2016).

Coordination of Ongoing Efforts

Coordination is probably the most critical factor in a successful hazard mitigation effort or program. Many state and local agencies (as well as some private sector organizations) are already performing functions or administering programs that in some way contribute to hazard mitigation. Examples of existing, ongoing activities that promote or can contribute to hazard mitigation include (but are not limited to):

- Capital improvements planning;
- Budgeting;
- Site-specific hazardous material emergency planning (through Local Emergency Planning Committees);
- Watershed management planning;
- Solid waste management planning;
- Local community planning and zoning activities;
- Regional planning;
- Transportation planning;

- Recreation planning;
- Forest management;
- Coastal zone management;
- Infrastructure design, regulation and permitting;
- Floodplain management; and
- Public facility design and construction review.

Improved coordination of these programs and activities is still necessary and actively sought after in this updated plan, to achieve even more widespread hazard mitigation and vulnerability reduction.

Michigan Hazard Mitigation Plan:
4. Planning Process

This plan was revised in 2018-2019, overseen by the Emergency Management and Homeland Security Division of the Michigan State Police (MSP/EMHSD), working in conjunction with the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC) and a wide array of other stakeholders. (A table later in this section provides a list of those stakeholders who contributed to the plan's revision.) Work to update the Michigan Hazard Analysis began much earlier, with some elements (like noting new reports of hazard events and seeking new ideas about project funding) continually worked upon even as the previous edition of the plan was being completed in early 2014. Elements that could not be added to the 2014 edition have been included in this new 2019 edition, along with a great deal of additional information and new ideas about how to make use of available and new resources to achieve hazard mitigation goals in Michigan. **For details on past and present planning processes, please refer to Appendix 5.**

General Development Process for the Michigan Hazard Analysis

Since the previous edition of the Michigan Hazard Mitigation Plan (MHMP) was completed and adopted in March of 2011, it was again recognized that the 2014 update needed to allow more time for such a large plan to be reviewed by all relevant agencies and their subject matter experts. Work upon the hazard analysis sections continued practically as soon as the 2014 plan was adopted, but logistical problems arose as useful new information sources flooded EMHSD planning staff with an avalanche of news reports that had to be sorted through. Numerous staffing changes, policy changes, and an increase in the amount of staff time required for disaster response, SEOC activations, and new training requirements and administrative procedures meant that there was actually an unintended decrease in the number of staff hours being dedicated toward the hazard analysis and state hazard mitigation plan. Additionally, concerns involving the sheer bulk of the document and whether all portions of it should continue to be posted online resulted in uncertainties about the best procedure to allow for an increase in review opportunities, since the internet posting of draft documents had been a very helpful process used in previous plan updates. Despite the clear need to improve the update and input process, a persistent problem still remained, in that such a huge amount of work still had to be borne by the State Hazard Mitigation Planner. There was no increase in the number of personnel assigned to work on the tasks, and as before, the bulk of the update process took place within the final two years of the 5-year period.

Since the 2014 plan was about 950 pages long, and more than 400 pages of it consisted of hazard analysis sections previously published as a separate document which had been published as the Michigan Hazard Analysis (MHA) in July 2012. It was eventually agreed that the 2019 plan would involve a main document focusing on the plan and its related requirements, while the general hazard analysis would be formatted with its own page numbering as an attachment. The analysis and the plan were updated almost simultaneously and involved most of the same personnel. It was also known that a change of administration would result from the 2018 election, and that the time-frame of the update could either be entirely completed in 2018, or should be delayed until 2019, so as to ensure that all portions of it were reviewed consistently (without needing to be re-reviewed by new staff, officials, and appointees). Moreover, although work proceeded decently on updating the natural hazards portion of the MHA from 2016-2018, the comparably sized materials dedicated to technological and human-related hazards would require a more accelerated process in order to be completed on time. FEMA standards only require the inclusion of natural hazards, with specific review criteria being applied to those materials, but the technological and human-related sections of MHA tended not to have such clear standards for assessment. These types of hazards are certainly considered important, and indeed are mandated under EMAP's all-hazard approach to a comprehensive emergency management program, so they were certainly going to stay in the plan (unlike the 2008 plan in which they were temporarily removed because available staffing did not allow them to be updated within the MHMP update schedule of the time). Moreover, a full MHA was still adding up to over 450 pages, since it contains an expanding set of useful hazard event descriptions that are widely used throughout the state to inform the periodic update of as many as 100 local hazard mitigation plans. The administrative solution that seemed most appropriate involved the update of the natural hazards portion of the MHA, which could meet FEMA review requirements (which do not assess technological and human-related hazards) and whose components could be distributed for review while work shifted to the update of the main MHMP itself. A new

edition of the MHMP might therefore get completed by the MHMP expiration deadline on April 22, 2019. The inclusion of a full range of hazards within a full MHA could provide the factual basis for continued EMAP compliance, but the updated analysis of natural hazards currently attached to the 2019 MHMP would thereby allow the plan to remain more closely on-schedule. The timeline of plan development and review was also concerned with the unknown and potential impacts of the partial federal-government shutdown that began in December 2018 and lasted more than a month, until late January 2019. Moreover, most of the technological and human-related hazards either do not have as clear of analytic processes available and officially recognized (e.g. terrorism risks), or they often involved programs that already were being dealt with by other agencies with their own dedicated plans (e.g. public health emergencies or invasive species), or they seemed most appropriate to be dealt with on a different level than through state government (e.g. nuclear attack). This recognition justified the prioritization of the natural hazards within this 2019 update, because there has been a stronger institutional and technical process for clearly analyzing them in a way that is agreed to be acceptable. All kinds of hazards continue to be emphasized within the MHMP and most local hazard mitigation plans, however. And as will be seen, substantial improvements had been made to the key natural hazard sections that FEMA was requiring to be complete before the MHMP update deadline, and included as an attachment to this April 2019 plan.

The following description provides a section-by-section overview of the changes made within the Michigan Hazard Analysis document since the publication of the previous edition of the Michigan Hazard Mitigation Plan in early 2014.

Years' worth of accumulated materials had been collected since 2014, many of which "made the cut" to provide the basis for adding new information to MHA chapters. Each chapter was checked to ensure that a consistent format would be used wherever possible, and that the format would address each of the FEMA and EMAP analytic requirements. A state profile section was adapted from the 2014 MHMP and updated for inclusion in the front of both 2019 documents, as a convenient way to summarize the state's features, population distribution, land use trends, and geographic differences in hazard impacts. Explanations were provided about urban, suburban, exurban, and rural differences throughout the state, as well as a new feature describing a typical "calendar" for Michigan's seasonal hazard risks, divided between (1) a winter-risk season whose most dangerous hazards tend to be ice storms (for property and infrastructure impacts) and pandemic illness (for potential to cause casualties), and (2) a non-winter risk season whose most dangerous hazards tend to be floods and severe winds (although those can and do also happen during winter, though a bit less frequently). Updated summary tables of Michigan's hazards were included. A new table was produced that summarized natural hazards (for which quantitative data were readily available to analyze), according to varied risks and impacts between four major geographical divisions that had been defined in terms of distinct patterns of population density, land use, and climate-related land cover patterns (such as the presence of state and national forest lands). Meteorological tables were updated, in some cases involving corrections that were provided by the National Weather Service and other authoritative sources. Quantitative tables were updated for all natural hazard chapters that had Michigan information readily available within an online NOAA/NWS database called the National Center for Environmental Information (NCEI), formerly known as the National Climatic Data Center (NCDC). A standard set of subsections ("Impact on…") were included in each chapter, to cover all the analytic requirements spelled out within the newest EMAP standard. The most significant new events involving each hazard were added into the list provided in the chapters for those hazards, including all major disasters and emergencies. In some cases, a few listings were removed, when they no longer seemed comparable to other events in Michigan, or when they had only occurred outside of Michigan, or when there were accumulated doubts about the accuracy of the information that had been reported in previous editions. All text from 2014 was reviewed and, where appropriate, changed to try to improve its clarity, accuracy, and timeliness. Most of the chapters were sent out to subject matter experts for review during 2017 and 2018. Just a small final portion of the MHA natural hazards' timeline fell into the beginning of 2019 and therefore involved the kind of tight deadlines that ideally all agencies would prefer to avoid.

As updates for each natural hazard chapter became substantially complete, they were sent to FEMA for review. Feedback on these chapters was favorable, and even suggested that some additional material could be dropped where it seemed to be too repetitive. In general, however, the updated MHA retains the same approach that had been used previously, involving some repetition of hazard mitigation strategies and resources between multiple chapters that involve similar hazards (such as severe winds and tornadoes, or severe winter weather and ice/sleet storms). This choice allows each chapter to feel more independent if read on its own, since it was considered unlikely that most readers would read the entire document. The MHA is designed to be used as an important and accurate reference

work, knowing that in many cases it may be referred to during an actual disaster event, to provide limited but useful overviews of various hazards from a Michigan-specific perspective. **The MHA was designed for multiple purposes,** including the provision of:

(1) Accurate information about Michigan's hazards, for use within local hazard mitigation plans,
(2) Ideas for mitigating the impacts of each hazard, for consideration within local plans and project proposals,
(3) General overviews of each hazard, and its risks and impacts, for use by the general public, emergency preparedness and response personnel at all levels of government, public officials concerned with their community's or agency's risks, professionals who may help to address hazard risks through their work in utility industries or other relevant organizations, and related personnel from out of state, who may be familiar with hazards but not with Michigan's specific risks and vulnerabilities to them.

In these ways, it can be seen that the Michigan Hazard Analysis is both generally useful as well as serving specific regulatory, instructional, and policy-guidance functions. Some have questioned its size, but as long as a text is well-organized, it does not need to be small in order to be effective in serving those who need quick information in a hurry, as well as those who need to spend months with it while developing or updating a local hazard mitigation plan. **Thus, each part of the document, despite its size, does have a purpose that is considered useful and justifies its inclusion within the plan.**

Some maps had become a bit outdated and were replaced with new or newer maps. An entirely new historical, geographic, and quantitative consideration of agricultural disasters was researched and added to the chapter on Extreme Temperatures (one of the leading causes of such disasters). Some adjustments were made to the chapter titles and document descriptions, to better explain where certain types of phenomena were considered even if they did not receive a full chapter of their own. An entirely new chapter called "Climate Trends" was added to the document, to ensure that it complied with all federal planning standards, as well because the importance of the topic seemed to merit its separate inclusion, even though it has primarily been viewed here in terms of how it may be expected to affect the frequency and intensity of other hazards. Substantial revisions were made to the hydrological chapters of the document, especially flooding, which is both more detailed in its analysis as well as better-organized within a format that is now consistent with the other chapters. Additional weight was given to urban flood problems, by adding an entirely new chapter to see whether the topic benefits from being given a separate treatment from that of riverine and shoreline flooding. The shoreline hazards chapter now includes information about harmful algal blooms (HAB), which recently returned as a major problem after years of being "outside the headlines." New types of hazards have been specifically included for the first time in the new edition of the MHA, including ice surges (within the shoreline hazards chapter) and mudslides (within the chapters on floods and subsidence). The chapter on subsidence includes a new emphasis upon both urban subsidence, flood-related mudslides, and the potential for old mine collapses. **A more detailed chronology of MHA update activities is provided within Appendix 5.**

Update Process for the 2019 MHMP

As the updated natural hazards portion of the Michigan Hazard Analysis neared completion in late 2018, concentrated effort began on the update of the Michigan Hazard Mitigation Plan, along with the regular direct involvement of MCCERCC and its Hazard Mitigation Committee (as described in Chapter 3). The full MCCERCC met on November 5, 2018, January 28, 2019, and March 25, 2019, with the MHMP as an active agenda item for discussion and action during these meetings. The MCCERCC's Hazard Mitigation Committee met a greater number of times and also communicated as necessary to provide more detailed feedback and contributions into the plan update process. The State Hazard Mitigation Planner, on staff at MSP/EMHSD, served as the main editor and overseer of the process. Communications were also maintained with FEMA throughout, as well as other stakeholders, through regular meetings of agencies such as the Silver Jackets. The 2014 edition of the MHMP had remained online at the MSP/EMHSD publications site with a standing invitation for any agency, citizen, or other member of the whole community to be able to provide feedback to the State Hazard Mitigation Planner at any time. Multiple monthly webinars shared information about the plan and its update process with Michigan's network of local emergency management coordinators (and other participants) during 2018 and 2019. The process culminated in the submission of a partial draft plan for FEMA and MCCERCC review in January 2019, a full draft plan in March 2019 as adopted by MCCERCC, and a completed plan in April 2019 which passed review by FEMA and was then approved by the Michigan State Police and Governor Gretchen Whitmer. **A more detailed chronology of MHMP update activities is provided within Appendix 5.**

Analysis of Michigan's Hazards for the 2019 MHMP Update (See Chapter 5)

The hazard analysis chapters that provide a factual basis for this plan are in an attached document and referred to as the Michigan Hazard Analysis (MHA), but is an integral component of this plan. The hazard analysis section of the previous edition of the Michigan Hazard Mitigation Plan (2014) had contained three large sections organizing about three dozen chapters within a general framework of natural hazards, technological hazards, and human-related hazards. In some cases, hazards that are very closely related have some of their relevant features and mitigation strategies mutually described in introductory material for an overarching section (e.g. thunderstorm hazards, hazardous materials) rather than solely within each of the most specific chapters (e.g. lightning, severe winds). All the natural hazard chapters were updated for this plan, with each chapter now using a more consistent format, and due to the size of that analysis, it is an attachment to this plan (as a companion volume) rather than included within its main body of text (but is summarized in Chapter 5 and has its analysis extended in places such as Appendix 8). A couple large changes in the Michigan Hazard Analysis involved the inclusion of a separate chapter on urban flooding, which is one of Michigan's most damaging forms of disaster, and also an entirely new chapter on climate trends.

The standard organization for each chapter involved the following subsections for each hazard (where enough research has accumulated on the topic, to allow all of these sections to be developed and included): (1) hazard description, (2) hazard analysis, (3) significant historical events, (4) programs and initiatives, (5) known hazard mitigation alternatives, and (6) assessments provided within local hazard mitigation plans. Within the hazard analysis, FEMA-required assessments of risk, frequency, and impacts were included, along with EMAP-required impact subsections and (for certain types of natural hazards), a subsection entitled "Climate Change Considerations." Each of these subsections is further described below, and is intended to help (A) clearly identify for FEMA and EMAP reviewers where to find each of the elements required under their plan review standards, and (B) to help move toward a similar or parallel formatting that the developers of local hazard mitigation plans may find convenient to use, further coordinating state and local hazard mitigation plans over time.

Technical detail has been limited to applications that have, or are likely to, appear and be of use within local or federal plans, and in community and agency decision-making. Because of the regional nature of hazards, some details of particular chapters may be more relevant to certain portions of the state, and similarly some types of hazards are of greater interest to particular agencies than they are to other types of agencies. The document is very large in order to best serve all potential stakeholders as a valuable and trustworthy reference source, rather than being designed as casual reading. There was no way that a short document could analyze all of Michigan's significant hazards in a manner compliant with federal and EMAP standards as well as to share the state's analytic findings with local plan developers in a way that was useful for them—these functions required the document to be large, but an understanding of its overall organization (most easily seen within its Table of Contents) can allow it to be easily and quickly used by general readers and specialists alike.

Hazard Description

Each hazard was described in a manner that explains its nature in a way that is considered appropriate for use both by the general public and to more specialized readers, especially emergency management coordinators at all levels of government. Federal review standards under the Disaster Mitigation Act of 2000 require this element for all significant natural hazards, in hazard mitigation plans both at the state and the local level. These standards were most recently expressed in the following FEMA guidance documents: State Mitigation Plan Review Guide (March 2015), Local Mitigation Plan Review Guide (October 1, 2011), and Local Mitigation Planning Handbook (March 2013). The Emergency Management Accreditation Program Standard of 2016 was also used for compliance with that program.

Local developers of hazard mitigation plans (or those reviewing such a plan as part of an update process) may freely make use of the information within the Michigan Hazard Analysis in developing and updating their own plans—this is one of its key functions as a form of technical assistance that the state has provided to support its communities and their own local planning processes. (In order to promote further coordination between state and local plans, however, the local plan should include the fact that it made use of the Michigan Hazard Analysis during that local plan development or review process, in compliance with one of the federal requirements that the local plan describe the review and incorporation of existing plans.)

Hazard Analysis

The diversity of the hazards and their associated data sources precluded a totally standardized approach to their analysis, but the hazard analysis for each chapter has tended to make use of the best readily available information to try to consider the most salient aspects of each hazard, as well as to cover all of the FEMA risk assessment requirements and EMAP consequence analysis requirements. Each chapter tends to include the following:

(1) Location: For hazards that vary significantly in their impacts or frequency from one part of the state to another, the locations of these different risks tend to be analyzed through the use of maps or tables, and the detailed description of historical events in a form that is digitally searchable by county name. A local analyst can easily peruse the plan for specific information about the county or region of the state for which a local plan must be made or reviewed. Some hazards are more amenable to spatial analysis than others. Some hazards have a longer history of occurrences than others, and the amount of detail that is conveniently available in known data sources varies quite a bit. This element is nevertheless required for both state and local plans to pass federal review, but the amount of local detail will naturally be greater in the local plans. Typically, the MHMP will describe geographic variation in hazards down to the county level, often stating the name of an involved or nearby community, and the local hazard mitigation plans (which are typically produced by county-level emergency management programs) should then provide appropriate additional location information down to the level of each minor civil division, specified floodplain areas, or even specific sites, for hazards that are considered to be locally significant. This is especially important because a hazard (i.e. a small floodplain area) might be too small to show up on a state-level map, yet may result in disaster-level damages and harm to its nearby communities. Analyses and plans must also include a consideration of development patterns and trends.

(2) Probability (or frequency) of future events: For most hazards, the probability or frequency of future events is estimated from the recorded history of past significant events. A probability may be very difficult to calculate, as in the engineering calculations that underlie the Flood Insurance Rate Maps which designate recognized flood areas that have a calculated 1% annual probability of reaching or exceeding a particular flood level. Since most of the general public does not have a great deal of training in probability theory, yet may have valuable information to contribute about hazards events that had occurred, it is also acceptable to describe hazards in terms of their past and expected frequency of occurrence. This provides one of the clearest and most straightforward analyses of risk. For example, snow falls every year throughout Michigan, which translates to an annual probability of 100%, but it is the frequency and extent of snowfall that is much more analytically relevant for emergency management. Rather than a simple statement that every area does receive snow, the analysis focuses upon the average number of snowstorms per year in different areas, based upon official historical data from NOAA/NWS. Differences between geographic locations are more meaningfully identified and assessed through the use of straightforward estimates of frequencies of occurrence, rather than probabilities that may be difficult to interpret. Mathematically, the expected frequency of occurrence can easily be estimated through the calculation of a simple average—the number of significant hazard events, divided by the number of years within the available historical records. For example, 50 snowstorms over a 10-year period results in an annual expected frequency of 5 snowstorms per year. (By definition, a "probability of occurrence" does not ever exceed 100%, and the mathematical procedures for estimating probabilities can quickly become complicated when dealing with the full range of known variables associated with various data patterns.) For a second example, if 10 tornadoes occur during a 50-year period, then the annual expected frequency of tornadoes is 0.2, or 1/5, which (taking the reciprocal) can be expressed as an average of about 1 event every 5 years, on average. In this way, all hazards can readily be compared with each other, but great caution must be used before the risk from any hazard is declared to be "zero." The simple absence of recorded events within a recent time period does not mean that an event is impossible, which is what a zero probability implies. If there are no recorded events in a particular area within the available historical period, then a theoretical approach should be used to estimate the likelihood of events that could happen in an area. For example, is one county really so different from the next county that the most severe hailstorm could never occur there, or is the absence of a recorded event in one county merely just an historical fluke in the incidence of a relatively rare event? Even if no events have yet been observed within a county or the state (e.g. certain types of terrorism), this does not mean that such events are impossible. A closer look often reveals "close calls" or incidents that were successfully stopped before they became an actual disaster, and these reports tend to be harder to find than those for actual destructive events. One might look at the history of similar areas (other states, similar types of communities) in order to produce such an estimate of whether each hazard is possible, and how common or rare it is. Various techniques like this have been employed throughout the MHA and summarized here in the MHMP, as

considered appropriate for the consideration of each type of hazard. **Please refer to Chapter 5 for the actual summaries of the results of the 2019 Michigan Hazard Analysis.**

> Technical note: Mathematically, a probability and a frequency are different in various ways. A probability has a value between zero and one, but a frequency can more flexibly express an annual chance of occurrence for very common events that happen many times per year. For example, it is more informative to know that snowstorms occur an average of 360 times per year than to hear that snowstorms have a 100% chance of occurrence each year. This particular expression of risks should be understood as more thoroughly and effectively satisfying the federal requirement that the probability of each hazard must be assessed within state hazard mitigation plans, even if the term "frequency" rather than "probability" has been used to describe these expressions and calculations.
> Probabilistic concepts are sometimes misinterpreted by non-specialist readers. For example, a "base flood" has a 1% chance of occurrence per year—a probability that has been calculated by engineers or scientists after expensive and time-consuming field measurements. Over a 100-year period, however, the cumulative chance of a flood occurring within that area is <u>not</u> 100%, as many laypersons might guess, but only 63.4%, due to the mathematical rules that apply to a sequence of conditional 0.01 probabilities over the course of 100 years: $1 - 0.99^{100}$. In addition, it is quite possible for a 0.01 probability flood to occur many times within a 100-year period, just as it is possible to occasionally get "lucky" and roll several "snake eyes" in a row on a pair of dice, or to flip a coin numerous times and have it land on "heads" every time. Even the 1% annual chance amounts to a 26% chance of flooding during a 30-year mortgage. But there are also new questions arising about what adjustments need to be made to account for climatic trends. Calculated probabilities for flood risk now appear especially likely to understate the actual frequencies with which such events will occur in the future, if they have merely treated the future as having the same characteristics as the past. Rather than deal with all the technical mathematical details involved in such methods, this plan presents the most straightforward means of describing these concepts, and recommends that local plans include a similarly straightforward expression of risk—a frequency of occurrence stated in terms of the expected (average) number of hazard events per year.

Based upon these principles, various natural hazards had their probabilities and impacts assessed in terms of the annual expected events, casualties, property, and crop damage, based where available upon the NCEI online database's records back to 1996. The results are shown in a series of two-page tables for all the natural hazards from that source, covering a period of 21.33 years, as a basis for estimating future probabilities and impacts on the basis of recent hazard histories for these hazards. Some hazards had a longer set of data available to use, such as droughts, whose records date back to 1895 and were completely re-assessed in 2019 on the basis of that data. For rare, theoretical, or generally non-damaging hazards such as meteorites, terrorism, or fog, estimates were made to the extent that the data, event history, or theoretical understanding could allow. For example, decent estimates of meteorite probabilities were available on the basis of approximate global impact rates, adjusted by a factor involving the size of Michigan's land area as a percentage of the global surface. For climate impacts, clear trends in temperature and precipitation are illustrated at different scales within a new chapter of the Michigan Hazard Analysis ("climate trends"), but most of the science does not yet allow global climate models to be applied to state or local-level assessments. Such topics were explored at length with the Michigan Climate Coalition, its partners, and at conferences, workshops, and webinars attended by key MHMP planning staff (see Appendix 5).

The quantitative NCEI data also allowed county-level assessments and comparisons. A summary of the Michigan Hazard Analysis is found in Chapter 5, including some additional MHMP assessments to prioritize the most heavily impacted counties from Michigan's most significant natural hazards. Additional detail on state facilities is found within Appendix 8. A summary table appears on page 41, in which all hazards have had their risks systematically assessed and compared. Page 42 provides a prioritization of Michigan's hazards on the basis of the quantitative information <u>plus</u> other considerations described within the "Reason" column of that table. For hazards such as hazardous materials incidents, disastrous industrial accidents, and pipeline breaks, complete data was not available to be systematically analyzed, as it was for the top natural hazards. The estimated impacts from these hazards was estimated from the lists of historical events appearing within the Michigan Hazard Analysis. For example, although a full set of industrial accidents was not available, great weight was placed upon the 1999 Dearborn plant explosion, whose impacts were estimated to be on the order of $1 billion, comparable to the costs of the 2010 Calhoun County oil pipeline disaster. Both events were infrequent (or unique) enough that no clear pattern of probability could be determined, but both categories of hazard were estimated as occurring about every 15-20 years, and therefore involving an average of about $57 million in damage per year ($1 billion divided by 17.5 years). Similar estimates were made for all other hazards that had some level of documented history of occurrence within Michigan. By poring over the record of most damaging known events within each chapter of the Michigan Hazard Analysis, similar estimates were made for all hazards, reviewed by stakeholders (described in Chapter 5), and provided in this plan.

(3) The extent (magnitude, severity, intensity) of the hazard: This element is required for the analysis in local hazard mitigation plans, but has also been included within state-level planning. Not only is it vital for the analysis of many hazards, but again helps to provide information for local plan reviewers or developers to make use of. Where intensity scales (e.g. Enhanced Fujita) or intensity categories (e.g. advisories or warnings) have been defined by recognized authorities on a particular hazard, these helpful measurements have been described in the Michigan Hazard Analysis. Some hazards, such as hail, are unlikely to become disasters unless their extent exceeds a certain extent, and the emphasis of the state has been placed upon hazards that have the capacity to cause disaster and emergency-level events.

(4) The impact of each hazard: This element is not only required for all local plans, but is also required by EMAP for a state-level plan to comply with its accreditation standards. Furthermore, an EMAP-compliant state must describe each hazard in terms of its impact upon the public, property, facilities, infrastructure, emergency responders, continuity of operations, continued delivery of services, the environment, the economic condition of the state, and public confidence in state governance. These EMAP requirements have therefore been given their own specific subsections within each chapter of the Michigan Hazard Analysis. Furthermore, a special section within this MHMP provides an overarching overview of the potential impact of Michigan's hazard upon public confidence in government. **Please refer to Appendix 9 for the analysis of this special EMAP topic, and Appendix 16 to see the official descriptions of EMAP standards.**

(5) Vulnerabilities to each hazard: This element is required within the state analysis and planning process, in two forms. The first involves an assessment of the vulnerability of state assets (state-owned or operated facilities and infrastructure). **Appendix 8 in this MHMP document focuses upon this assessment**, although some types of information have been withheld from publicly accessible editions of this plan, where such information included details that could be vulnerable to misuse. The second type of vulnerability assessment involved an assessment of the state's communities, which for ease of research and presentation has usually been presented at the level of Michigan's 83 counties rather than its multi-layered array of smaller-scale district boundaries. Since most local hazard mitigation plans are completed at the county level and Michigan's network of local emergency management coordinators are also predominantly county-level agencies, the use of this jurisdictional level for the assessment is consistent with these organizational patterns and encourages further coordination between state and local planning processes.

Significant Historical Events

This component is required for both state and local plans, and not only provides sufficient detail to allow many local jurisdictions to use this information within their own plans, but also tends to include various impact, intensity, and location information. The descriptions were designed to be digitally searchable by county name, and are an important part of the jurisdictional vulnerability assessment process. (Past damages and casualties provide evidence for current vulnerabilities, unless changes and protective measures have been extensive enough to reduce such risks later on.)

Programs and Initiatives

These sections provide a useful guide for resources that are potentially available to address or mitigate vulnerabilities, and are included within most chapters within the Michigan Hazard Analysis.

Hazard Mitigation Alternatives

These subsections provide important guiding steps to lead readers and analysts from the analysis of hazards into proactive tasks to organize prevention and mitigation activities, including those presented within this 2019 MHMP document. For each hazard or type of vulnerability described in the hazard analysis, there is often at least one hazard mitigation idea that might be chosen as a feasible activity. Some of the ideas can be implemented by individual residents and property owners, and others are suited for local or regional agencies to implement through their own plans or those of the communities/regions they are a part of. For purposes of state-level planning, the emphasis must be upon activities that are the closest match with hazard mitigation as officially defined by the federal government ("sustained action taken to reduce or eliminate long-term risk to people and their property from hazards"), and upon activities that can be undertaken and encouraged by state-level agencies and its partners. Within this plan, there has been an effort to de-emphasize preparedness activities, even though they are very important, so that the required emphasis upon hazard mitigation, specifically, will not be distracted from.

Assessments in Local Hazard Mitigation Plans

These subsections include references to local hazard mitigation plans which have been reviewed by MSP/EMHSD personnel, identifying the counties which had identified each hazard as one of their most significant. These subsections document one of the ways in which local hazard mitigation plans have been considered within the state hazard mitigation planning process, just as the state plan is designed to inform the local planning processes. These subsections in the Michigan Hazard Analysis were a mere starting point, however, for a richer consideration of the local plans' contents. **For more detailed summaries of the findings of local hazard mitigation plans, please refer to Appendix 7.**

Coordination with Local Hazard Mitigation Planning

To the extent practicable at this time, this plan has been developed in coordination with local hazard mitigation planning efforts. The Michigan Hazard Analysis was informed by locally derived risk and vulnerability assessment information, while it in turn provides a great deal of information that is used by local communities in their own hazard mitigation planning (and also in preparedness, prevention, response, and educational public awareness activities). In addition, many of this plan's objectives were developed and selected after a consideration of not only the state's resources, authorities, and programs, but also (1) the identified local vulnerabilities to natural, technological, and human-related hazards, (2) local project applications that have been received and processed by MSP/EMHSD and MCCERCC (also handled by the same Hazard Mitigation Committee that oversees this plan), and (3) hazard mitigation proposals that have been included in local plans reviewed by MSP/EMHSD staff. A comprehensive review of all local plans was completed specifically for consideration and inclusion within this 2019 MHMP. **The results of that review are now included as a part of Appendix 13 and Appendix 7**. Appendix 13 is greatly expanded from the previous edition of this plan. **Successful hazard mitigation project applications are described in Appendix 11.**

Integration of Local Plan Data

Since this document is a state-level plan, it focuses primarily on issues and concerns of a statewide or regional nature and most of its plan elements are necessarily broad in nature, scope and application. The State of Michigan acknowledges the "home rule" principle that hazard vulnerabilities involving local communities, local hazard areas, and local facilities primarily need to be addressed in local hazard mitigation plans—since it is the local level at which zoning and building permits and land use planning takes place, and the local level at which local resources and information regarding drains and roads and municipal elected officials exist. As a state plan, the MHMP necessarily takes a more "global" approach than any of the local plans, by addressing hazards and vulnerabilities across the state, which usually involves a level of agency that focuses upon coordination, guidance, leadership, encouragement, funding, regulations, legislation, and state agency resources—although at the same time including a consideration of local needs, priorities, information, and coordination. Especially since many local hazard mitigation projects are funded through higher-level government programs such as the Hazard Mitigation Assistance Program. This 2019 plan seeks a broader array of hazard mitigation ideas than has been achieved in previous plans. Since the same staff from MSP/EMHSD that has provided ongoing assistance to local emergency management programs in the development of their local plans involves the same personnel who have been most heavily involved in the update of this state plan.

The process of updating the MHMP included the consideration of all approved local mitigation plans and planning draft materials on file with the MSP/EMHSD State Support Unit. Consideration was especially given to the following types of information, for local jurisdictions:

- Information on vulnerable residential and commercial structures in the floodplains and other hazard areas, where this was substantial enough to suggest a need for state assistance or awareness.
- Historical events and their associated loss estimates.
- Land use trends and associated areas of concern where development may overlap with identified floodplains and other hazard areas.
- Specific mitigation projects coinciding directly with state goals and objectives, or that exhibit concerns serious enough to warrant consideration at the state or federal level.

Consideration has also been given in avoiding the description of local information that may be considered sensitive or confidential, especially in light of homeland security efforts to prevent terrorism and similar criminal activities.

In addition to the direct contacts between local communities and state-level agencies that address various types of hazards (i.e. MSP/EMHSD, EGLE, MDNR, MDOT, etc.), the MCCERCC has been involved through regular meetings and monitoring of the state planning and update process, and thereby connects MSP/EMHSD (as a network hub) with many other state agencies. This is supplemented by the Michigan Silver Jackets, whose charter was officially adopted in 2016, and provides regular coordination between partners at the state and federal government level, as well as some additional agencies that include stakeholders at the level of Michigan's regional and local levels. This updated 2019 MHMP has been discussed with and reviewed by MCCERCC members, and was the subject of concentrated effort by its Hazard Mitigation Committee. Its final draft version (the FEMA review copy) went before the MCCERCC and its hazard mitigation committee in January-February 2019 and received official support from the full MCCERCC in March 2019. Thus, the MCCERCC (which includes representatives of the local emergency management programs and the public at-large) was involved in the drafting process and its member agencies have provided extensive feedback during the updated process. Although the MCCERCC is officially designated as an advisory body, the practical and organizational import of its review and approval of this updated plan (at the same time that FEMA's review takes place) enables a confident set of recommendations and endorsements of the quality of this plan to be made to the Governor, to allow timely review and approval from that office. (Both the FEMA and the state review processes lead into the official adoption of the finalized plan by the Governor, the last requirement for full FEMA approval of this update.)

Public Involvement and Outreach Activities for the 2019 MHMP Update

This plan was developed in coordination with the MCCERCC—a visible state agency with its own web site and a regular open meeting schedule that allows the attendance of any interested citizens. Various citizens have observed the MCCERCC meetings over the years, and although some communication took place that allowed a discussion of hazard mitigation, emergency management, and planning activities, there were no specific comments provided from that source that needed to be reflected specifically in this plan update. Rather, such interactions involve the kind of exchange that has been common in the numerous outreach and educational activities provided by MSP—the provision of information, answering of questions, discussion of planning and mitigation options, provision of guidance and materials, web links, and so on. Reactions to review drafts of the MHMP have been positive, especially regarding the need to simplify and shorten the document, and have provided the impression that the document is very impressive for citizens and professionals alike. (The Michigan Hazard Analysis also seems to be good enough that most persons, including expert reviewers, have accepted each portion without suggestions about how to improve it. Nevertheless, repeated review opportunities were provided, especially on the new Climate Trends chapter, to ensure that the document is as high-quality and authoritative as possible. That chapter provided the primary exception, going through many revisions over the course of at least two years prior to its eventual inclusion.) In 2014, MDNR staff had stated that the Invasive Species chapter should be completely overhauled. Although this hazard was not one that was stated by FEMA as being required, as a natural hazard that is significant to Michigan, efforts were nevertheless made to make improvements in its chapter, to comply with that activity which had been identified within the 2014 MHMP. A more systematic process to include more diverse government agency review at both the state and federal level was utilized for the 2019 MHMP.

Interest in MSP training courses and conferences has been strong, and there is continued interest in having EMHSD staff provide outreach to communities (at local meetings) and students (in college courses). Since the same staff members who are involved in presenting hazard mitigation planning information at these outreach activities are also the ones who are involved in the update of the MHMP (as well as the review of local plans, which have their own associated public involvement requirements), the reactions and ideas of the public can partially be gauged by the ideas generated during these events and activities. Instances of doubt, uncertainties, concerns, confusion, or questions could often be discussed personally with the plan editor through these meetings. In other cases, various officials and representatives attended and anonymously relayed concerns or ideas that had been expressed by citizens who had communicated with the jurisdictions or agencies that they oversee or represent. Through such discussions and feedback, various amendments have been made to the text of the MHMP to help update the document to better reflect these concerns, clarify content, and make the sometimes-technical aspects of the subject more accessible for these

constituents. As already described, relevant subject matter experts were sought out for involvement and input even if they were not officially representing a specific partnering agency.

A pattern was noticed that feedback at the level of state planning was more heavily weighted toward the middle and professional classes, while feedback at the level of local planning was more likely to include a broader array of backgrounds and concerns in its citizens. This makes sense in terms of the greater awareness and direct impact that the local governments often have upon the property and lives of the average citizen, and thus reinforces the need for the state level plan to continue to coordinate with the processes involved in local plan development, and to consider the public input obtained at the local level in terms of its relevance for state-level planning. Obtaining representative citizen feedback is often a challenge for all planning processes—especially those that operate on a fairly specific timeframe and deal with a sometimes-complex topic that can include sensitive information (e.g. pipeline locations) that needs to be handled delicately or (as in the case of the state critical facilities list) kept somewhat confidential. Therefore, in addition to the specific outreach and public involvement opportunities described in this plan, MSP/EMHSD personnel have also tried to incorporate additional public concerns as reflected in discussion, newspaper letters/editorials, broadcast media discussions, internet postings, political presentations, and so on. EMHSD planning staff has, since 2012, included in its activities the perusal of compiled media reports that pertain to the Michigan State Police and its activities. In early 2014, an additional compilation activity was added to consideration, involving all identified media reports involving emergency management activities and conditions in Michigan. These, plus weekly updates from the MDNR, are part of the ongoing information sources that are tapped to learn about new events and programs. EMHSD staff also was directly involved in the development of some local plans during the period since 2014, most significantly the first FEMA-approved hazard mitigation plan to cover Monroe County, and gained more grassroots feedback during that process. It is as a result of that plan, for example, that harmful algal blooms were added to the hazard analysis. On the opposite corner of the state, feedback and information provided from Dickinson County caused abandoned mine subsidence risks to be elevated in priority within this plan. Actual disasters and emergency events have provided an additional means of receiving feedback from citizens and representative groups. Please refer to **Appendix 6** for a list of the disasters and emergencies declared at the state and federal level within Michigan. Numerous SEOC activations also involved key MSP/EMHSD staff in additional events that did not involve official declarations.

Michigan Hazard Mitigation Plan:
5. Hazard and Vulnerability Summary

Michigan's Vulnerability to Hazards

Michigan is vulnerable to a wide range of natural, technological and human-related hazards. Although Michigan is fortunate in that it is generally not susceptible to catastrophic disasters involving major earthquakes or hurricanes, it nonetheless has its share of potentially severe and widespread disasters and emergencies. As a relatively heavily populated state with thousands of inland lakes, hundreds of rivers and streams, over 3,200 miles of Great Lakes shoreline, numerous major manufacturing centers, frequent wind and winter storms, and lying on the northern fringe of the nation's tornado belt, Michigan experiences major disasters and emergencies on a regular basis.

The attached 2019 Michigan Hazard Analysis describes the state's vulnerability to about 20 different types of natural hazards, ranging from tornadoes to earthquakes. Although Michigan can potentially be affected in some way by all of these hazards, several of them cause a disproportionate number of disaster events and generally result in more damages and impact upon Michigan communities. (The Michigan Hazard Analysis is a companion volume attached to this plan. This chapter of the MHMP provides a summary of it.)

Since 1953, Michigan has experienced 39 events that resulted in the declaration of a major disaster or emergency by the President (including one fire suppression event in 1999). Since 1977, Michigan has experienced 79 events that resulted in one or more Governor's declarations of disaster or emergency. The majority of those declarations, at both levels, were granted for flooding, tornadoes, winter storms, or severe thunderstorms. These disasters or emergencies resulted in hundreds of millions of dollars in damage and destruction and caused tremendous disruption to the affected communities. Clearly, there is a need to focus hazard mitigation efforts on floods and winds, in particular.

Michigan's hazards can also be thought of in **seasonal** terms that divide the year into two risk periods: a winter risk season and a non-winter risk season. Although light snow sometimes falls during warmer months and other unusual events do sometimes occur, many natural hazards are strongly associated with particular times of year, and should encourage patterns of preparedness to occur on an annual cycle. The most damaging winter hazard has been ice storms, and pandemic influenza the most lethal. **Floods** do occur throughout the year, but especially after major snowpack thaws accompanied by heavy precipitation. The current annual pattern for Michigan's seasonal hazards appears to be the following:

March:	Final month for the highest-risk period involving influenza epidemics or pandemics
April:	Winter risk season (involving significant risk of **extreme cold, snowstorms, blizzards, and ice/sleet storms**) ends in the Lower Peninsula
May:	Winter risk season ends in the Upper Peninsula, non-winter risk season begins in the Lower Peninsula (involving a significant risk of **extreme heat events, severe thunderstorms, lightning, hail, tornadoes, and wildfires**)
Late **May**:	Non-winter risk season begins in the Upper Peninsula
Early **September**:	End of the non-winter risk season in the Upper Peninsula
Late **September**:	Winter risk season begins in the Upper Peninsula, end of non-winter risk season in most of the Lower Peninsula
Early **October**:	End of non-winter risk season in the southernmost counties of the Lower Peninsula
October:	Start of the highest-risk period for influenza epidemics or pandemics
Early **November**:	Winter risk season begins in the Northern Lower Peninsula
Late **November**:	Winter risk season begins in the Southern Lower Peninsula

Michigan, which contains three operating commercial nuclear power plants, has continued to develop and expand its capabilities to respond to a nuclear accident. Although stringent steps are taken at each plant to ensure safe and trouble-free power generation, accidents can occur. To combat that possibility, Michigan must continue to be a leader

in nuclear safety to ensure that the state's residents are adequately protected from the potentially harmful effects of an accidental radioactive material release.

Unfortunately, Michigan has experienced major acts of terrorist-like criminal action. On May 18, 1927, a disgruntled taxpayer set off a bomb in a schoolhouse in Bath, killing 45 persons (mostly children) and injuring 58 others. In 1992 and 1999, eco-terrorists committed arson attacks against Michigan State University research facilities. In 2009, Michigan narrowly avoided having a major terrorist act occur, as an attempt to bomb a passenger airline over Detroit did not succeed. As evidenced by the mounting history of criminal and terrorist events and plots—the bomb blasts at the World Trade Center in 1993, Oklahoma City in 1995, the Summer Olympics in 1996, the Boston Marathon in 2013, and the New York Metro Area in 2016; the September 2001 terrorist strikes in New York City and Washington D.C.; lethal shooting events at the University of Texas (1966), in a McDonald's restaurant in San Diego (1984), at a restaurant in Killeen, TX (1991), at Columbine High School (1999), along Washington D.C. highways in 2002, at Fort Hood in Texas (2009), in the Century 16 cinema in Aurora, CO (2012), at Sandy Hook Elementary in Newtown, CT (2012), in San Bernardino, CA (2015), a nightclub in Orlando, FL (2015), at a Congressional recreational baseball game in Arlington, VA (2017), in the First Baptist Church in Sutherland Springs, Texas (2017), and at the Country Music Festival in Las Vegas (2017); and attacks involving motor vehicles in Columbus, OH (2016), Charlottesville, VA (2017), and New York City (2017)—constant vigilance is needed by all citizens to prevent and deter future events of these types.

Finally, this document presents some of the actions that must be taken to mitigate the hazards outlined here (and fully addressed within the Michigan Hazard Analysis). Hazard mitigation is officially defined by FEMA as "any action taken before, during or after a disaster or emergency situation to permanently eliminate or reduce the long-term risk to human life and property from natural, technological and human-related hazards." Hazard mitigation actions, especially if implemented in a coordinated, inter-governmental, inter-disciplinary manner, can effectively reduce the damage, suffering, injury, and loss of life and property associated with these hazards. That, in turn, helps reduce disaster response and recovery costs, saving untold millions of dollars in public and private disaster relief assistance. In addition, hazard mitigation can greatly reduce the social, economic and political disruptions that disasters bring to bear on Michigan communities. The old adage "an ounce of prevention is worth a pound of cure" is certainly true when it comes to disasters.

It is for those reasons that the Michigan Hazard Analysis directly informs this Michigan Hazard Mitigation Plan, in coordination with the Michigan Emergency Management Plan, the Michigan Citizen-Community Emergency Response and Coordinating Council, the Emergency Management Accreditation Program (EMAP), FEMA's Threat and Hazard Identification and Risk Assessment process (THIRA), and other plans, groups, agencies, and processes, including those undertaken by Michigan's network of local emergency management coordinators and state agency emergency coordinators. Continuing to promote and advance the art and science of hazard mitigation will help ensure that Michigan's citizens are protected, to the maximum extent possible, from the harmful impacts of future disasters.

Statewide Hazards and Regional Hazards

The most damaging hazards in Michigan, in terms of property and crop damage, currently appear to be floods, public health emergencies, oil/gas pipeline accidents, major industrial fires/explosions, and severe winds. These top four hazards included huge events within the past 20 years whose costs each topped $1 billion.

An initial ranking <u>on the basis of estimated physical damages and known response/recovery costs</u> during recent decades, resulted in a list that was discussed and debated by MCCERCC. The list did not include cyber-attack and several other hazards whose assessment is less straightforward. The list was revised, based on the discussion and additional consideration of other types of impacts, but the following presents the initial consideration.

1. **Flooding**: statewide expected annual losses are now estimated at more than $100 million ($25.69 million had previously been estimated in the 2014 Michigan Hazard Mitigation Plan, but federal disaster 4195 confirmed a higher magnitude more in line with earlier EGLE estimates, as that Metro-Detroit flood event was quite similar to federal disaster 1346 during the previous decade).
2. **Fixed site hazardous materials incidents and/or industrial accidents**: statewide expected annual losses of about $57 million.

3. **Oil/gas pipeline accidents**: statewide expected annual losses of about $57 million.
4. **Public health emergencies**: immense human costs from pandemic illness, PBB, Flint water emergency, etc. are estimated to average in the tens of millions each year.
5. **Severe winds**: statewide expected annual losses of about $25.4 million.
6. **Tornadoes**: statewide expected annual losses of about $19.6 million.
7. **Hail**: statewide expected annual losses of about $16.6 million.
8. **Ice/sleet storms**: statewide expected annual losses of about $11 million.
9. **Drought**: statewide expected annual losses of about $8.4 million.
10. **Snowstorms**: statewide expected annual losses of about $3.3 million.
11. **Hazardous materials transport**: statewide expected annual losses of about $3 million.
12. **Wildfires**: statewide expected annual losses of about $1.1 million.
13-16. **Invasive species, infrastructure failures, major structural fires, major transportation accidents**: statewide expected annual losses of at least $1 million (although some of these costs are difficult to estimate).
17. **Geomagnetic storms**: statewide expected annual losses of up to about $1 million.
18. **Lightning**: statewide expected annual losses of about $966,000.
19. **Extreme cold**: statewide expected annual losses of about $300,000.
20. **Land subsidence**: statewide expected annual losses of about $200,000, but recent events have involved technological, urban infrastructure breakdowns as a cause, such as broken water mains that cause road collapses, which are expected to increase in frequency and severity. In addition, Michigan's most recent flood disaster revealed a previously unseen vulnerability to mudslides within the Western Upper Peninsula, which hadn't yet been factored into this initial estimate.

The statewide expected annual loss from **earthquakes**, **shoreline hazards**, impacting **celestial objects**, and **scrap tire fires** are each estimated to be less than $100,000 (although extremely rare catastrophic asteroid strikes are a possibility that has here been downplayed in favor of smaller and likelier impacts expected within normal human time-frames). Hazards such as **extreme heat** and **fog** do not have direct property damage normally associated with them, even though freezing fog occasionally causes treacherously icy road conditions.

Michigan's position as a national and international manufacturing and business center means that the state will remain vulnerable to hazardous material incidents and other technological hazards, even though efforts must persist to minimize the damage caused by these events. **For summaries of all declared state and federal disaster and emergency declarations in Michigan, please refer to Appendix 6. See Appendix 7 for a summary of vulnerabilities described in local-level analyses.**

There have also been 12 drought-related agricultural disaster declarations in Michigan between 2012 and 2018.

These further considerations are included in the following Hazard Analysis Summary Table that has been updated from the one that first appeared in the 2014 Michigan Hazard Mitigation Plan.

Hazard Analysis Summary Table

	Average annual events	Average annual deaths	Average annual injuries	Average annual property and crop damage	Development trend effects	Risk rating: casualties	Risk rating: property	Risk Rating: economic costs	Risk rating: Infrastructure effects	Risk rating: Environment	Frequency as a top local hazard
Hail	**191**	**0**	**0.2**	**$18.2 million**	**+**	**1**	**2**	**2**	**1**	**1**	**Some**
Lightning	**14**	**0.8**	**5.3**	**$0.8 million**	**=**	**1**	**1**	**2**	**2**	**2**	**Some**
Ice and sleet storms	**16**	**0.2**	**0.5**	**$11.4 million**	**+**	**1**	**2**	**3**	**3**	**1**	**Some**
Snowstorms	**360**	**0.1**	**0.1**	**$1.9 million**	**+**	**1**	**1**	**2**	**2**	**1**	**Many**
Severe winds	**395**	**1.7**	**12.6**	**$51.3 million**	**+**	**1**	**2**	**3**	**3**	**1**	**Many**
Tornadoes	**18**	**3.6**	**49.6**	**$17.2 million**	**+**	**2**	**2**	**3**	**3**	**2**	**Many**
Extreme heat	**11**	**0.4**	**41.0**	**None reported**	**=**	**2**	**0**	**2**	**2**	**0**	**Some**
Extreme cold	**35**	**1.0**	**9.4**	**$6.4 million**	**=**	**2**	**2**	**3**	**3**	**1**	**Some**
Fog	**4**	**0.1**	**0.1**	**None reported**	**+**	**1**	**0**	**1**	**1**	**0**	**None**
Flooding	**48**	**0.4**	**0.3**	**$106.6 million**	**+**	**1**	**2**	**3**	**3**	**2**	**Some**
Shoreline hazards	**2**	**1.4**	**0.4**	**< $0.1 million**	**+**	**1**	**2**	**3**	**2**	**1**	**Some**
Dam and levee failures	**2.3**	**> 0.1**	**> 0.1**	**$18.1 million**	**+**	**1**	**2**	**3**	**2**	**2**	**Some**
Drought	**3**	**0**	**0**	**> $7.0 million**	**?**	**0**	**0**	**3**	**1**	**2**	**Few**
Wildfires	**> 1**	**> 0**	**0.2**	**$1.0 million**	**+**	**1**	**2**	**3**	**2**	**3**	**Some**
Invasive species	**< 1**	**< 1**	**> 1**	**> $1.0 million**	**?**	**1**	**2**	**3**	**1**	**3**	**None**
Earthquakes	**< 1**	**> 0**	**> 0**	**< $1 million**	**+**	**2**	**2**	**2**	**2**	**2**	**Few**
Subsidence	**> 1**	**< 0.1**	**< 1**	**$0.2 million**	**+**	**2**	**2**	**2**	**2**	**1**	**Few**
Celestial impacts (impacting object)	**< 1**	**0**	**> 0**	**< $0.1 million**	**+**	**1**	**1**	**1**	**1**	**1**	**None**
Celestial impacts (space weather)	**< 1**	**0**	**0**	**< $1.0 million**	**+**	**1**	**1**	**2**	**2**	**1**	**None**
Structural and industrial fires (major)	**> 1**	**> 1**	**> 1**	**$57.0 million**	**-**	**2**	**2**	**2**	**1**	**2**	**Few**
Scrap tire fires	**< 1**	**0**	**0**	**< $1.0 million**	**=**	**0**	**1**	**2**	**1**	**2**	**Few**
Hazardous materials incident (fixed site)	**> 1**	**> 1**	**> 7**	**$4.0 million**	**+**	**2**	**2**	**2**	**2**	**2**	**Some**
Nuclear power plant	**< 1**	**0**	**> 0**	**< $0.1 million**	**+**	**1**	**1**	**2**	**2**	**2**	**Few**
Hazardous materials (transportation)	**> 1**	**> 1**	**> 1**	**> $3.0 million**	**+**	**2**	**2**	**2**	**2**	**2**	**Some**
Oil & gas pipelines	**> 1**	**> 1**	**> 1**	**$57.0 million**	**+**	**1**	**2**	**2**	**2**	**2**	**Few**
Oil & gas wells	**< 1**	**< 1**	**< 1**	**< $1.0 million**	**+**	**1**	**1**	**1**	**1**	**1**	**Few**
Infrastructure failures	**> 1**	**< 1**	**< 1**	**> $1.0 million**	**+**	**2**	**1**	**3**	**3**	**2**	**Some**
Energy emergencies	**< 1**	**0**	**0**	**None reported**	**+**	**1**	**0**	**2**	**2**	**1**	**None**
Transportation accidents (major)	**> 1**	**> 3**	**> 18**	**> $1.0 million**	**+**	**2**	**1**	**2**	**1**	**1**	**Few**
Catastrophic incidents	**< 1**	**> 0**	**> 0**	**Outside of MI**	**=**	**1**	**1**	**2**	**2**	**2**	**Few**
Civil disturbances	**< 1**	**< 1**	**> 1**	**< $1.0 million**	**=**	**2**	**2**	**2**	**1**	**1**	**Few**
Nuclear attack	**< 1**	**> 1**	**> 1**	**> $1.0 million**	**-**	**2**	**2**	**2**	**2**	**2**	**Many**
Public health emergencies	**< 1**	**> 10**	**> 100**	**None reported**	**-**	**2**	**0**	**2**	**2**	**1**	**Few**
Terrorism and similar activities	**< 1**	**> 1**	**> 1**	**> $1.0 million**	**=**	**2**	**2**	**2**	**2**	**2**	**Some**
Cyber-attack	**Many**	**< 1**	**< 1**	**Undetermined**	**?**	**1**	**1**	**2**	**2**	**1**	**Some**

"**Average annual**" numbers are medium-term estimates only. Medium-term means that most estimates were based upon decades' worth of data, to predict future decades' risk. Some entries merely say less than (<) or greater than (>) some value.

Development trend effects use the following symbols to estimate the effects from Michigan's recent land use trends (which still mainly involve a net shift toward constructing suburban, exurban, and rural detached homes for persons moving out of denser areas).

"+" means increasing risks, "=" means few net effects, "-" means decreasing risks, "?"means trends are unclear

Risk Ratings are based upon the estimated severity of average annual impacts (medium-term), as follows:

"0" means negligible: The risks as currently known are not likely to cause any emergency-level event.

"1" means minor: There is a known although infrequent chance for impacts of moderate or purely local severity.

"2" means significant: A regular pattern of moderate effects, or an infrequent chance of severe impacts.

"3" means major: A regular pattern or high risk of major impacts, of statewide significance.

"**Frequency as a top local hazard**" refers to the number of local plans listing this as one of their top hazards. Categories include "Many," "Some," "Few," and "None." Note that because FEMA requires the analysis of natural hazards, but not technological and human-related hazards, local plans are inclined to favor the listing of natural hazards.

Some figures round down to zero (e.g. less than 1 death in the period of over 20 years), and have been expressed as ">0" to distinguish them from a true zero.

The preceding table is an effort to "compare apples with oranges" by presenting estimated annual impacts from each type of hazard (although some hazards are too new or unclear to have a precise set of impacts accurately estimated in such a clear-cut manner). The table is still limited by a need for additional information, since some hazards have little or no event history within Michigan, and could benefit from the insights, research, and analysis of additional subject-matter experts. Detailed chapters are found in the Michigan Hazard Analysis, but since it is important to provide an overall summary of the findings of that analysis, the following table attempts to do so, adjusting the previous listings to include the full array of likely economic, environmental, energy, communication, casualty, and quality-of-life impacts that threaten to arise, in addition to the damage and emergency response costs previously estimated.

Summary of Michigan's Estimated Hazard Rankings

Note: Many hazard assessments are based upon a limited historical analysis and therefore their estimated rankings should be treated merely as rough estimates.

Type of Hazard	Priority	Reason
Floods	Top	Many damaging incidents: urban, riverine, and coastal; disruptive
Public health emergencies	Top	Major incidents involving water quality, PBB (1973), pandemic potential
Oil and gas pipeline incidents	Top	Billion-dollar Kalamazoo River event (2010), related concerns
Major fires or industrial incidents	Top	Dearborn plant explosion (1999), potential casualties and disruption
Invasive species	Top	Potential Asian Carp and agribusiness impacts, Emerald Ash Borer damage
Severe winds	Top	Regularly occurring incidents with serious damages, widespread impacts
Tornadoes	Top	Potential for extreme damage and massive casualties, though uncommon
Infrastructure failures	Top	Potential impacts and disruption from major blackouts, though uncommon
Extreme heat	Top	Potential for widespread human impacts, burden upon infrastructure
Cyber-attack	*	Potential economic, infrastructure, disruptive effects; global source of risk
Catastrophic incidents	*	Recent hurricane impacts and other potential national emergencies; supply risks
Nuclear attack	*	Potential for terrorist device; potential from geopolitical strife
Terrorism and similar incidents	*	Recent U.S. incidents, 2012 sniper, 2009 airline incident, 1927 Bath School event
Hazardous materials incident (site)	High	Many events of local concern occur frequently; potential for serious events
Hazardous materials transportation	High	Many events of local concern occur frequently; potential for serious events
Ice storms	High	Michigan's most damaging winter hazard; infrastructure/transportation breakdowns
Dam and levee failures	High	Severe impacts upon vulnerable locations; costly environmental risks
Major transportation accidents	High	A pattern of major interstate crashes, 1987 plane crash near Detroit
Hail	High	Strong events, although uncommon, have been as costly as tornadoes
Wildfires	High	Long wildfire history; some large-scale emergency events, potential casualties
Extreme cold	High	Causes human casualties, infrastructure failures, and some other disruptions
Drought	High	Huge historical impacts might again be felt; agriculture's importance in Michigan
Great Lakes shoreline hazards	High	High lake levels, harmful algal blooms, casualties from dangerous currents
Lightning	High	More casualties than many hazards, but trickier to mitigate; needs awareness
Subsidence	*	Imminent need to assess Western U.P. risks; an increase in urban subsidence
Space weather	*	A strong geomagnetic storm could cause widespread infrastructure failures
Civil disturbances	*	Recent U.S. incidents, multiple historical events within Michigan
Energy emergencies	*	Currently an interagency priority, but closer to preparedness than mitigation
Snowstorms	Medium	Annual events in each part of Michigan, transportation risks; limited damages
Scrap tire fires	Medium	Multiple past events, but tire quantities have been greatly reduced in recent years
Earthquakes	Medium	Unclear risks in Western U.P. subsidence zones; potential infrastructure loss
Nuclear power plant accidents	Medium	Events are rare, most are not severe, few facility locations, extensive preparedness
Oil and gas well accidents	Medium	Disaster events are rare; usually limited to one site or small area
Celestial impacts	Medium	Catastrophic impacts are very rare; shorter-term risks tend to be limited
Fog	Medium	Problematic for transportation; the worst direct impacts involve freezing fog

* The hazards marked with an asterisk are especially difficult to assess, but have been placed to divide the sets of top-priority hazards from the high and medium-impact ones.

Every hazard in the list is considered significant, having the potential to result in at least a local emergency situation or to cause human casualties. These rankings are primarily based upon the state's actual history of property damage, crop

losses, human casualties, economic and environmental impacts, and secondarily upon theoretical estimates of risks and vulnerabilities involving hazards that do not have a clear history of occurrences to extrapolate from. Some potentially catastrophic events were prioritized here using more than just a consideration of their worst-case destructive potential. This table instead seeks to balance each hazard's short- and medium-term likelihood, as currently understood, with their corresponding level of expected impacts within these limited time-frames. Although **climate trends** have been described in an entirely new chapter in this document, the topic has not yet been ranked here. It can be conceived in terms of its influence upon the hazards that have been ranked. State rankings differ from national/global ones. In addition, some attention has been given to the way in which vulnerabilities and priorities can vary throughout different parts of the state. The following table summarizes some of this data (for natural hazards) at the level of the four general geographic divisions defined and described in this document's State Profile (Chapter 1).

Quantitative Summary by Region

Source: NCEI Storm Events online database* (1996-2017)

	Average annual events	Average annual deaths	Average annual injuries	Average annual property and crop damage	Average annual events	Average annual deaths	Average annual injuries	Average annual property and crop damage
Geographic Division→	**Upper Peninsula**				**Northern Lower Peninsula**			
Hail	**2.2**	**0**	**0**	**$3,302,677**	**1.3**	**0**	**> 0**	**$2,012,844**
Lightning	**0.1**	**0.1**	**0.2**	**$24,600**	**0.1**	**0.3**	**1.3**	**$49,337**
Ice and sleet storms	**0.2**	**0**	**0**	**$14,063**	**0.1**	**0**	**0**	**$83,205**
Snowstorms	**8.8**	**0.1**	**0.1**	**$70,900**	**3.7**	**0**	**0**	**$1,243,754**
Severe winds	**3.0**	**0.1**	**0.1**	**$1,064,335**	**1.9**	**0.2**	**2.6**	**$4,647,190**
Tornadoes	**0.1**	**0**	**0**	**$351,568**	**0.1**	**> 0**	**0.2**	**$348,474**
Extreme heat	**> 0**	**0**	**0**	**$0**	**> 0**	**0**	**0**	**$0**
Extreme cold	**1.4**	**> 0**	**0**	**$0**	**0.1**	**0**	**0**	**$3,492,242**
Fog	**0.2**	**0**	**0**	**$0**	**> 0**	**0**	**0**	**$0**
Flooding	**0.8**	**> 0**	**0**	**$2,374,256**	**0.3**	**0**	**0**	**$2,591,244**
Shoreline hazards	**1.1**	**0.5**	**0**	**$9,469**	**> 0**	**0.2**	**> 0**	**$0**
Drought*	**> 0**	**0**	**0**	**$0**	**> 0**	**0**	**0**	**$0**
Wildfires	**> 0**	**0**	**0.2**	**$849,201**	**> 0**	**0**	**0**	**$109,689**
***NOTE: This data source is not comprehensive for drought impacts. Refer instead to the Drought chapter in MHA.**								
Geographic Division→	**Southern Lower Peninsula**				**Metropolitan Detroit**			
Hail	**2.6**	**0**	**0.2**	**$11,752,581**	**6.5**	**0**	**0**	**$1,173,300**
Lightning	**0.2**	**0.2**	**2.1**	**$293,770**	**1.1**	**0.3**	**1.6**	**$457,788**
Ice and sleet storms	**0.2**	**0**	**> 0**	**$2,948,718**	**0.2**	**> 0**	**0.2**	**$8,366,709**
Snowstorms	**3.2**	**0**	**> 0**	**$535,555**	**2.3**	**0**	**0.3**	**$88,314**
Severe winds	**6.3**	**0.8**	**7.7**	**$3,145,786**	**15.8**	**0.5**	**2.2**	**$14,230,488**
Tornadoes	**0.3**	**0.2**	**2.6**	**$9,332,874**	**0.3**	**> 0**	**4.6**	**$7,101,064**
Extreme heat	**0.2**	**0**	**3.1**	**$0**	**0.6**	**0.4**	**38.3**	**$0**
Extreme cold	**0.2**	**0.1**	**5.7**	**$1,389,866**	**0.7**	**0.8**	**3.7**	**$283,598**
Fog	**> 0**	**> 0**	**> 0**	**$0**	**0.1**	**0**	**0**	**$0**
Flooding	**0.7**	**0.3**	**0.4**	**$11,782,215**	**1.7**	**> 0**	**0**	**$90,584,306**
Shoreline hazards	**0.8**	**0.8**	**0.4**	**$938**	**0**	**0**	**0**	**$0**
Drought*	**> 0**	**0**	**0**	**$0**	**0.1**	**0**	**0**	**$7,031,360**
Wildfires	**> 0**	**0**	**0**	**$0**	**> 0**	**0**	**0**	**$938**

"Average annual" numbers are medium-term estimates only. Medium-term means that most estimates were based upon decades' worth of data, to predict future decades' risk. Some figures round down to zero (e.g. less than 1 death in the period of over 20 years), and have been expressed as "> 0" to distinguish them from a true zero.

Local Hazard Loss Estimation Tables

A series of tables had analyzed natural hazards within the Michigan Hazard Analysis. These tables covered all 83 Michigan counties, for each natural hazard with records available in the National Climatic Data Center online database, now known as the National Center for Environmental Information. These summary tables had provided a more valuable and accessible method of estimating average losses for each hazard type than had been included in the original editions of the Michigan Hazard Mitigation Plan. Previous editions of the MHMP had included efforts to take some of that data and "smooth it" to better represent the risks to all of Michigan's counties, since the initial data had not included enough records to accurately represent all the risks when broken down to a local level. With the agreement of a FEMA plan reviewer, these tables in the Michigan Hazard Analysis do indeed serve as an effective replacement for a much longer set of tables that were being updated in previous editions of MHMP. The tables effectively assess the vulnerability of local jurisdictions at the county level (at which most local hazard mitigation plans are maintained), in terms of past impacts and casualties. However, some additional assessment is worthwhile here, rather than leaving those tables to "explain themselves." Some counties would be expected to have higher measured impacts, purely by chance, but the key is to assess whether some areas of Michigan are more vulnerable because of their location or some identifiable source of risk. For example, Oakland County experienced more hail than adjacent Livingston County, but which county is more vulnerable to hail? Only long-term figures would show this, rather than just a couple of decades. When the rare severe hailstorm finally struck the area, Oakland County had a thousand times more damage than adjacent counties, including its more urban neighbor, Wayne County. Were these impacts purely by chance? Since severe hail comes from strong thunderstorms and the incidence of such thunderstorms is similar for those counties around Oakland, the answer appears to be "Yes, these damages were in Oakland County instead of its neighbors purely by chance, rather than because of a special vulnerability of that county." Therefore, the important thing is to identify the large number of severe thunderstorms seen in all those counties, and to treat Oakland as an example of what is likely to eventually happen to all counties in that area—rare events with severe hail damage—and to plan to protect the entire area as a whole.

In this sense, the assessment of local vulnerabilities must be statistical in a broader sense, and informed by known meteorological theory as well as the limited-term data that is available. The table on the previous page is one way to "smooth" the impact of rare events across the many counties where such events could have occurred, but did not necessarily occur within the recent data we're using. The "Quantitative Summary by Region" table shows that the historical impacts data, accumulating for more than 20 years now, predict over $1 million in hail damage per year in the 5-county Metro area as a whole. The average impacts for the rest of the Southern Lower Peninsula are about 10 times as much, but that also covers a much larger geographic area. This is why maps have also been included within the analysis, such as those showing tornado frequencies in each county. Severe summer weather risks are similar to the tornado frequencies maps, since so much of the damage during the summer weather risk season is connected with Severe Thunderstorms. An area of higher vulnerability can be identified from southwestern Berrien County, stretching diagonally up through Saginaw Bay, and all areas to the southeast of that line. Vulnerabilities exist throughout the state, but that region includes both (1) a higher risk of severe convective weather events, and (2) the most dense urban areas, so that any particular location being impacted is more likely to have some sort of built structure and human occupants located within it. This type of vulnerability assessment can be seen for each type of natural hazard for which a history of impact damages is available. Some natural hazards, such as earthquakes and fog, have caused very few documented damages in Michigan. The overall state priorities for its hazards can therefore be compared in this way with the local assessments included within the Michigan Hazard Analysis. **For additional information on local jurisdictional vulnerabilities, see Appendix 7, 8, and 13** (vulnerability assessments from local plans, and additional information about the state's assessments of vulnerabilities, and project ideas from local plans).

Although general findings for the state and its regions have been summarized in these handy tables (earlier in this chapter), a few points within the tables are worth noting. The largest damage amounts are seen in the categories of Metro Detroit floods, Metro Detroit winds, Southern Lower Peninsula floods, and Southern Lower Peninsula Hail. more detailed breakdown of risks by county (as well as an assessment of the impacts upon state owned/operated facilities), **Appendix 7** and **Appendix 8** show additional details. **For an assessment of emergency impacts upon public confidence in governance, please refer to Appendix 9.**

When it comes to the comparative vulnerability of Michigan's counties, the following table presents a ranking of counties by each of the hazards that was able to be quantitatively assessed in the Hazard Analysis. (However, the table only shows counties that had an **estimated expected annual damage** amount of at least $1 million from that corresponding hazard. This reduces the distraction that less-serious hazards might otherwise cause within the assessment.) As explained previously, many weather impacts these counties should also be considered indicative of vulnerabilities in similar, nearby counties.

County Ranking	Flood Impacts	Severe Wind Impacts	Tornado Impacts	Hail Impacts	Ice/Sleet Storm Impacts	Drought Impacts
1	Wayne	Wayne	Wayne	Kalamazoo	Oakland	Wayne
2	Oakland	Kent	Monroe	Marquette	Macomb	
3	Macomb	Oakland	Eaton	Van Buren		
4	Ottawa	Ottawa	Macomb	Ogemaw		
5	Gogebic	Macomb		Oakland		
6	Allegan	Muskegon				
7		Washtenaw				
8		Calhoun				
9		Genesee				
10		Livingston				
11		Saginaw				
12		St. Clair				
13		Leelanau				
14		Montcalm				
15		Lenawee				
16		Monroe				

No Michigan Counties had annual expected losses of more than $1 million from lightning, snowstorms, wildfires, extreme temperatures, fog, shoreline hazards, dam failures, earthquakes, subsidence, or celestial impacts. **Please note that technological hazards have not been considered in these comparisons, due to insufficient data.**

When comparing individual county risks (from natural hazards only, defined in terms of annual historic damages) against each other, the following rankings result:

1. Wayne Flooding	$52,684,868	18. Ottawa Flooding	$2,356,708
2. Oakland Flooding	$18,902,700	19. Muskegon Severe Winds	$2,326,856
3. Macomb Flooding	$18,863,977	20. Washtenaw Severe Winds	$2,090,236
4. Wayne Drought	$7,032,150	21. Calhoun Severe Winds	$1,953,672
5. Kalamazoo Hail	$6,098,046	22. Genesee Severe Winds	$1,683,590
6. Oakland Ice/Sleet Storms	$5,037,457	23. Ogemaw Hail	$1,528,321
7. Wayne Severe Winds	$4,677,317	24. Livingston Severe Winds	$1,514,397
8. Kent Severe Winds	$4,660,112	25. Saginaw Severe Winds	$1,493,535
9. Wayne Tornadoes	$4,277,893	26. St. Clair Severe Winds	$1,486,409
10. Oakland Severe Winds	$3,031,607	27. Macomb Tornadoes	$1,444,170
11. Marquette Hail	$3,030,716	28. Oakland Hail	$1,172,541
12. Ottawa Severe Winds	$2,955,566	29. Gogebic Flooding	$1,135,130
13. Macomb Severe Winds	$2,918,530	30. Leelanau Severe Winds	$1,132,129
14. Monroe Tornadoes	$2,822,378	31. Montcalm Severe Winds	$1,190,777
15. Macomb Ice/Sleet Storms	$2,687,453	32. Lenawee Severe Winds	$1,094,296
16. Van Buren Hail	$2,377,804	33. Allegan Flooding	$1,055,526
17. Eaton Tornadoes	$2,371,336	34. Monroe Severe Winds	$1,038,461

Although these rankings may appear to be clear-cut, keep in mind that they do not include a consideration of human casualties, local resources (for example, although more snow falls in the Upper Peninsula, it causes less damage there),

and other considerations beyond property damage reports. They are also based upon little more than 20 years of data. **It is always appropriate for these statistics to be reviewed by multiple agencies, including the involved local emergency management programs, if they are given consideration for use in prioritizing hazard mitigation activities.** (In addition, certain types of hazards are more susceptible to available mitigation options, and therefore any prioritization in a hazard mitigation plan should not be based exclusively upon the extent of perceived property risk. Some types of hazard mitigation projects are likely to be far more effective than others, and might produce a greater benefit as a result than a less-effective project aimed toward the worst-risk areas.) For additional information about local hazard assessments, NCEI damage records, and cross-county comparisons, please refer to **Appendix 7**.

State Facilities Assessment

This plan's assessment of (1) state owned and operated critical facilities located in identified hazard areas, and (2) potential dollar-loss estimates for those facilities (where appropriate) for significant natural hazards can be found in **Appendix 8**. However, because of the potential for misuse of data about Michigan's critical facilities, copies of this plan that are available for general distribution do not include the specific details about the location and type of those facilities.

Michigan Hazard Mitigation Plan:
6. Overview of Hazard Mitigation Methods

Hazard Mitigation: Unlocking the Disaster Equation

Perhaps the best way to understand hazard mitigation is to first understand the nature of disasters themselves. The basic equation for a disaster is simple: **Hazard Forces x [Vulnerable (Persons + Structures)] = Disaster.** Disasters only occur because people, structures, or infrastructure are located in harm's way, vulnerable to the impacts of particular hazards.

The key to preventing or limiting a hazard's impact is to unlock and separate the key components of this equation. Controlling the hazard may be difficult or impossible (a tornado is a good example), but there are situations in which vulnerability can be effectively reduced. (See strategy numbers 2 through 4 below for more information.) Modifying the characteristics of people and structures is often easier and more effective in reducing or eliminating hazard vulnerability because these elements are more closely under our control than the threatening hazards are. However, since multiple fundamental freedoms are a vital part of American society, and there is a widespread appeal to living near water, in the woods, on hillsides, and in other hazard-prone or at-risk areas preventing harm in a way that does not impose too high a cost, while simultaneously respecting individual choice, property rights, and economic needs, can be a complicated process.

In some cases, the best option is to seek merely to inform persons of known risks and historical events. In other cases, persons and agencies may voluntary choose preventive actions, because of the benefits that result to their property, safety, and quality of life. Some of these voluntary actions can be encouraged and subsidized by insurance and government policies and resources. Additionally, since police and executive powers can authorize mandatory evacuations, development regulations, and other restrictions only when there is a recognized need and benefit from such applications of power, it is in everyone's interest to keep such powers limited to rare and extreme events, by protecting ourselves from foreseeable hazards such as floods and severe weather, so that these do not result in life-threatening emergencies that cause roads, flooded areas, schools, churches, and community facilities to become inaccessible or hazardous, as well as requiring expensive and sometimes intrusive (yet necessary) emergency response and recovery efforts to try to protect and restore everything to its ordinary, preferred state.

The following are six basic hazard mitigation strategies that can reduce or prevent the harmful interaction between hazards, people, and development that results in a disaster:

Strategy #1: Modification of the Hazard

The first strategy involves modification of the hazard itself—removing or eliminating the hazard, reducing its size or amount, or controlling the forces it exerts. In the right circumstances, this strategy can be successful, but it is often difficult to do. Examples of this strategy include stream widening or modification to improve water flow and prevent floods, and slope planting to prevent erosion. These measures can be cost-effective, but their application is normally limited and expensive, and therefore not always as effective as other strategies in reducing or eliminating damage on a wide scale. In terms of "the disaster equation," if a hazard forces can be reduced to zero, there will be no disaster. Hazard mitigation of this type attempts to reduce the impact of a hazard as much as possible.

Strategy #2: Segregating the Hazard

Strategy number two, segregating the hazard, attempts to *"keep the hazard away from people."* This is often accomplished in flood-prone areas through the construction of structural protection measures such as dams, levees, floodwalls, debris basins, and other public works projects designed to redirect the impacts of a flood away from people and development. This strategy can be highly effective, but it can also be expensive and in some cases can cause (or exacerbate) environmental problems. Also, history has shown that structural protection measures constructed to protect one community can increase problems in other communities (e.g., levees that channel and increase the velocity of floodwaters, causing severe flooding downstream). Limited budgets and structural maintenance costs may make this strategy less feasible in some communities and situations.

Strategy #3: Preventing or Limiting Development

The third strategy involves preventing or limiting development in locations where people and development would be at risk. This approach is based on *"keeping the people away from the hazard"* and includes a variety of land use planning and development regulation tools, such as comprehensive planning, zoning, floodplain management ordinances, capital improvements planning, and disclosure laws, as well as the acquisition and relocation of hazard-prone properties. This approach attempts to reduce or eliminate the vulnerability of persons and structures, through wise and prudent land use and development decision-making. When properly applied, this strategy can be highly effective in promoting safe, sustainable development. Hazards continue to exist, but if human vulnerability has been sufficiently reduced, no disaster will result from the hazard.

Strategy #4: Altering Design or Construction

The fourth strategy involves alteration of the design or construction of development to make it less vulnerable to disaster damage. This strategy can be thought of as *"interacting with the hazard,"* and allows the hazards to interact with human systems that have been designed and planned to withstand potentially destructive impacts. Examples of this strategy include elevating structures, employing wet and dry flood-proofing to improve flood damage resistance, managing vegetation buffer zones in urban/wildland interface areas, using wind bracing to improve structural wind resistance, and insulating water and sewer lines to prevent freezing damage. This strategy allows development in hazard prone areas, but requires that the development meet stringent disaster-resistant performance criteria. In many situations, this approach is an economically welcome method of reducing community hazard vulnerability. History has shown that the two goals are not mutually exclusive. When careful and prudent development decisions are made that take into account the reduction of hazard vulnerabilities, the result is safe and sustainable community development. Safe rooms should be widely considered, to protect residents at home, workers at work, and visitors at special events.

Strategy #5: System Capacity, Redundancy, and Back-Up Features

Like the previous strategy, this focuses upon mechanical, design, and construction elements, but of some important system (e.g. critical infrastructure) rather than just for a specific structure. The design of structures should include back-up power options for vital operations, and infrastructure should be able to accommodate the full extremes of weather, drainage patterns, temperatures, and so on. Capacity should not be presumed to be a statically defined concept that has never changed, but should take into account current trends toward increasing precipitation and heavy-rain events. Critical facilities should have a reliable source of back-up power. Road and power systems should, if possible, provide enough redundancies to allow the system to effectively handle the occasional breakdown in some of its components.

Strategy #6: Early Warning and Public Education (overlaps with emergency management preparedness/response)

This strategy seeks to ensure that the public is aware of the hazards it faces, and that proper warning and communication systems and practices are in place to save lives and protect property. This strategy should be applied in all communities, as it is typically the last line of defense against serious disaster related injury or loss of life.

Hazard Mitigation: Corrective and Preventive

An alternative way to think of hazard mitigation strategies is to consider the following two broad categories:

- **CORRECTIVE MITIGATION –** correcting past practices that had increased hazard vulnerability; and
- **PREVENTIVE MITIGATION –** preventing future problems from occurring in the first place through public education, wise decision-making, and disaster-resistant building and development practices.

The Corrective form of hazard mitigation can be expensive, resource intensive, time consuming, and sometimes only marginally effective. Structural protection measures, hazard modification, and large-scale retrofitting fall under this category. Attempting to go back and fix something that is problematic is almost always more difficult than doing it right the first time. However, when dealing with hazard-prone property (i.e., structures in a floodway, floodplain, or other hazard area), it is often necessary to go back and try to correct the problem in order to protect the affected community and individual property owners from future harm.

The Preventive form of hazard mitigation is desirable because it seeks to prevent future problems from occurring in the first place. Wise land use planning and building design, small-scale retrofitting, and early warning and public education fall under this category. When it comes to reducing community hazard vulnerability, the old adage "an ounce of prevention is worth a pound of cure" certainly makes sense. (Or, with hazard mitigation, perhaps it is more appropriate to say "an ounce of mitigation is worth a pound of recovery!") Doing it right the first time is almost always preferable to going back and trying to correct recurring problems at a later date. Preventive mitigation is generally easier to implement than corrective mitigation because the administrative mechanisms that guide the land development process—planning and plan review, zoning, capital improvements programming, building codes and standards, etc.—are available to every local community and only require adoption and consistent application to be highly effective in reducing or eliminating hazard vulnerability.

This plan addresses both types of hazard mitigation—an ideal hazard mitigation program will involve both types being applied in appropriate amounts, in appropriate places, in a coordinated fashion. **However, particular emphasis is placed on the preventive form of hazard mitigation, since this approach is generally more flexible and cost-effective and can significantly reduce or eliminate future hazard vulnerability.** The preventive form of hazard mitigation can help ensure that, at the very least, the state and local governments do not contribute to the increasing severity of the problem through unwise decision-making. The corrective form of hazard mitigation measures, on the other hand, are emphasized for areas that suffer recurring or particularly severe disaster damages and impacts or that offer clear hazard mitigation opportunities that can be addressed with existing resources.

Hazard Mitigation: Creating Safe, Sustainable Communities

To create and maintain safe, sustainable communities, **both preventive and corrective forms of hazard mitigation must occur at the state and local levels.** An example of the preventive form of hazard mitigation at the local level would be a policy requiring that all future development occur in such a way as to avoid or reduce, to the extent possible, community exposure and vulnerability to hazards. That would seek to prevent the scope and magnitude of hazard impacts from increasing. The corrective form of hazard mitigation therefore could be applied in those areas that already have a high degree of exposure and vulnerability to certain hazards and therefore suffer severe and/or repetitive damage as a result. Such actions would correct current problems that had been caused by unwise and/or outdated land development patterns.

Because disasters can be particularly devastating for private businesses and industry, creating and maintaining safe, sustainable communities makes "business sense" as well—statistics from the National Fire Protection Association (NFPA) show that 40% of organizations that suffer a major disaster of any kind go out of business within one year. A University of Minnesota study found that 93% of all businesses that lost their data centers for 10 days or more went out of business—50% filing for bankruptcy almost immediately. A follow up study by Datapro Research found that 43% of the businesses in the University of Minnesota study never reopened, and an additional 29% went under within two years. Creating and maintaining safe, sustainable communities through the implementation of mitigation measures at the state and local government levels is certainly in the best interests of private business and industry.

As stated previously, this plan addresses both types of hazard mitigation but emphasizes the preventive form as a more efficient and effective way to try to keep the scope and magnitude of future problems in check.

Hazard Mitigation Plans Identify and Create Implementable Hazard Mitigation Opportunities

It must be emphasized that the hazard mitigation measures identified in this plan and in counterpart local plans are, in reality, **hazard mitigation opportunities.** Identification of a possible hazard mitigation measure does not necessarily mean that it can or even should be implemented. Implementation (and the desirability) of a hazard mitigation measure is highly dependent on a number of factors—environmental, social, economic and political. Just because a measure may reduce or eliminate the effects of a hazard does not necessarily mean that it should be implemented. There may be extenuating factors or circumstances that could or should preclude its implementation. Those decisions will be made in the local and state political arenas and in the land use and land development decision-making processes. Typically, hazard mitigation measures will be implemented if they are able to balance environmental, social, economic and political factors, and are cost-effective. It does not make sense to implement a measure that will not be supported by state and/or local officials and the citizenry, or that cannot be economically justified.

Accomplishing everything proposed in this plan will be a very tall order and will take years. Nevertheless, it is important to the future of this state that these issues be addressed, at least to some degree. Our nation, our state, our local communities and the insurance industry cannot continue to respond to and pay for increasingly large disasters. Proper application of hazard mitigation measures and strategies, coupled with wise land use and land development decision-making, can help our communities become more safe and sustainable, and our future as disaster-free as possible.

For a more detailed description of hazard mitigation ideas, resources, and capabilities, please refer to Appendix 10.

Note: It should be emphasized that the focus and intent of this plan is not to encourage wholesale limits on development or in any way to usurp the authority or scope of local land use and land development decision-making. Land use decisions in Michigan, by and large, have been made by local officials based on local priorities and conditions. What this plan seeks to promote is *safe, sustainable development and communities* by integrating hazard mitigation considerations into everyday governmental and private sector business practices and processes. This in turn will help reduce injuries and loss of life, property and environmental damage, and adverse economic, social, and service impacts caused by natural, technological, and human-related hazards.

Michigan Hazard Mitigation Plan:
7. Hazard Mitigation Accomplishments and Progress

Since the 2014 plan, 64 plans or plan updates have been completed and approved by FEMA. These include 57 county plans, plus 7 independent, community-level or university plans. An approved tribal organization was in several plans.

The totals in the following multi-page table represent 424 separate grants. Three-hundred-eighty-one (381) of the projects are complete and the totals included in the table are based actual project costs. Forty-three (43) of the grants are awarded but not yet complete as of January 2019. For these grants, projected totals were used based on grant application budgets. For grants that benefited multiple counties, the project totals were evenly distributed to the counties they benefitted. A total of 26 grants yielded statewide benefits, and those are totaled under the category of "Statewide" within the table. The project grant totals provided here are from grants awarded to the State of Michigan from the Federal Emergency Management Agency (FEMA). The grants were awarded from four separate FEMA grant programs, which are collectively known as Hazard Mitigation Assistance (HMA). The grant programs within HMA are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) program, the Pre-Disaster Mitigation (PDM) program, and the Repetitive Flood Claims (RFC) program. The RFC program no longer exists as an independent grant, but is part of FMA. All grants, other than totaled in the "Statewide" category, were passed through from the State of Michigan to local units of government, tribes, or state agencies.

MITIGATION PROJECT FUNDS MADE AVAILABLE SINCE 1994, BY COUNTY (as of Jan. 2019)

COUNTY	PROJECT TOTAL	FEDERAL SHARE
Alcona	$358,662	$224,581
Alger	$49,557	$36,624
Allegan	$10,804,718	$8,086,954
Alpena	$627,210	$411,669
Antrim	$469,887	$303,039
Arenac	$303,139	$195,100
Baraga	$112,668	$81,852
Barry	$343,076	$256,124
Bay	$3,244,737	$2,578,999
Benzie	$126,290	$88,712
Berrien	$28,632	$21,195
Calhoun	$104,456	$78,125
Cass	$121,116	$89,136
Charlevoix	$469,308	$329,002
Cheboygan	$64,010	$47,672
Chippewa	$624,143	$468,413
Clare	$2,263,973	$1,698,846
Clinton	$873,506	$655,184
Crawford	$62,637	$46,056
Delta	$62,133	$46,056
Dickinson	$117,006	$87,359
Eaton	$405,623	$289,208
Emmet	$179,684	$83,983
Genesee	$5,720,039	$4,302,903
Gladwin	$63,379	$48,401
Gogebic	$713,348	$407,771
Grand Traverse	$1,888,630	$1,413,973
Gratiot	$493,944	$339,986
Hillsdale	$55,407	$26,634
Houghton	$760,708	$560,694
Huron	$663,392	$430,966
Ingham	$1,792,709	$1,321,132

Ionia	$425,228	$324,100
Iosco	$218,075	$115,912
Iron	$243,791	$174,340
Isabella	$1,568,077	$1,170,544
Jackson	$163,044	$103,431
Kalamazoo	$218,304	$161,926
Kalkaska	$22,375	$16,781
Kent	$7,310,511	$5,269,782
Keweenaw	$184,618	$138,097
Lake	$134,767	$100,000
Lapeer	$1,055,993	$791,726
Leelanau	$44,350	$30,656
Lenawee	$202,855	$137,220
Livingston	$674,605	$459,067
Luce	$57,491	$43,424
Mackinac	$494,272	$333,142
Macomb	$2,838,700	$1,695,652
Manistee	$22,375	$16,781
Marquette	$2,166,234	$1,334,220
Mason	$631,906	$471,604
Mecosta	$123,094	$123,094
Menominee	$49,557	$36,624
Midland	$1,704,215	$1,440,576
Missaukee	$22,375	$16,781
Monroe	$6,258,169	$4,755,396
Montcalm	$12,727	$12,727
Montmorency	$60,670	$44,581
Muskegon	$1,781,097	$1,335,703
Newaygo	$329,868	$245,302
Oakland	$4,594,043	$3,101,583
Oceana	$106,827	$80,000
Ogemaw	$294,056	$217,639
Ontonagon	$98,777	$73,977
Osceola	$40,668	$32,727
Oscoda	$60,670	$44,581
Otsego	$62,776	$46,156
Ottawa	$4,371,821	$3,117,035
Presque Isle	$809,416	$604,715
Roscommon	$858,368	$644,643
Saginaw	$4,167,642	$2,736,640
Sanilac	$729,896	$458,251
Schoolcraft	$49,557	$36,624
Shiawassee	$179,175	$134,113
St. Clair	$1,286,974	$953,557
St. Joseph	$327,175	$245,381
Statewide	$4,571,418	$3,739,893
Tuscola	$4,138,550	$2,680,040
Van Buren	$636,393	$416,935
Washtenaw	$5,899,496	$4,335,841
Wayne	$19,036,463	$13,298,426
Wexford	$868,806	$651,605
State of Michigan Totals:	**$116,176,040**	**$83,605,905**

For a summary of projects funded through Hazard Mitigation Assistance in the past, please refer to Appendix 11. For a list of hazard mitigation objectives previously appearing in past editions of the Michigan Hazard Mitigation Plan, please refer to Appendix 12.

Michigan Hazard Mitigation Plan:
8. Hazard Mitigation Alternatives, Criteria, and Selection

Hazard Mitigation Alternatives

The identification of risks and vulnerabilities should lead planners and officials to consider various hazard mitigation alternatives that might be applied to improve the safety and security of residents, property, the environment, the economy, and quality of life. A hazard mitigation alternative is not the same as a project or specific action that will definitely be implemented. Rather, an alternative is one of a potential set of actions or strategies that will be evaluated and compared with each other (as well as with the maintenance of the status quo, sometimes called a "do nothing" alternative, which can be handy for considering the costs and benefits of a project). An evaluation process should involve more than one agency, take into consideration feedback from the public, legal limitations, economic constraints, and so on. The eventual result would be the identification of one or more specific actions that can (and should) be undertaken to improve conditions for all or part of the planning area. Chapter 6 had provided an overview of various general types of hazard mitigation actions. This chapter involves an extensive consideration of numerous alternatives for each significant hazard that can affect Michigan. Chapter 9 in this plan will then present the array of carefully selected hazard mitigation objectives, which have received multi-agency approval for their appropriateness and feasibility, cost-effectiveness, legal defensibility, and so on. But such a list of specific objectives stems from a consideration of a wide variety of mitigation alternatives, both general and specific in nature.

In this current chapter, an array of hazard mitigation alternatives is presented. Some of these alternatives (such as zoning decisions) are more appropriate for local implementation, and the state's role would be to try to promote the consideration of these hazard mitigation strategies in local hazard mitigation plans. Other alternatives (such as legislation) are more appropriate for implementation by state government. Some alternatives may involve the participation of multiple actors at different levels (local, state, and federal; public, private, and non-profit). An example of such a hazard mitigation idea could be an improvement in a local community's drainage infrastructure that obtains federal grant funds (administered by a state agency) and makes use of matching funds from a local community foundation, while providing benefits to downstream areas in the watershed region as well. These types of very specific projects usually stem from hazard the mitigation actions found in local hazard mitigation plans, which are usually produced in coordination with state and federal agencies (the Michigan State Police Emergency Management and Homeland Security Division, and the Federal Emergency Management Agency).

An extensive list of alternatives had appeared within the Michigan Hazard Analysis, and is presented again in the first part of **Appendix 13**. The list was considered here by planners and stakeholders at the state level, but is also intended for consideration by planners and emergency managers in regional and local jurisdictions.

Hazard mitigation is often presented as if it is something entirely distinct from "preparedness, response, and recovery," (known together as four phases of emergency management, but later amended to be described as five mission areas, in which preparedness was replaced with prevention and protection). However, there are not always clear limits or distinctions between other activities that are designed to save lives and protect property. The federal definition of hazard mitigation includes the concept of seeking a "permanent" solution that reduces vulnerability, but shorter-term solutions can also be worthwhile. All "mission areas" and "phases" of emergency management ultimately share the same goals of protecting life and property, community quality of life, and so on. Many of the hazard mitigation strategies listed in state guidance documents (and local plans) have included preparedness activities, and it has been widely recognized that many hazard mitigation activities can occur most easily during a period of recovery from a disaster (for example, while rebuilding a community's structures to a higher standard). However, the many strategies listed in Appendix 13 were refined from broader lists previously published, and have tried to emphasize the kinds of activities that are closer to how FEMA has defined hazard mitigation, and thus to have a better chance of gaining FEMA grant eligibility for at least some project ideas. Additional activities may potentially help to save lives and protect communities and important agencies, beyond the lists here representing the ideas that are closer to "pure" hazard mitigation actions. But not all ideas must fall within the official definition of hazard mitigation. The key accomplishment is that at least some strategies are clearly recognized by FEMA as hazard mitigation. That is, a "pure" hazard mitigation strategy is an effort to prevent hazard impacts, or to take advance, proactive steps toward the long-

term reduction of the impacts of hazards on a community. Some of these may take place during the response or recovery phases of a disaster, and many will be implemented before an event occurs. (Another event may begin as soon as an earlier disaster ends, and therefore anything that gets done is always potentially in advance of some future hazard event). It has been emphasized by FEMA that the narrower, more specific view of hazard mitigation should receive emphasis (but not exclusive emphasis) so that this plan receives their approval and thus meets requirements for HMA project grant eligibility.

The extensive list of hazard mitigation alternatives is available for general consideration, and has been organized by hazard types, following their order of appearance within the Michigan Hazard Analysis. Some hazards that are relatively new to this type of planning do not yet have a clearly established set of hazard mitigation strategies, but it is anticipated that this list will be refined in the future. **Please refer to Appendix 13 for lists of hazard mitigation ideas.**

State Hazard Mitigation Goals and Objectives

The State of Michigan's four hazard mitigation goals are:

GOAL 1: Promote Life Safety
Minimize disaster-related injuries and loss of life through public education, hazard analysis, and early warning.

GOAL 2: Reduce Property Damage
Incorporate hazard mitigation considerations into land use planning, resource management, land development processes, and disaster-resistant structures.

GOAL 3: Build Alliances
Forge partnerships with other public safety agencies and organizations to enhance and improve the safety and wellbeing of all Michigan communities.

GOAL 4: Provide Leadership
Provide leadership, direction, coordination, guidance, and advocacy for hazard mitigation in Michigan.

Under each goal is a set of hazard mitigation objectives. A full list of these objectives appears, with explanatory descriptions, within Chapter 9 of this plan.

The hazard mitigation goals and objectives listed in this plan were developed by the MHMCC and MCCERCC and the MSP/EMHSD staff after extensive hazards research, consultations with stakeholders, and years of experience in dealing with a wide variety of disasters and emergencies. The goals and objectives were developed from practical and philosophical considerations, which include but are not limited to the following:

- The desire to minimize hazard-related deaths and injuries as much as possible.
- The desire to minimize hazard-related property and environmental damage as much as possible.
- The desire to minimize the number of disasters that occur in Michigan, and their associated response and recovery costs, as much as possible.
- The desire to minimize negative hazard-related social and economic impacts.
- The desire to enhance and maximize coordination between local, state and federal agencies and applicable nongovernmental organizations in identifying problems, opportunities, and solutions, and to coordinate resources to implement the identified solutions.
- The desire to make hazard mitigation a part of the daily business practices of all Michigan governmental agencies and nongovernmental organizations, to the extent possible.
- The desire to keep hazard mitigation "on the front burner" of current issues, concerns, and priorities by institutionalizing it within comprehensive planning and land development processes at the local and state levels.

- The desire to make hazard mitigation an important part of the daily lives of all Michigan citizens by increasing their awareness of their hazard vulnerability, their willingness to undertake appropriate hazard mitigation measures for their homes and businesses, and their support for community and statewide hazard mitigation activities.

Development of Statewide Goals

With these and other relevant factors in mind, the MHMCC and the MSP/EMHSD began to develop a core set of hazard mitigation goals and objectives that reflected these practical and philosophical values as early as late 1998. Numerous work sessions were held during that period to develop and ultimately refine the plan goals which have served Michigan well since that time, even as numerous objectives within each goal have been changed and replaced. That original work had been carried out primarily through the MHMCC operating committee structure. Advice and assistance from numerous supporting agencies and organizations had been solicited during the development of the goals and have been open to input from the whole community ever since the first edition of this plan received official publication and gubernatorial adoption back in 2005.

After the federal Disaster Mitigation Act of 2000 and the subsequent development of regulations further interpreting that Act, these goals have been regularly revisited to ensure that they continue to be appropriate to address Michigan's wide array of hazards. More specific planning "Objectives" are placed under each of the main goals. Since many specific hazard mitigation actions must be implemented at a local level, this state plan emphasizes higher-level coordination and funding administration issues that cannot be covered in local plans. This newest edition in 2019 has made an effort for these objectives to be more heavily based upon the findings of the Michigan Hazard Analysis.

These goals include both the reduction of future hazard-related damage and negative impacts, through preventive mitigation, and the correction of existing problems (corrective mitigation) that may contribute to an increase in the number or severity of hazards and their resultant damage and impacts. One significant revision has been proposed and accepted for this 2019 update, in which the original phrase "land use planning/management" within Goal 2 has been amended to clarify and broaden the concept. Michigan's current goals are:

MICHIGAN'S STATEWIDE HAZARD MITIGATION GOALS

1. **Promote Life Safety:** Minimize disaster-related injuries and loss of life through public education, hazard analysis, and early warning.
2. **Reduce Property Damage:** Incorporate hazard mitigation considerations into land use planning, resource management, land development processes, and disaster-resistant structures.
3. **Build Alliances:** Forge partnerships with other public safety agencies and organizations to enhance and improve the safety and wellbeing of all Michigan communities.
4. **Provide Leadership:** Provide leadership, direction, coordination, guidance, and advocacy for hazard mitigation in Michigan.

Development of Objectives

In support of these four statewide goals, a number of specific objectives have been identified related to each goal. Those objectives, and guidelines for the implementation of each, are listed in Chapter 9. The list of objectives has been far more subject to change and reconsideration than the general goals–-changing and evolving with each new edition of this plan to better meet the current problems, concerns, and issues facing the State of Michigan, its local governments, private industry, residents, and other stakeholders.

Review of Goals and Objectives for 2019 Plan Revision

For the 2019 MHMP revision, the goals and objectives were thoroughly reviewed by the MCCERCC, MSP/EMHSD, and relevant stakeholders (i.e., state and federal agency subject matter experts and nongovernmental organizations). As a result of that process, the four goals remain essentially unchanged, but extensive changes were made to the objectives. Many objectives were reprioritized, amended as required, and "retired" (removed) if they were deemed either to have been adequately addressed or unfeasible within current and projected political and budgetary environments. These determinations were based on current and anticipated conditions in Michigan regarding hazard

risks and vulnerabilities, state and local governmental budgeting, and stated priorities of the new gubernatorial administration regarding governmental structure, functions, and standards. In accordance with the requirements of the Emergency Management Accreditation Program (EMAP) accreditation process (in which the State of Michigan has participated since 2011), some objectives address technological and human-related hazards (including homeland security), in addition to those natural hazard objectives that are expected and required by FEMA as part of the federal DMA 2000 plan approval process.

Consideration of Hazard Mitigation Ideas from Local Plans and Previous Disaster Reports

This 2019 MHMP includes an enriched consideration of two additional sources of important information: (1) Local hazard mitigation plans (or draft materials) from Michigan's 83 counties, plus selected additional local communities, universities, and Native American organizations, and (2) Post-disaster hazard mitigation strategies that had been developed after federally declared disasters. Information from these sources is presented within appendices. **Hazard mitigation project information from local plans has been summarized as part of Appendix 13. Information from hazard mitigation strategies from recent federal disasters is found in Appendix 14. Additionally, for Michigan's Executive Actions involving Flood Mitigation, please refer to Appendix 15.**

Selection and Prioritization of 2019 MHMP Objectives

The objectives presented in this updated 2019 edition of the Michigan Hazard Mitigation Plan were selected and prioritized according to the following criteria:

- Objectives have been added to the 2019 plan in order to better reflect activities that are actually being implemented by Michigan agencies, but which may not have been represented in previous editions.
- Activities considered to be very high priority by Michigan's agencies and active partners, by the Michigan Hazard Analysis, or within local hazard mitigation plans, were compared and prioritized according to their perceived balance of risks and expected benefits.
- Objectives listed in the 2014 MHMP were assessed to see (1) whether sufficient progress had been made to enable the objective to be removed from, or assigned a lower priority in, the updated list for 2019, or (2) whether progress had stalled because of resource, coordination, political, technical, or other issues.
- Objectives were re-prioritized on the basis of their perceived match with the current and anticipated trajectory of programs, administrative organization, funding, political support, or other aspects of the current operating environment. Some objectives were re-phrased to better match the current operating environment.
- Strategies for which resources were currently available, or likely to be available soon, were prioritized over objectives that required more resources than are likely to be available. The scope of some objectives has been adjusted so that there is a better match with the resources currently available.
- Objectives had their priority adjusted to reflect the degree of match between the involved tasks and the agencies available to implement them. The prioritization process favored objectives that seemed better-matched for Michigan's agencies and their active partners.

The following chapter includes additional detail that was considered appropriate for the specific objectives that were actually selected as a result of these initial prioritization considerations, such as the current implementation and funding capability of each lead agency and its main partners, estimated project cost-effectiveness, and other aspects of feasibility. This kind of additional information is presented in the notes that each of the objectives provided within the full list appearing in Chapter 9.

Michigan Hazard Mitigation Plan:
9. Action Plan for 2019-2024

Hazard Mitigation Opportunities, Recommendations, and Implementation

Overview and General Guiding Principles

The mitigation opportunities and recommendations listed (in the form of objectives) in the goals tables that follow are just that—opportunities and recommendations. Listing an objective does not necessarily mean that it definitely will be implemented. It merely means that the objective could, and probably should**,** be implemented because the basic principles behind the activity (or activities) associated with the objective are sound and will result in a reduction or elimination of damage, impact and suffering caused by natural, technological or human-related hazards. In the case of many high-priority objectives, however, implementation is already ongoing. This plan seeks to make more hazard mitigation actions an ongoing reality in Michigan's local communities, state agencies, and the private sector. The opportunities and recommendations contained in the goals tables that follow are designed to make a real difference in the lives of Michigan's citizens by reducing or eliminating the dangers and costs associated with disasters.

Political, social and fiscal realities must be understood and taken into consideration when implementing hazard mitigation activities. Even the best ideas and opportunities, if not crafted within the parameters of existing system constraints, may be considered impractical or unfeasible from the start. Some of the recommendations listed may be very difficult to achieve in the near future because it may have one or more significant constraints working against it. Nonetheless, those recommendations have been included in the plan because the principles behind the recommendation are strong and they at least warrant future consideration.

In developing mitigation recommendations and implementation strategies for the hazards addressed in this plan, the following general guiding principles have been included:

- Non-structural measures should be considered along with structural measures.
- Voluntary measures have been emphasized over mandatory measures.
- Education-based compliance and cooperation has been emphasized over legislated mandates.
- The least expensive alternative has, in general, been emphasized over more expensive alternatives.

Furthermore, the following additional principles will govern the development and implementation of flood hazard mitigation recommendations:

- NFIP-participating communities will have priority over non-participating communities.
- Communities and sites suffering repetitive losses will have greater emphasis.
- Flood mitigation projects will tend to be implemented in the following order of priority:
    1. Acquisition and relocation of flood-prone structures.
    2. Elevation of flood-prone structures.
    3. Stormwater management/improvement projects.
    4. Drainage projects (culverts, channels, retention ponds, detention ponds, etc.).
    5. Wet and dry flood proofing of structures.
    6. Structural measures (floodwalls, dikes, jetties, etc.).

Funding Sources for the Implementation of Hazard Mitigation Projects

For each mitigation opportunity or recommendation listed in the following tables, potential funding sources have been identified. For the most part, those sources include the federal Emergency Management Performance Grant (EMPG), and state, local and private funding, and the Hazard Mitigation Assistance program—an umbrella grant program that includes the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMAP), and the Pre-Disaster Mitigation Program (PDMP). A few items still refer to the Homeland Security Grant Program (HSGP), where still considered potentially relevant. Those are the primary funding mechanisms currently used to implement

hazard mitigation projects in Michigan (and most other states). It should be noted that Michigan does not yet have a state mitigation fund, although the establishment of such a fund is a recommended measure under Goal 4 of the Mitigation Opportunities, Recommendations, and Implementation Section that follows (see Objective 4.5 later in this chapter). The state does have a Disaster and Emergency Contingency Fund (DECF) as a result of amendments to P.A. 390, which requires the legislature to annually appropriate sufficient funds to maintain the fund at a level between $2.5 million and $10 million. This marks a substantial improvement over previous years, although the fund is not oriented specifically toward hazard mitigation.

Sources of pre-disaster funding include the federal grants available under PDMP and FMAP. One identified need had been for Michigan to compile specific information from local plans in order to better solicit specific hazard mitigation projects within the sometimes-tight timeframes under which applications must be submitted. This need has finally been met for this updated plan, as seen in the second part of **Appendix 13**.

The main source of post-disaster hazard mitigation funding is the HMGP. However, there have been numerous cases over the past decade in which Michigan has attempted to gain federal disaster declarations, but in which these attempts have resulted in disappointment, and a lack of additional HMGP funds. Some of the successful Michigan requests have been relatively modest in the amount of funds made available, and in some cases, the limited amount of post-disaster funds has meant that they only served a limited portion of the state, rather than a representative selection of communities, statewide. (The fairest distribution in such cases has often been considered as one that favors the area specifically impacted by the disaster.) The Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program provides funds for activities that reduce risks for eligible High Hazard Potential Dams. The MHMP was revised to comply with the additional analysis that is required to receive these funds.

A desirable future work activity for the MCCERCC Hazard Mitigation Committee could involve the identification of specific protocols for creating public/private partnerships and accessing private-sector funding for hazard mitigation purposes. It is unlikely that large amounts of private sector funding will be identified for general hazard mitigation use, but such funding would likely be targeted to specific projects, even if they may turn out to be one-time-only projects and circumstances. Nonetheless, private sector funding can, in many instances, be obtained and is a valuable supplemental funding source for project implementation in the right circumstances.

It is often possible to successfully fund hazard mitigation projects using other sources of federal funding targeted primarily for other purposes. This typically involves “multi-objective” projects that include, either purposely or coincidentally, hazard mitigation elements. For example, a riverfront parkland acquisition project also includes the added benefit of preventing unwanted development in the floodplain, thereby effectively mitigating potential flooding problems. These types of projects are possible and desirable, but they often are more difficult to implement because more individuals and agencies are involved and the benefits of hazard mitigation might not be the primary objective. However, under the right circumstances, they can work to the benefit of all involved parties.

Recognizing that fact, this plan includes guidance within **Appendix 10**, which can provide a “roadmap” to the many governmental and private sector funding programs and mechanisms currently in place that can be used to assist in implementing hazard mitigation projects and initiatives of a multi-objective nature. It points the way to more detailed information sources available to anyone via the Internet, such as the Federal Assistance Listing, state agency web sites that describe funding programs, and private philanthropic organization web sites. This information can be used either to help implement projects at the local level, or to identify potential funding sources for mitigation projects of regional or statewide application. Actual Michigan projects subsidized with federal funds are listed in **Appendix 11**.

Project Funding Criteria

Pursuant to Executive Order 2007-18, the MCCERCC is responsible for reviewing, prioritizing and selecting all projects for funding under the HMGP, FMAP and PDMP. The MSP/EMHSD and MCCERCC have established specific review criteria and a multi-step review process for carrying out that responsibility.

The review process in each case begins with the MCCERCC Hazard Mitigation Committee, which is responsible along with the MSP/EMHSD staff for screening of solicited applications and potential applicants. For each of the grant programs, the MCCERCC Hazard Mitigation Committee reviews the applications received (project and planning) to

ensure applicant, work and cost eligibility and to categorize the project type. For major events involving a large number of project applications, the MCCERCC Hazard Mitigation Committee has convened a State Selection Panel that consists of committee members, selected MSP/EMHSD staff, and state agency representatives with expertise in the particular type of disaster that occurred. The size of the State Selection Panel is left to the discretion of the Hazard Mitigation Committee chair, but typically consists of 7-10 individuals. The State Selection Panel reviews and evaluates each eligible application received (project and planning) and then prioritizes the applications using a numerical scoring system (from 1 to 5) based on the following criteria:

- The project demonstrates sound hazard mitigation techniques.
- The project is listed in the applicable local hazard mitigation plan.
- The project supports the Michigan Hazard Mitigation Plan.
- The project meets the required eligibility criteria.
- The project is suitable for funding under the Hazard Mitigation Assistance (HMA) programs, rather than other funding programs.
- The project is consistent with the MCCERCC approved strategy for the federally declared disaster (if applicable).
- The project completely or substantially solves the problem.
- The project provides a permanent or long-term solution.
- The project is likely to be cost-effective based on physical damages prevented.
- The project will not create negative environmental effects.
- The project is consistent with other projects, initiatives, and state agency priorities.
- Communities with the highest risk.
- Communities with the greatest number of repetitive-loss properties.
- Communities with the greatest number of NFIP-insured structures.
- Communities with the most intense development pressures.
- Communities with the largest increases in population and/or physical development.
- Communities that have the ability to successfully implement hazard mitigation projects within the required timeframes.
- Communities that have expressed interest in hazard mitigation activities.

The numerical scores for each project are added together and then divided by the number of voting members of the State Selection Panel, thereby establishing an average score for the project. The projects are then ranked according to their numerical score. (See **Appendix 10** for a sample project scoring matrix and a further explanation of the prioritization criteria used.)

Generally, the scored projects are then funded according to their ranking, up to the established federal funding limit, after receiving full Council concurrence. However, in some cases the Council may establish special priority for certain types of projects and those projects would then receive the highest funding consideration for that disaster. For example, the Council may determine that acquisition or elevation of flood-prone structures is the highest priority for a federally declared disaster and those types of projects would receive consideration over other types of projects for HMGP funding. Any special funding priorities established would be set forth in the mitigation strategy developed jointly with FEMA for that disaster.

For the nationally competitive PDMP, project applications are reviewed and prioritized for funding consideration by the Council upon recommendation of the MSP/EMHSD mitigation staff. All PDMP applications are submitted directly by applicants to FEMA via the federal E-Grants system. A prioritized project application listing is submitted by the MSP/EMHSD to FEMA for federal review by national review committees established by FEMA. Once the project applications enter that review process, there is no guarantee that the State's highest priority applications will actually be selected for funding under the PDMP. In some cases, lower priority projects may be selected because the national review committee felt that the higher priority projects were not eligible due to technical problems with the project or a lower benefit/cost ratio. Beyond any minimum amount that gets stated by FEMA as authorized for each state, it is possible that no additional projects get selected for the State of Michigan, due to the competitive nature of the programs.

In the event that project applications received exceed available funding possibilities, the projects will be prioritized and selected for funding consideration (e.g. on the basis of the highest benefit-cost ratio as determined by the applicant and the MSP/EMHSD staff). Other prioritization and selection criteria may be instituted by the MCCERCC Hazard Mitigation Committee based on current or anticipated local conditions or other relevant factors.

Under the HHPD program, EGLE analyzes its high hazard dam data to create a FEMA recommended risk matrix. The matrix is based primarily on individual Population at Risk (PAR) figures and the likelihood that a specific dam might fail (such a matrix is included in the Dam and Levee Failures chapter of the MHA). Not all high hazard dams are eligible for inclusion in the risk matrix due to federal requirements, which include Emergency Action Plans, FEMA-approved local hazard mitigation plans, and other criteria. A full list of limitations can be found HERE.

Assurances:
The State of Michigan will comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c) and will amend its plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

At the time of application for FEMA mitigation grant funds, applicants sign FEMA Form 20-16 certifying that they will comply with applicable standard assurances as follows: (FEMA Form 20-16A) Assurances for Non-Construction Programs, (FEMA Form 20-16B) Assurances for Construction Programs, (FEMA Form 20-16C) Certifications Regarding Lobbying; Debarment, Suspension, and other Responsibility Matters; and Drug-Free Workplace Requirements, and (FEMA SF-LLL) Disclosure of Lobbying Activities.

At the time of grant award for FEMA mitigation grant funds, recipients sign a grant agreement officially certifying that they will administer the grant in accordance with federal regulations including (but not limited to) Titles 2, 31, and 44 of the Code of Federal Regulations, OMB Circulars, and applicable State laws and statutes.

HAZARD MITIGATION OPPORTUNITIES, RECOMMENDATIONS, AND IMPLEMENTATION

Under the four planning goals, each objective is listed with one or more specific implementation methods, a priority classification, targeted completion date, potential funding source(s) if needed, explanatory comments including current "2019 status" description, any additional clarifying comments, and descriptions of benefit-cost considerations.

The current implementation status ("2019 status") of each objective from the 2014 plan edition can be found in the "Comments" section under each objective, including an explanation of any delays, implementation problems, or amendments made to the objective in this 2019 plan.

Objectives from the previous plans that have been completed or removed from further consideration (due to non-feasibility, consolidation or other reasons) have been transferred to the tables and listings within **Appendix 12**.

Benefit-cost review text ("BC Review") is provided for every objective, to explain why a net benefit would be expected <u>if</u> sufficient resources, staff time, interagency coordination, political priorities, etc. are sufficiently available to allow the objective's implementation.

The list of currently active, prioritized objectives for this 2019 plan is summarized in the corresponding table entitled "Summary of Target Completion Dates for Plan Objectives," at the very end of this chapter.

Notes for Goals and Objectives:

THE OBJECTIVES UNDER EACH GOAL ARE <u>NOT</u> LISTED IN ORDER OF PRIORITY.

Note on Committee Priorities: The MCCERCC Hazard Mitigation Committee re-assessed and re-prioritized these plan objectives in early 2019. Priority rankings are as follows:

HIGH PRIORITY objectives are those slated for implementation during the next 2 years (by 2021), as resources and circumstances allow.
MEDIUM PRIORITY objectives are those slated for implementation during the next 5 years (by 2024), as resources and circumstances allow.
LOW PRIORITY objectives are those slated for implementation over the next 10 years (by 2029), as resources and circumstances allow. (Note: This ranking may also include projects that, because of their nature, will require a multi-year, phased implementation approach. However, the one project from the 2014 plan which had that "Phased Implementation" status has been amended and reclassified within this updated plan.)

The option of having selected high-priority objectives being given additional emphasis was discussed by the MCCERCC Hazard Mitigation Committee. The possibility of having some objectives reclassified with a new "top priority" status was left open as an available option while every 2014 objective plus several new ones were discussed for inclusion, potential amendment, and re-prioritization in this plan. During that process, it was felt unnecessary to add an additional category to add additional emphasis to some of the objectives. Therefore, at the moment, all objectives do happen to be targeted for progress within the 5-year timeframe of this plan. In addition, discussion has begun to have this plan updated on a shorter time-frame (e.g. for upcoming EMAP re-accreditation, and then every 4 years). However, in terms of the implementation schedule for these objectives (displayed in a table toward the end of this chapter), a distinction was made between the HIGH (ongoing) classification and the HIGH classification, with the former listed within the year 2020 for their "completion" schedule (rather than repeating them within each year's listings). MEDIUM objectives also had some finer classification adjustments in their implementation priority within that table, although technically the three-category priority classifications were initially assigned and defined in terms of a 2-year timeframe, 5-year timeframe, and longer timeframe. It was felt that the FEMA prioritization standards would value the additional prioritization detail implicit within the "Summary of Target Completion Dates" table.

Funding Program Acronyms and Terms:

EMPG = Emergency Management Performance Grant
HMA = Hazard Mitigation Assistance
HMGP = Hazard Mitigation Grant Program
PDMP = Pre-Disaster Mitigation Program
FMAP = Flood Mitigation Assistance Program
CAP = Community Assistance Program
HSGP = Homeland Security Grant Program
CDBG = Community Development Block Grants
HHPD = Rehabilitation of High Hazard Potential Dam Grant Program
FEMA HMTAP = FEMA Hazard Mitigation Technical Assistance Program
RiskMAP = FEMA's RiskMAP (Mapping, Assessment, Planning) Program
USDA = United States Department of Agriculture
State Funding = Funds appropriated by the Michigan Legislature from the State General Fund
Private Funding = Funds provided by a private sector entity for hazard mitigation purposes

Cost-effectiveness is described using a text description under the heading "BC REVIEW." Formal techniques for the review of benefits and costs (including qualitative techniques) is described in the FEMA "How To" guidance document FEMA 386-5, "Using Benefit-Cost Review in Mitigation Planning," dated May 2007. An important part of the BC concept established by FEMA is that the total benefits of a project are to be compared with its total costs, regardless of who receives these costs and benefits. Project costs are usually being considered with respect to the justifiability of applying federal funds. Thus, although a specific project may involve a substantial federal subsidy, the federal grant usually is not seeking a net benefit for its own budget, but rather is seeking an overall collective benefit, in the form of reduced damages and costs for all who may be affected or at-risk (not just the government).

NOTE: All of these objectives have been considered satisfactory in terms of environmental soundness and technical feasibility. Some comments include clarification or confirmation of how a particular objective can address a full array of natural, technological, and human-related hazards ("multi-hazard" applicability), rather than just one specific type of natural hazard.

Goal 1

Promote Life Safety: Minimize disaster-related injuries and loss of life through public education, hazard analysis, and early warning.

Objective 1.1: Increase public and private sector awareness of hazard related dangers, resiliency principles, and mitigation solutions.

Implementation Method:

- State agencies will distribute information about hazard mitigation through training sessions, the internet, professional networks, and other readily available means.

Committee Priority: HIGH (ongoing)
Completion Target: 2021
Funding: HMA
Comments: (2019 status) Originally connected with an HMGP project to develop educational materials targeted to professional groups, for distribution on CD-ROM, this objective has evolved into a more general series of ongoing outreach and educational activities. The continued development and update of guidance documents for wider distribution through internet web sites, and the training offerings provided by state agencies and their partners, are the forms of outreach that this objective has most frequently involved.
BC REVIEW: Many casualties occur only because people were unaware of the actual risks present in hazards such as lightning, severe winds, industrial accidents, floods, hazardous materials incidents, public health emergencies, or wildfires. By building awareness through the provision of instructional materials and partnerships with other agencies (governmental, media, educational) at the local, state, and federal level, casualties are certainly prevented, for costs that are far less than most other projects. For example, the web posting of a booklet involves negligible marginal costs and therefore may pay off it its reading prevents even a single life from being lost. For example, the mere awareness of actual risks from lightning for persons outdoors may save lives.

Objective 1.2: Encourage and promote multi-hazard emergency plans in all public and private institutions, to include provisions for mitigating applicable hazards.

Implementation Method:

- Provide planning guidance, technical assistance, and continuous follow-up to applicable facilities, as required.

Committee Priority: HIGH (ongoing)
Completion Target: 2021
Funding: State Funding (General Fund), HMA, EMPG, etc.
Comments: (2019 status) Michigan schools are now required by 1999 PA 102 to plan for incidents of violence and other hazardous situations. Virtually all state-owned facilities have an emergency plan in place that addresses a wide range of hazards. Community and site planning for hazardous materials are ongoing activities and one of the main missions of MCCERCC. Such plans are informed by the Michigan Hazard Analysis and Michigan Emergency Management Plan, both of which are currently being updated. These are ongoing activities that will be continued and supported by state staff. State agencies also provide training to many persons in these subjects. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: Federal funding has been used for the development and maintenance of these plans, in accordance with relevant regulations. Plan development is not evaluated for a cost-benefit ratio in the way that physical projects are (although federal funding for physical hazard mitigation projects requires FEMA-approved state and local plans to be in place, and the development of emergency response plans is an ongoing activity associated with the Emergency Management Performance Grant at both the state and local level). In view of the enormous potential impacts of hazards such as transportation accidents, terrorism, wildfires, and infrastructure failures, it clearly makes sense to have coordinated planning efforts taking place throughout the state. Such plans also help to justify budgets and priorities established for grant fund use. The planning process requires the involvement of multiple agencies and thus encourages these other agencies to contribute their efforts and resources toward at least some of the goals, activities, and projects identified by the plans. It has been reported by some local emergency management programs in Michigan that the benefits realized from multi-agency coordination, by themselves, were already considered to justify the local planning efforts, even before the plan had been completed.

Objective 1.3: Promote local early warning systems and capability.
Implementation Method:
- Use information from local hazard mitigation plans to assess gaps in warning system coverage.
- Assist with funding warning systems and warning sirens in local jurisdictions, through the administration of FEMA Hazard Mitigation Assistance grant funds.

Committee Priority: MEDIUM
Completion Target: 2024
Funding: HMA, EMPG, HSGP
Comments: (2019 status) Many sirens have been funded by EMHSD through the use of federal funds. At certain times, the frequency of that activity would have qualified this action for high priority status, but the funds available for this activity have been limited to a limited, discretionary portion of HMGP post-disaster funds. The State endorses the nationally recognized Emergency Management Accreditation Program (EMAP) standards for early warning systems and capability as part of its ongoing local emergency management and hazard mitigation planning efforts. Federal mitigation grant funding will continue to be provided, where available and appropriate, for future early warning capability enhancement projects, but this may only mean a small fraction of the mitigation funds available after a declared disaster.
BC REVIEW: The great value of human life and health, and the relatively low cost by which many warning systems can alert large numbers of persons about hazardous events and conditions, warrant continued emphasis as a very cost-effective way of preventing casualties from all types of large-scale hazards. Michigan has been involved in the administration of federal funds that have been directed toward warning systems, with local emergency management programs themselves proposing the specific locations for sirens, and areas needing coverage by new warning systems. Other types of warning systems, such as the provision of NOAA weather radios to facilities (including equipment that had been specially adapted to serve the hearing-impaired), and the installation of radio relay towers, have also been funded. This is done in accordance with FEMA benefit-cost standards, typically through the use of "5%" State discretionary funds under HMA.

Objective 1.4: Promote the concept of "safe rooms" within homes, businesses, and local and state governmental facilities to prevent and minimize injury and loss of life from tornadoes and severe winds.
Implementation Method:
- Work with the Michigan Committee on Severe Weather Awareness to promote safe rooms as a viable option for severe storms protection.
- As circumstances allow, develop prototype "safe rooms" within public buildings to serve as demonstration projects.
- Develop new (or enhance existing) safe space public information materials for mobile home residents.
- Make use of available grants to support qualifying safe room projects.

Committee Priority: MEDIUM
Completion Target: 2024
Funding: HMA, EMPG
Comments: (2019 status) A safe room demonstration project was funded at the Michigan State University Day Care Center under HMGP for Federal Disaster 1346. (This project, which includes eight safe rooms, was completed during 2002.) FEMA provides detailed technical guidance in the form of publication FEMA P-361, which is available online for reference. Bullet 1 described an ongoing effort. Bullet 2 is exemplified by a safe room demonstration project at the Grand Traverse Band of Ottawa and Chippewa Indians Reservation in 2008, consisting of six safe rooms. Bullet 4 describes an ongoing effort.
BC REVIEW: Certain safe room projects have been shown to be cost-effective life-protective measures even when calculations have been focused exclusively on severe wind events. Safe rooms are potentially useful for other types of hazards for which sheltering may be useful, which might increase the cost-effectiveness of this strategy (e.g. technological and human-related hazard events that may result in a need for "sheltering in place," such as terrorism, nuclear attack, nuclear power plant accidents, or hazardous materials incidents). Each proposed safe room is assessed on a case-by-case basis, using a FEMA-established quantitative assessment. (Additional safe room projects may be

privately implemented, without the use of grant funds, by business and residential owners who have independently decided that the projects are useful.)

Objective 1.5: Support and utilize a system of real-time rainfall and river flow gauges throughout Michigan as part of an overall flood warning system.

Implementation Method:

- Support a multi-agency system of stream gauges and inter-gauge interpolation for local, state, and federal users.
- Incorporate stream gauge system and data into State hazard analysis and resource protection activities.
- Encourage local and regional agencies to consider or make use of stream gauge data in their own activities.
- Maintain weather web site to display precipitation information so that agriculture and fire weather notice and actions may be undertaken in a timely manner.

Committee Priority: HIGH (reclassified from MEDIUM)

Completion Target: 2021

Funding: Federal Funding (current effort led by U.S. Geological Survey); state/federal partnering agencies

Comments: (2019 status) Several state agencies supported a U.S. Geological Survey grant proposal to obtain funds for inter-gauge interpolation of stream gauge data starting in 2013. A StreamStats system provides information to local, regional, state, and federal agencies. Stream gauges are in place on many rivers throughout the state, but conditions between the gauges must be interpolated, to make the gauges maximally effective. Beta versions of interpolated stream monitoring have recently become active. This objective has therefore been upgraded to HIGH priority, in light of these new advances. Many gauges that are already in place throughout Michigan as part of a real-time monitoring system can be examined through the WaterWatch web site at http://waterwatch.usgs.gov).

BC REVIEW: Although an expansion of the gauge locations does seem to be cost-effective within floodplain areas that contain development, the capacity to use computers to interpolate stream conditions between these gauges similarly appears beneficial to provide extra information for many areas throughout the state, at a cost that is ultimately lower than adding and maintaining additional gauges. Although originally designed for flood mitigation, these gauges are also useful for other water-related hazards, such as the 2010 Enbridge pipeline break disaster, in which a large amount of fuel was accidentally released into the Tallmadge Creek and Kalamazoo River. Immediate access to water level measurements provided useful information for emergency responders, technicians, and engineers.

Objective 1.6: Develop comprehensive hazard analyses and risk assessments, as part of a hazard mitigation plan development process in all local emergency management program jurisdictions, to address all pertinent natural, technological, and human-related hazards.

Implementation Method:

- The multi-year hazard analysis development process initiated in FY 2000 is primarily implemented by municipal and county governments and their partnering agencies, making use of local grant agreements (annual work plans for EMPG-funded emergency management programs), available planning grants, and dedicated hazard mitigation planning staff in MSP/EMHSD.
- Create hazard area data sets using the locally compiled and reported hazard data.
- Overlay the hazard area data on the critical facilities inventory and relevant population data to identify and further define and quantify risk and vulnerabilities.

Committee Priority: HIGH (Ongoing)

Completion Target: 2021

Funding: EMPG, HMA

Comments: (2019 status) Local emergency management program jurisdictions (and their partnering agencies) use printed and digital (web-posted) guidance materials, plus state-agency input and training opportunities, to develop a detailed hazard analysis as part of their local hazard mitigation plan development process. Local hazard data is, in turn, compiled by the MSP/EMHSD over time, feeding into periodic updates of the Michigan Hazard Analysis and Michigan Hazard Mitigation Plan. Some of this information is used at the state and local levels to develop and select hazard mitigation projects and to make more informed hazard mitigation decisions (e.g. see Appendix 13 within this document). This objective still describes ongoing activities for MSP/EMHSD and its network of local emergency management programs, funded through EMPG. It ties in with other assessment processes overseen by different

branches of government, such as the flood map updates, transportation plans, public health plans, and so on. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: Federal funding has subsidized the development of local hazard analyses and mitigation plans in about 100 local Michigan EM programs. Since plans assist with quality hazard mitigation project selection, and the tens of millions of dollars so far spent on hazard mitigation has been estimated to save as much as 6 times as much in long-term reductions in emergency response costs, property damage, environmental impacts, loss of life, and economic/business impacts, it has been deemed worthwhile to include the costs of planning as part of that calculation.

Objective 1.7: Update the Michigan Hazard Analysis to include the full array of natural, technological, and human-related hazards.
Implementation Method:
- Expand the Michigan Hazard Analysis (EMHSD Pub. 103) by 2020, to update the full array of technological and human-related hazards required under EMAP standards.
- Document will be reviewed by FEMA and EMAP personnel, to ensure that it complies with the current standards rooted in the Disaster Mitigation Act of 2000, and the Emergency Management Accreditation Program.

Committee Priority: HIGH (Ongoing)
Completion Target: 2020
Funding: EMPG, HMA
Comments: This objective had previously appeared in the 2005 and 2008 editions of the Michigan Hazard Mitigation Plan. It has been restored to this 2019 plan, to reflect the anticipated need for a Michigan Hazard Analysis document to include updated technological and human-related hazard chapters to comply with the standards of the Emergency Management Accreditation Program. The document will still provide a factual basis for the MHMP, MEMP, various local hazard mitigation plans, and other processes, and if the Michigan Hazard Mitigation Plan is also updated earlier than its required 2024 timeframe, then a 2020 update of the Michigan Hazard Analysis might be well-timed to be integrated into full plan update if it occurs around the same time or not too long afterward.
BC REVIEW: This document is updated primarily with the staff time of existing department personnel, and is therefore deemed cost-effective to support the various activities just described.

Goal 2

Reduce Property Damage: Incorporate hazard mitigation considerations into land use planning, resource management, land development processes, and disaster-resistant structures.

Objective 2.1: Increase knowledge of urban/regional planners and emergency managers about sound land use and development practices that can help reduce long-term hazard risks and vulnerabilities.

Implementation Method:

- Coordinate with accreditation organizations for undergraduate and graduate city, urban, and regional planning programs at Michigan colleges and universities, to encourage integration of hazard mitigation principles and practices into comprehensive planning courses, and the development of course, materials, and conference sessions on the topic.
- Encourage the American Institute of Certified Planners (AICP) and the American Planning Association to include questions pertaining to hazard mitigation on the exam for AICP certification.

Committee Priority: HIGH (Ongoing)
Completion Target: 2021
Funding: EMPG
Comments: (2019 status) A Hazard Mitigation / Comprehensive Plan Interface course is included in MSP/EMHSD PEM training requirements, and the course is consistently offered as part of the MSP/EMHSD training curriculum. In addition, hazard mitigation training sessions and presentations have been offered to planning and urban studies students at Wayne State University, Michigan State University and the University of Michigan at various times since 2001. These sessions and presentations continue to be offered as requested. In recent years, awareness and outreach has been greatest at Michigan State University, due primarily to the convenience of its location and the great overlap between State government and university social networks. State agencies gave presentations at a 2017 "Resilience Summit" conference of the Michigan Association of Planning, in 2018. A webinar on hazard mitigation was hosted by the MSU Extension Region for the Saginaw Bay watershed, and posted online for additional viewing. Other educational institutions and conferences are hereby encouraged to inquire about having a guest speaker from EMHSD on the topics of hazard awareness, hazard vulnerabilities, and hazard mitigation activities. Additional presentations have occurred at other professional conferences around the state. Information on the FEMA Mitigation Management Series training courses has been included in recent MSP/EMHSD Training Catalogs. Planning guidance is provided online and in MSP/EMHSD Publication 207a (Hazard Mitigation Planning Handbook). This document and the Michigan Hazard Analysis have been widely distributed to the planning community and to other professional disciplines involved in hazard mitigation and/or land use planning in Michigan. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: The costs of guidance activities are being minimized through the use of internet resources, but there are still many live conferences which involve invited speakers and direct social networking. The benefits of these conferences is indicated by their continued occurrence and the sometimes substantial registration fees that are willingly paid by attendees and their organizations. Guidance documents can be readily accessed from federal and state agency web sites, and their use is encouraged during correspondence, courses, and presentations at already-established conferences. Since these conferences are already held periodically, costs are not great to simply add or fill one of the sessions with a speaker on the subject. The publication of articles and letters in planning magazines and newsletters (or editorial postings on web pages and associated web logs) is also considered to be a very cost-effective means of reaching a large number of professionals. The costs of such activities would easily be justified if hazard awareness allows even just a few extra lives to be saved. The urban and regional planning profession has traditionally sought to foresee and address such issues as infrastructure failures, transportation accidents, and potentially conflicting land uses (e.g. the segregation of industrial hazardous materials handling from schools and residential areas). Michigan's guidance documents, technical assistance, and plans seek to expand planners' awareness of additional types of spatial and systemic interactions, such as the potential impact of hazards upon critical facilities, special populations, and other emergency management concerns (such as the capacity for evacuation and other emergency response actions within a vulnerable area).

Objective 2.2: Additional evaluation of flood vulnerabilities in specified state owned/operated critical facilities.
Implementation Method:

- As needed, arrange with vendors for a detailed assessment of the flood vulnerabilities of state owned or operated critical facilities to help to determine what protective measures might reduce those vulnerabilities and also lower insurance costs.
- Michigan Department of Technology, Management and Budget (MDTMB) oversees these studies at designated sites on a periodic basis, coordinated with insurance needs.

Committee Priority: MEDIUM
Completion Target: 2024
Funding: Facility and Insurance Budgets, HMA, FEMA HMTAP, RiskMap, USGS, etc.
Comments: (2019 status) A detailed study of vulnerable state owned/operated critical facilities, specifically, is performed as needed, in conjunction with insurance arrangements and through the use of vendor services. These help to determine the types of floodproofing or flood mitigation projects that could permanently reduce a facility's vulnerabilities to flooding. This objective has been re-worded with MDTMB assistance, to clarify the nature of activities to support this objective.
BC REVIEW: The coordination with insurance concerns assures that flood mitigation is considered to be cost-beneficial. Some of the facilities in question involve critical functions and other types of emergency-related concerns, such as public health, energy emergencies, transportation accidents, and infrastructure failure.

Objective 2.3: Consolidate flood-related data into appropriate Geographic Information Systems to promote increasingly integrated assessments that inform development decision-making and future land use planning.
Implementation Method:

- Make the results available to all appropriate land use planning and regulatory agencies in the state.
- Where resources allow (e.g. transportation studies), use the available data to assess the need for water storage areas at each project site or within a floodplain area.
- Promote multi-agency and intergovernmental coordination between public agencies and private developers so that drainage and infrastructure needs are more effectively addressed.

Committee Priority: HIGH (reclassified from LOW – Phased Implementation)
Completion Target: 2021
Funding: HMA, CAP, FEMA HMTAP, USGS, USACE, State Funding (General Fund)
Comments: (2019 status) The Michigan Hazard Analysis provides a mechanism for achieving progress in this task, the new 2019 edition having included updated maps showing all currently available dFIRM information throughout the state. More extensive analysis using Geographic Information Systems is anticipated to follow within the next 5 years as the state becomes comprehensively covered with digital information from LiDAR. RiskMAP activities have been ongoing and continue to occur in Michigan watershed areas and their associated local governments. The ready availability of digitized floodplain information across Michigan will thus enable the quality of flood analysis to improve. Further dFIRM progress is still being awaited, however.
BC REVIEW: Specialized Geographic Information System resources makes new kinds of research feasible. As digital flood information becomes available from RiskMAP and LiDAR projects in Michigan, it can be used for hydrologic modeling, floodplain overlays, and other analyses. The result can take the form of detailed maps that estimate flood risks throughout the state's diverse facility locations. A complete "layer" of floodplain areas throughout the state, "overlaid" with a complete layer of critical facility locations, would provide an ideal starting point, followed by further considerations of local topography and "first floor elevations" for facilities that may be at-risk. As with planning activities, the expected benefits of these risk assessment activities are expected to exceed the costs of that research. Moreover, some of these topographic and hydrological analyses can be useful for hazards such as pipeline breaks, chemical spills, or water contamination. Further development of digital geographic data sets may be needed on the part of specialized geologic or hydrologic agencies to make the costs (mostly staff time for data preparation and processing) lighter. With further progress on that task, and confirmation that modeling capabilities are sufficiently valid, greater certainty about the cost-effectiveness of this objective would result.

Objective 2.4: Acquire/remove, relocate, or elevate structures that currently occupy Michigan's floodplains, or that have otherwise suffered from repetitive flood losses.

Implementation Method:

- Identify structures that are in floodplains, or that have suffered from repetitive flood losses.
- Acquire/remove, relocate, or elevate these at-risk structures.

Committee Priority: HIGH

Completion Target: 2021

Funding: HMA

Comments: (2019 status) This objective has merged together two previous objectives that had been separately listed within the 2014 MHMP (as objectives 2.4 and 2.5). These activities are addressed by Hazard Mitigation Assistance projects, such as those described in Appendix 11 in this document. The acquisition and relocation of at-risk structures has been consistently funded under various HMA program cycles. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**). Also see **Appendix 10** for RL and SRL detail.

BC REVIEW: The projects for this objective are typically assessed on a case-by-case basis, and the consent of private property owners is essential. Projects funded through HMA grants must pass a FEMA-mandated benefit-cost analysis calculation, to demonstrate the cost effectiveness at each proposed project site. Thus, those specific projects to be funded with federal matching grants will have had their cost-effectiveness verified in this way. Some at-risk properties may involve businesses that handle hazardous materials (or provide valuable community services), and thus help to prevent secondary harm from such hazards in the event of a flood.

Objective 2.5: Encourage Community Wildfire Protection Plans and establish and sustain additional FIREWISE communities, statewide.

Implementation Method:

- The MDNR will assist communities in developing Community Wildfire Protection Plans (CWPP), as funding allows.
- Communities with completed CWPPs are to be encouraged, as appropriate, to obtain FIREWISE designations to address their wildfire risks/vulnerabilities (where local willingness exists to establish and sustain the program).
- As MDNR staff resources allow, work with the identified communities to focus local activities to meet FIREWISE program requirements, fire-related elements of their CWPPs, "fire adapted community" standards, etc.
- Formally recognize outstanding CWPPs, examples of FIREWISE community participation, "fire adapted communities," and other wildfire-related achievements, as a "best practice" for other Michigan communities to emulate.
- Expand wildfire mitigation to include related efforts, such as the "fire adapted communities" standard, referenced in the new guidance document available at http://www.fs.fed.us/openspace/fote/reports/GTR-299.pdf.

Committee Priority: HIGH

Completion Target: 2021

Funding: USDA Forest Service, HMA, EMPG, local match

Comments: (2019 status) The promotion of the FIREWISE program in Michigan dates back to pilot programs in 2001. The MDNR Forest Management Division established pilot FIREWISE communities and then sought to expand the program statewide. A state "FIREWISE" Conference was held in December 2001. A statewide fire threat assessment project was partially funded under the HMGP for Federal Disaster 1346. Wildfire mitigation efforts are more diverse than just the FIREWISE program, so this objective recognizes multiple related means of increasing wildfire resilience and safety. Part of this objective had involved the completion of the "Wildfire Prevention in Southern Michigan Project" funded under Federal Disaster 1346-DR-MI. Future, relevant projects covering multiple areas of the state are being promoted as time, resources and circumstances permit.

BC REVIEW: This strategy would encourage CWPP, FIREWISE, and other community preparedness and wildfire mitigation activities. Since it need not add heavy administrative or staffing requirements, and would be adopted by communities that have substantial wildfire risks, its guidance and coordination efforts toward wildfire preparedness, mitigation, and management is considered to be clearly cost-beneficial for these communities, in light of the substantial wildfire costs and risks many of them have endured. This initiative can also help to protect against the failure of critical facilities and infrastructure which may be located in the wildfire risk area.

Objective 2.6: Promote and assist with flood mitigation projects in all vulnerable areas, statewide.
Implementation Method:
- EGLE will continue their flood mapping coordination work, dam safety programs, NFIP outreach, and other activities to alleviate general flood risks (beyond the specific sites identified in Objectives 2.4 and 2.11).
- MSP/EMHSD will continue to provide technical assistance with, and promotion of, hazard mitigation planning that identifies potential at-risk sites for flood mitigation activities.
- MSP/EMHSD will continue to administer grant programs that allow federally subsidized flood mitigation activities to occur.
- Develop ways to evaluate flood damage to and caused by the failure of sewage handling systems.

Committee Priority: HIGH
Completion Target: 2021
Funding: HMA, EMPG, State Funding (General Fund)
Comments: (2019 status) This objective generally covers all additional flood mitigation activities not otherwise specified. The projects are mainly determined in accordance with HMA funding principles and voluntary participation by property owners and the communities they are located within. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: Evaluations of flood mitigation projects are typically assessed on a case-by-case basis, and the consent of the involved property owners is essential. In the case of grant-funded projects, a specific benefit-cost analysis calculation is required by FEMA to demonstrate the cost effectiveness at each proposed project site. Thus, those specific projects to be funded with federal matching grants will have had their cost-effectiveness verified as a part of the grant's administrative procedures. Additional benefits from some of these projects might include reductions in infrastructure failures, hazardous material incidents, transportation accidents, and other flood-associated hazards.

Objective 2.7: Promote and assist with wildfire mitigation projects statewide.
Implementation Method:
- MDNR will make use of grants from the USDA Forest Service to help fund local communities in their development of Community Wildfire Protection Plans.
- Coordinate with USDA Forest Service in their Landfire fuel modeling program to assess statewide fire risks.
- Since wildfires can be very damaging in large areas of Michigan, scan local plans for hazard mitigation projects to support with technical assistance and/or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2021
Funding: HMA, EMPG, USDA Forest Service
Comments: (2019 status) This objective generally covers all additional wildfire mitigation activities not otherwise specified. MDNR and USDA Forest Service coordination has been ongoing for years now.
BC REVIEW: The evaluation of wildfire mitigation projects must be assessed on a case-by-case basis. Although there is not an extensive history of HMA funding for such projects in Michigan, an array of USDA Forest Service activities has been increasing. Past damages from this hazard have sometimes been extensive, and therefore new ways to prevent or mitigate its impacts need to be explored. It is therefore judged as cost-effective to promote such efforts.

Objective 2.8: Identify and fund appropriate mitigation measures for vulnerable public and private facilities and infrastructure.
Implementation Method:
- Continue to identify, solicit, fund and implement cost-effective, environmentally sound, and technically feasible mitigation projects under the HMA, EMPG, and other pertinent programs.
- Per Objective 1.3, fund early warning systems under the HMGP 5% state discretionary set-aside provision and other pertinent programs.
- Per Objective 1.4, fund "safe rooms" within vulnerable public and private structures.
- Per Objective 2.2, further define identified flood vulnerabilities in state owned/operated critical facilities.
- Per Objective 2.4, acquire/remove or relocate at-risk structures currently occupying Michigan floodplains, or that have suffered from repetitive flood losses.

Committee Priority: HIGH
Completion Target: 2021

Funding: HMA, EMPG, State Funding (General Fund), Private Funding (Partners TBD), FEMA HMTAP.
Comments: (2019 status) Please refer to the specific objectives referenced in the bullet points for more details related to each action item. The State of Michigan has funded, or is currently funding, structural and/or non-structural measures under each of the objectives listed in the "Implementation Method" descriptions. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: Although limited federal funds are available for hazard mitigation projects at any given time, such grant funds are only given to subsidize projects that have passed a formal, FEMA-mandated benefit-cost review, thus ensuring that such expenditures are considered to be cost-effective, on a case by case basis.

Objective 2.9: Promote and assist with severe wind mitigation projects statewide.
Implementation Method:
- Since tornadoes and severe winds are very damaging events in Michigan, scan local plans for hazard mitigation projects to support with technical assistance or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2021
Funding: HMA, EMPG
Comments: (2019 status) This objective generally covers all additional wind and tornado mitigation activities not otherwise specified.
BC REVIEW: The evaluation of wind mitigation projects must be assessed on a case-by-case basis. Yet, the damages from this hazard are extensive, and therefore some of the identified ways to prevent or mitigate its impacts are likely to include measures that are cost-effective. Additional benefits may include reductions in infrastructure failures, transportation accidents, and other hazards.

Objective 2.10: Promote and assist with winter weather mitigation projects statewide.
Implementation Method:
- Since severe winter weather is very damaging in Michigan, scan local plans for hazard mitigation projects to support with technical assistance or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2021
Funding: HMA, EMPG
Comments: (2019 status) This objective generally covers all additional ice storm, snowstorm, and deep-freeze mitigation activities not otherwise specified.
BC REVIEW: The evaluation of winter weather mitigation projects must be assessed on a case-by-case basis. Yet, the impacts from these hazards have been extensive, and therefore some of the identified ways to prevent or mitigate their impacts are likely to include measures that are cost-effective. Additional benefits may include reductions in infrastructure failures, transportation accidents, and other hazards.

Objective 2.11: Prioritization of HHPD funds availability to reduce risks and vulnerabilities at Michigan's grant-eligible dam locations.
Implementation Method:
- Grant application for rehabilitation of the Edenville and Sanford Dams using HHPD funds.
- Updating risk analysis processes to facilitate future grant applications for other eligible dams.

Committee Priority: HIGH
Completion Target: Application in 2021 (project implementation would normally occur within the 36-month Period of Performance for the HHPD grant). Updating of risk analysis processes is underway but will require a multi-year effort to fully complete.
Funding: HHPD, with local match requirement
Comments: Although this objective is placed under MHMP Goal 2 (Reduce Property Damage), it also directly serves Goal 1 (Promote Life Safety) because of the safety risks presented by flash flood vulnerabilities. The EGLE Dam Safety Program is currently updating risk prioritization assessments for all of its regulated dams. Update priority is being given to High Hazard Potential Dams in poor or unsatisfactory condition, and then to Significant Hazard Potential Dams in unsatisfactory or poor conditions, and finally to all remaining High and Significant Hazard Dams (with Low Hazard Potential Dams being last). The DSP is using the FEMA Risk Prioritization Tool (FEMA P-713) to

help facilitate the process. Initially, this assessment will be based on coarse information readily available within the database such as condition rating, hazard classification, dam height, and downstream population (which is based on census data for downstream communities). Inundation mapping and human consequence analyses will be performed for all High and Significant Hazard Potential Dams. Where inundation maps aren't currently available, the DSP will utilize DSS-Wise to estimate PAR. Pending legislation if passed would also legally require dam owners to provide inundation mapping. In the interim, EGLE is prioritizing a paper map digitization process for its HHPD eligible dams. The DSP has begun tracking deficiencies at dams as reported in dam safety inspections in order to improve Potential Failure Mode (PFM) probabilities. It is also anticipated that future inspections and engineering re-evaluations will require PFM Analyses for all High and Significant Hazard Potential Dams, which will identify PFMs for incorporation in future risk prioritization assessments.

Dam Name	Deficiencies	Ongoing/Planned Mitigation
Little Black River Structure B	Piping with embankment loss adjacent to outlet pipe on downstream slope.	Initial communications have been sent to the City of Cheboygan (owner) requesting engineering evaluations and repairs to the outlet pipe and embankment. Given past engagements on City facilities and known financial constraints, further compliance and enforcement is planned.
Cornwall Creek Dam	Does not meet desirable factors of safety for slope stability due to ineffective clay core and high phreatic surface.	MDNR has completed design for rehabilitation of the dam. However, construction bids came in higher than current funding. MDNR is determining whether to move forward with rehabilitation or removal.
Portage Plant Dam	Engineering inspection long overdue	Dam owner has hired engineering consultant to complete inspection and report is anticipated shortly.
Manistique Papers Dam	Currently there is no legal owner of the dam due to bankruptcy and foreclosure. Significant structural deterioration of all concrete components. Difficulty with managing and operating gates, causes concerns for flow management.	While the Manistique Dam is in deplorable condition, it is already drawn down as far as possible through non-destructive means. The USACE is currently working on a project that would acquire the property through eminent domain and remove the existing dam.
Secord Dam	Spillway lacks adequate hydraulic capacity and embankments lack desirable factors of safety for potential instability modes.	Impoundment is currently drawn down to spillway crest, until all safety upgrades are completed. This includes sheetpile cutoff walls and increased spillway capacity.
Smallwood Dam	2020 flood exposed concerns for erosion and embankment loss at auxiliary spillway. Additionally, erosion on downstream slopes around primary spillway identified need for additional erosion protection.	Impoundment is currently drawn down to spillway crest, until all safety upgrades are completed. This includes more sheetpile cutoff walls and increased spillway capacity.
Edenville Dam	Dam failed on May 20, 2020. Failure mode was identified as static liquefaction induced by elevated water levels. Spillways lacked adequate hydraulic capacity.	Following the failure of Edenville Dam, temporary stabilization projects have been implemented to ensure the remaining dam features meet design standards, until the dam is reconstructed.
Sanford Dam	Dam failed on May 20, 2020. Failure mode was overtopping due to upstream failure of Edenville Dam. Former dam relied on fuse plug spillway for increased capacity.	Following the failure of Sanford Dam, temporary stabilization projects have been implemented to ensure the remaining dam features meet design standards, until the dam is reconstructed.
Buttermilk Creek Detention Dam	At some point, the auxiliary spillway for the dam was filled in for development of adjacent property. Further analysis required to determine impact on design flood capacity.	Owner's engineer has completed preliminary evaluation of design flood routing for the dam's current condition. Primary spillway has capacity to pass design event with limited freeboard. Further investigations are ongoing to restore auxiliary spillway or increase capacity of primary spillway.

BC REVIEW: The costs of the May 2020 disaster involving the Edenville and Sanford Dams has been estimated at $200-$320 million, with initial costs for surveying, engineering, and stabilizing just the Edenville Dam structure estimated at roughly $4 million. A recent HHPD grant award is for $396,745 (which includes a 35% state match, making total approved project costs $610,377). An updated assessment of average annual costs from dam failures within the past 40 years, described within the Michigan Hazard Analysis, estimates dam failure impacts to be about $18.1 million per year, assuming that most of the costs from a similar 1986 disaster had also arisen from its associated 11 dam failures.

Goal 3

Build Alliances: Forge partnerships with other public safety agencies and organizations to enhance and improve the safety and wellbeing of all Michigan communities.

Objective 3.1: Promote urban forestry and vegetation management programs and initiatives to develop more resilient woodlands, streetscapes, and landscapes in communities throughout Michigan.

Implementation Method:

- Promote coordination and provide technical support for local urban forestry programs (professional guidance, training, and education; tree selection, planting, and maintenance; local tree ordinance development; public awareness and education; street and park tree management and planning; community climate adaptation planning; utility vegetation management, awareness, and safety; recognition/certification).
- Conduct periodic educational programs on creating and maintaining a storm-resistant urban forest, targeted at urban forestry programs and local public works agencies, making their areas more resistant to severe winds, fires, lightning, ice storms, and invasive species.

Committee Priority: HIGH

Completion Target: 2021

Funding: EMPG, HMA, State Funding (General Fund), Private Funding

Comments: (2019 status) The MDNR Urban and Community Forestry (UCF) program covers the details in the first bullet point, and its recognition/certification aspects include designations such as "Tree City USA," "Tree Line USA," and Certified Arborist. The Michigan Urban and Community Forestry Council (MUCFC) is an advisory committee to state and urban foresters, and works to promote, recognize, and support effective and sustainable management of urban and community forests throughout the state.

BC REVIEW: Urban forestry programs have produced useful results in areas that were determined by local authorities (or utility providers) as being cost-beneficial. For example, where tree damages are likely to block high-traffic roads, heavily damage nearby property, or interfere with the services provided by critical infrastructure (e.g. electricity, telephones, drains, and sewer services), then some preventive urban forestry activities have clearly been beneficial. By promoting these types of programs, numerous local residents and programs are encouraged to identify the most promising locations and activities where the needs for action greatly exceed the associated costs.

Objective 3.2: Promote floodplain management activities throughout Michigan, and increase statewide participation in the National Flood Insurance Program.

Implementation Method:

- Conduct Community Assistance Contacts (CACs) and Community Assistance Visits (CAVs) to promote the NFIP.
- Where feasible, promote participation in the NFIP (as a viable and prudent flood mitigation measure) in all MSP/EMHSD and EGLE hazard mitigation guidance documents.
- Promote the NFIP at applicable governmental conferences and trade shows.
- Fully participate in all FEMA sponsored promotional events and activities for NFIP recruitment.
- Participate in RiskMAP activities and agency coordination.
- Following federally declared disasters in Michigan, coordinate with FEMA to deliver NFIP technical assistance to communities.

Committee Priority: HIGH (Ongoing)

Completion Target: 2021

Funding: EMPG, HMA, CAP, State Funding (General Fund)

Comments: (2019 status) The activities are all ongoing implementation efforts. EGLE regularly conducts CACs and CAVs to promote NFIP and floodplain management as part of its regular work plan under the federal CAP grant with FEMA. The EGLE regularly presents information on the NFIP at applicable conferences, training workshops, trade shows, etc. involving both flood hazard management professionals and elected officials. Both activities will continue to the extent possible. The MSP/EMHSD and EGLE promote NFIP participation in their guidance publications, and will continue to do so. The activity has become a part of FEMA-approved local hazard mitigation plans throughout Michigan. Progress on flood map updates has been substantial and widespread, as has been participation in the activities of the RiskMAP program. Several state agencies regularly attend local meetings in support of the RiskMap

program, helping to identify hazard vulnerabilities and brainstorm local hazard mitigation activities. This objective corresponds with recommendations within Disaster Strategies #4195, 4326, and 4381 (see **Appendix 14**).
BC REVIEW: Compared with the annual damages caused by flooding each year, the costs of encouraging most communities to participate in the NFIP are minor. In addition to making flood insurance available to residents throughout these communities, the NFIP (and its associated Community Rating System) encourages flood mitigation activities designed to reduce future losses. The NFIP also encourages improvements in various policies and practices, designed to increase the long-term safety and security of residents and communities. The costs associated with such improvements are also not primarily borne by just a few agencies or stakeholders, but are widely distributed among a great many public and private stakeholders, in a carefully calculated manner. Thus, the efforts and expense borne by any single participant in this network of stakeholders tends to be appropriate, from a cost-effectiveness standpoint.

Objective 3.3: Maintain and strengthen partnerships and coordination between public, private, and non-profit agencies.
Implementation Method:
- Maintain and strengthen coordination between federal and state agencies, and other participants in the Silver Jackets program.
- Maintain and strengthen coordination between state agencies and their partners and constituents.
- Continue MCCERCC coordination and activities.
- Maintain agency district, associated local networks, and other whole community outreach.

Committee Priority: HIGH (Ongoing)
Completion Target: 2021
Funding: State Funding (General Fund), EMPG, HMA, USACE
Comments: (2019 status) This is a new objective for 2019. Michigan's official Silver Jackets charter was put into place in 2016, and the Silver Jackets team was included within the processes to update the Michigan Hazard Analysis, Michigan Hazard Mitigation Plan, and related hazard mitigation projects, meetings, conferences, and opportunities. Regular meetings of State Emergency Management Coordinators and the governor-appointed MCCERCC body have provided many coordination opportunities directed toward hazard mitigation objectives, including the involvement of both within the update process for the Michigan Hazard Analysis, Michigan Hazard Mitigation plan, and related activities. Various state agencies work in coordination with local partners through districted or regionalized programs, representative associations, and other professional networks. In addition, all have at least occasional associations with volunteer agencies, private for-profit and non-profit organizations, utility providers, quasi-governmental entities, and programs and representatives of tribal organizations and neighboring states.
BC REVIEW: Most of these activities are integrated into the work of existing personnel, or so directly related to the stakeholders' missions that they are considered cost-effective. Decisions to increase staffing levels, attend training sessions, participate in exercises, or to host conferences, workshops, and coordination meetings all tend to be rooted in the value of these partnering activities as they enhance and parallel the specific programs whose merits have already justified their current funding levels.

Objective 3.4: Identify, establish, and promote new partnership opportunities.
Implementation Method:
- Agencies and their personnel will keep aware of other entities that share similar goals and may be available for coordination.
- When appropriate, more formal partnerships can be officially recognized.

Committee Priority: MEDIUM (Ongoing)
Completion Target: 2024
Funding: State Funding (General Fund), EMPG, HMA, USACE
Comments: (2019 status) This is a new objective within this plan. The formal establishment of Michigan's Silver Jackets charter in 2016 was an example of how what at first began as a voluntary series of meetings, at the original invitation of the U.S. Army Corps of Engineers, eventually became accepted as a beneficial arrangement and institutionalized by the most heavily involved organizations. Similar activities have been and continue to be explored. For example, the Michigan Climate Coalition has become increasingly involved in coordination with MSP/EMHSD and the review and refinement of appropriate sections of the Michigan Hazard Analysis.

Goal 4

Provide Leadership: Provide leadership, direction, coordination, guidance, and advocacy for hazard mitigation in Michigan.

Objective 4.1: Educate and inform local and state officials, political leaders, policy-makers, the public, and involved professional disciplines about resilience and hazard mitigation concepts, programs, processes, and considerations.

Implementation Method:

- Conduct educational seminars where feasible and appropriate.
- Develop, update, and distribute written guidance targeted to specific groups.
- Post relevant information on web pages of the MSP/EMHSD and other agencies.
- As necessary, update EMHSD Pub. 207: "Local Hazard Mitigation Planning Workbook."
- Refine or reformat the MSP/EMHSD "Best Practices" document to identify and formally recognize successful hazard mitigation activities in Michigan, with a greater emphasis upon the benefits gained from damage-reduction.
- Consider how new formats such as GIS Story Maps could be used to improve upon or replace the existing "Best Practices" document through easier web accessibility, multimedia formatting, and greater interactivity.
- Consider how existing project documentation and grant closeout reports could tie in with these recognition efforts.
- Highlight the cost savings and other benefits to taxpayers that have resulted from successful hazard mitigation activities.

Committee Priority: HIGH (Ongoing)
Completion Target: 2021
Funding: EMPG, HMA, State Funding (General Fund)
Comments: (2019 status) Ongoing activities include the distribution of guidance materials, handling inquiries with appropriate information, conducting training sessions in multiple locations throughout Michigan, and outreach to interested college and university classes related to urban and regional planning. EMHSD Pub. 207 provides detailed guidance to agencies that develop local hazard mitigation plans, along with similar FEMA guidance documents. This objective corresponds with recommendations within Disaster Strategy #4195 (see **Appendix 14**).
BC REVIEW: This objective is met by the distribution of information (including web-posting), attendance and presentations at meetings, training sessions, and appropriate conferences, and by the submission of materials to newsletters, electronic networks, or targeted publications. All these options generally entail only low-to-moderate staff, preparation, and travel costs, and the selected approaches can be readily adjusted over time to suit the current staffing and budget situations of the implementing agency. Thus, the benefits of this effort are very likely to outweigh the costs involved.

Objective 4.2: Promote better information flow on hazard mitigation among agencies, between levels of government, and between public and private entities.

Implementation Method:

- Invite other state agencies and private industry to share their concerns, expertise, and ideas with the MCCERCC.
- Regularly publicize the MCCERCC's activities and actions using all appropriate means.
- Promote greater overlap between state and local planning activities.

Committee Priority: HIGH
Completion Target: 2021
Funding: EMPG, HMA, State Funding (General Fund)
Comments: (2019 status) Ongoing activity. Presentations by outside agencies and organizations have been included as a regular part of the MCCERCC meeting agenda. MCCERCC meeting notices, meeting notes, and associated reports are made available (via the MSP/EMHSD web site) to a wide array of public agencies and nongovernmental organizations. In addition to the MCCERCC, the primary focus of this objective will include its component agencies such as MSP/EMHSD, which monitors and encourages the development of local hazard mitigation plans throughout Michigan. An added element (#23) within Michigan's local hazard mitigation plan review sheets (see Appendix 16) encourages local plans to make reference to information and objectives in the MHMP and to consider coordinating their local objectives with this plan. Much greater outreach to and coordination with volunteer agencies has occurred

within the past few years. This objective corresponds with recommendations within Disaster Strategy #4195 (see **Appendix 14**).
BC REVIEW: The activities in this objective can be encompassed within current and ongoing staff duties, and therefore should not impose significant additional cost upon the involved agencies. Therefore, the benefits that should be gained from the specified activities can be seen as cost-effective.

Objective 4.3: Continually revise and enhance the Michigan Hazard Mitigation Plan (MHMP) to ensure it remains current, accurate, relevant, implementable, and in compliance with the federal Disaster Mitigation Act of 2000 and the Emergency Management Accreditation Program (EMAP).
Implementation Method:
- Integrate relevant data and findings from the Michigan Hazard Analysis and local hazard mitigation plans into the Risk Assessment and other appropriate sections of the plan.
- Keep the documents posted on the MSP/EMHSD web site, with appropriate staff contact information, so as to be continually available for public review and feedback.
- Maintain contact with all partnering agencies, and collect information about plan monitoring, project implementation, new conditions, emerging hazards, climatological changes, emergency incidents, and other topics relevant to all types of hazards that could affect Michigan.
- Revise the Michigan Hazard Mitigation Plan to address the appropriate revision period.
- As feasible, establish enhanced collection and analysis systems for the following types of data:
  - Loss estimations for all relevant state owned/operated facilities.
  - Structure counts in floodplains, with particular emphasis on commercial structures.
  - Use of satellite and aerial photographs (now readily available online) for risk assessment purposes.
- Develop the information management capacity to utilize the HAZUS-MH risk assessment tool or to match or exceed its capabilities through other means.

Committee Priority: HIGH
Completion Target: 2021 (expanded hazard analysis, and full plan update to support EMAP re-accreditation)
Funding: EMPG, HMA, State Funding (General Fund)
Comments: (2019 status) Earlier plan editions were approved as federal DMA 2000 compliant on March 29, 2005, March 27, 2008, March 26, 2011, and April 22, 2014. Plan revisions are now required every five years, in accordance with the state mitigation plan standards set forth in the federal DMA 2000. The MSP/EMHSD oversaw the 2019 MHMP update and simultaneously completed its updated natural hazards analysis within a 2019 edition of the Michigan Hazard Analysis, with extensive review and input from its partnering agencies. Internal Geographic Information System enhancements, the expansion of online database and aerial photo archives, and improved coordination among state and federal agencies have led to a substantial improvement in the capacity to analyze hazards. After the 2014 edition of the MHMP was completed, a substantial improvement in the coordination of state and local hazard mitigation plans was undertaken, through the perusal of all approved plans on file and the compilation of potentially fundable hazard mitigation projects (see Appendix 13 in this 2019 edition of the document). Coordination between state departments and other agencies upon the issue of climate change has also increased, resulting in a new chapter on the subject within the 2019 Michigan Hazard Analysis. Upcoming work will include updated Michigan Hazard Analysis chapters on various technological and human-related hazards, and state re-accreditation under EMAP. This objective corresponds with recommendations within Disaster Strategy #4195 (see **Appendix 14**).
BC REVIEW: This objective is a normal part of the work of MCCERCC, MSP/EMHSD, and its other constituent and partnering agencies, and therefore does not entail any unusual additional expense for the state. Since the MHMP is required for the receipt of numerous forms of federal disaster and hazard mitigation assistance, there is clearly a net benefit involved in accomplishing the task. This objective is required by FEMA in order to maintain eligibility for an array of grants and post-disaster public assistance, and this type of plan is considered to be a foundational activity for a good emergency management program. Therefore, the efforts of staff are considered to be well-justified in this activity.

Objective 4.4: Educate public policy-makers at all levels on the subjects of hazard mitigation and resiliency.
Implementation Method:

- Establish and maintain reporting relationships with state agency legislative liaisons so that mitigation-related aspects of proposed legislation are identified and shared with appropriate staff and other agency representatives, including State Emergency Management Coordinators and the MCCERCC.
- Establish and maintain a capability within the MSP/EMHSD to continually monitor proposed legislation for hazard mitigation implications (using the key word notification mechanism of the Michigan Legislature web site or by other means).
- Establish and maintain reporting relationships with all applicable emergency management and first responder organizations so that mitigation aspects of proposed legislation are identified and reported to the MCCERCC.
- Establish liaison with the Michigan Legislative Service Bureau so that the following are identified and reported to the MCCERCC (to the extent possible): 1) mitigation-related aspects of legislation, 2) the enactment, revision, and recession of Administrative Rules with mitigation implications, and (3) potential opportunities for legislation to be affected in ways that support the principles of resilience and hazard mitigation.

Committee Priority: MEDIUM
Completion Target: 2024
Funding: EMPG, State Funding (General Fund)
Comments: (2019 Status) Although each state department should have staff who are prepared for coordination on any forthcoming legislation that has implications for their operations (in this case including hazard mitigation), actual awareness and systematic communication has not appeared to be fully successful regarding legislation with (potential) hazard mitigation implications. Improvements have been made in media monitoring and coordination, but should also be made with respect to legislative monitoring and coordination throughout all MCCERCC-associated agencies and their partners. It takes time and diligence to establish and strengthen these links to become a part of standard operating procedure. The issue of legislation monitoring should be revisited regularly to seek improvements to its processes and opportunities.
BC REVIEW: Since certain staff already dedicate more time to this activity, it is hoped that this objective could be accomplished through increased awareness and the development of standard operating procedures that increase the level of communication among agency staff and partnering agencies. The costs of such progress might not be great, and therefore should be beneficial in view of the important impacts that legislation can have statewide, either to mitigate or to (unknowingly) exacerbate hazard risks and impacts. There should therefore be a clear net benefit from this effort.

Objective 4.5: Work to establish a new, state-funded hazard mitigation program within Michigan that can provide funds for qualifying activities and projects.
Implementation Method:

- Promote the state-level hazard mitigation funding program to become a legislative priority.
- If determined to be feasible and allowable, develop standard protocols for soliciting, accepting, expending, using, managing, reporting on, and accounting for donations (financial and/or in-kind).

Committee Priority: HIGH (reclassified from MEDIUM after the 2014 objective had been amended)
Completion Target: 2021
Funding: State Funding
Comments: (2019 status) The priority for this objective has been raised back to HIGH after amending it to emphasize a new state-funded hazard mitigation program rather than just the potential for MCCERCC to be enabled to make use of donated resources for hazard mitigation purposes. Limited progress had been made on that donations objective during the past decade, but in recent years, substantial progress has occurred toward the development of a state-funded source of hazard mitigation funds. The MCCERCC element has still been retained implicitly within this revised objective, but the more generalized wording now used has left open various possibilities for donations to be overseen by some other mechanism than MCCERCC.
BC REVIEW: State-funded hazard mitigation activities would be likely to include many principles and procedures seen in federal-level programs, to ensure that funds are fairly distributed to projects and activities that are judged to be cost-effective and otherwise beneficial for the improvement of Michigan's quality of life, infrastructure, economy, environment, health, and safety.

Objective 4.6: Improve coordination between local, regional, state, and federal agencies, private for-profit agencies, volunteer and not-for-profit agencies, and the general public.

Implementation Method:

- Consistent with federal principles and the National Framework for emergency management, processes should include outreach and coordination processes with the whole community of governmental and non-governmental agencies, for-profit and not-for-profit agencies, specialized subject matter experts and the general public citizenry.

Committee Priority: HIGH

Completion Target: 2021

Funding: EMPG, State Funding (General Fund)

Comments: (2019 status) This is a newly added objective. An increase in coordination activities has been important for the improvement of many processes over time, and is consistent with guidance from FEMA and the Emergency Management Accreditation Program.

BC REVIEW: Problems arise and can cause considerable expense, injury, and environmental harm if agencies have not adhered to these important coordination principles. Many are already acknowledged and merely need increased diligence to achieve, maintain, or improve, and this diligence can prevent costly disasters and emergency events, without necessarily involving much cost to achieve. This principle is clearly a prudent one to follow and bolster throughout all relevant agencies and their partners.

Objective 4.7: Identify strategies to assist local governments in overcoming obstacles to successfully applying for hazard mitigation grants.

Implementation Method:

- Identify sources of non-federal match for Hazard Mitigation Assistance Grants (including the pursuit of a state funded mitigation program) and educate local officials about grant matching opportunities.
- Develop supplemental assistance tools for local officials to use when developing HMA grant applications and the associated benefit-cost analysis process.
- Provide technical assistance to HMA applicants.
- Monitor the status of local hazard mitigation plans and promote the continued development and update of local plans to maintain local eligibility for HMA programs.
- Encourage the timely adoption of local hazard mitigation plans by participating communities within multi-jurisdictional plans.

Committee Priority: HIGH

Completion Target: 2021

Funding: EMPG, HMA, State Funding (General Fund)

Comments: (2019 status) This is another newly added objective. State administrative personnel have been making efforts to improve the processes by which grant applications can achieve success. The listed implementation methods reflect ongoing activities whose efficiency and coordination with non-state partners is in the process of being refined. Some recent staff reorganization efforts have sought to increase the number and specialized skills of those focusing upon each component of these processes, and additional refinements in work activities are being considered.

BC REVIEW: Since this objective is being implemented by existing state personnel, and since HMA grants already involve processes to ensure their cost-effectiveness, this objective is considered cost-beneficial.

Summary of Target Completion Dates for 2019 Plan Objectives

Year	Objectives to Be Completed	General Priority
2020	1.1: Increase public and private sector awareness of hazard related dangers and mitigation solutions. 1.2: Encourage and promote multi-hazard emergency plans in all public and private institutions, to include provisions for mitigating applicable hazards. 1.5: Support and utilize a system of real-time rainfall and river flow gauges throughout Michigan as part of an overall flood warning system. 1.6: Develop comprehensive hazard analyses and risk assessments, as part of a hazard mitigation plan development process in all local emergency management program jurisdictions, to address all pertinent natural, technological, and human-related hazards. 1.7: Update the Michigan Hazard Analysis to include the full array of natural, technological, and human-related hazards. 2.1: Increase knowledge of urban/regional planners and emergency managers about sound land use and development practices that can help reduce long-term hazard risks and vulnerabilities. 3.2: Promote floodplain management activities throughout Michigan, and increase statewide participation in the National Flood Insurance Program. 3.3: Maintain and strengthen partnerships and coordination between public, private, and non-profit agencies. 4.1: Educate and inform local and state officials, political leaders, policy-makers, the public, and involved professional disciplines about resilience and hazard mitigation concepts, programs, processes, and considerations. 4.3: Continually revise and enhance the Michigan Hazard Mitigation Plan (MHMP) to ensure it remains current, accurate, relevant, implementable, and in compliance with the federal Disaster Mitigation Act of 2000 and the Emergency Management Accreditation Program (EMAP).	**HIGH (ongoing)**
2021	2.3: Consolidate flood-related data into appropriate Geographic Information Systems to promote increasingly integrated assessments that inform development decision-making and future land use planning. 2.4: Acquire/remove, relocate, or elevate residential and commercial structures that currently occupy Michigan's floodplains, or that have otherwise suffered from repetitive flood losses. 2.5: Encourage Community Wildfire Protection Plans and establish and sustain additional FIREWISE communities, statewide. 2.6: Promote and assist with flood mitigation projects in all vulnerable areas, statewide. 2.7: Promote and assist with wildfire mitigation projects statewide. 2.8: Identify and fund appropriate mitigation measures for vulnerable public and private facilities and infrastructure.	**HIGH**

Summary of Target Completion Dates for 2019 Plan Objectives (continued)

Year	Objectives to Be Completed	General Priority
2021 (cont.)	2.9: Promote and assist with severe wind mitigation projects statewide. 2.10: Promote and assist with winter weather mitigation projects statewide. 2.11: Prioritization of HHPD funds availability to reduce risks and vulnerabilities at Michigan's grant-eligible dam locations. 3.1: Promote urban forestry and vegetation management programs and initiatives to develop more resilient woodlands, streetscapes, and landscapes in communities throughout Michigan. 4.2: Promote better information flow on hazard mitigation among agencies, between levels of government, and between public and private entities. 4.5: Work to establish a new, state-funded hazard mitigation program within Michigan that can provide funds for qualifying activities and projects. 4.6: Improve coordination between local, regional, state, and federal agencies, private for-profit agencies, volunteer and not-for-profit agencies, and the general public. 4.7: Identify strategies to assist local governments in overcoming obstacles to successfully applying for hazard mitigation grants.	**HIGH**
2022	3.4: Identify, establish, and promote new partnership opportunities. 4.4: Educate public policy-makers at all levels on the subjects of hazard mitigation and resiliency.	**MEDIUM**
2023	1.3: Promote local early warning systems and capability.	**MEDIUM**
2024	1.4: Promote the concept of "safe rooms" within homes, businesses, and local and state governmental facilities to prevent and minimize injury and loss of life from tornadoes and severe winds. 2.2: Additional evaluation of flood vulnerabilities in specified state owned/operated critical facilities.	**MEDIUM**

Future Planning Efforts

Support for Local Planning Activities

Following the adoption of this updated Michigan Hazard Mitigation Plan, planning efforts at the local level will continue to be actively supported through MSP/EMHSD monitoring, direct and indirect technical/planning assistance, and through the administration of relevant grant funds and provision of guidance materials and training. (At the same time, other state agencies' ongoing outreach efforts, related to the various hazards in this plan (e.g. MDNR re: forest fires, EGLE re: flooding, etc.), will continue. State and local coordination of hazard mitigation planning efforts during future plan updates (at both levels of government) will be enhanced through the:

- Sharing of state, local, and regional information on hazard incidents.
- Sharing information sources (e.g. printed guidance, online databases, etc.) between state and local planners.
- Provision of training sessions by MSP/EMHSD (and other state agencies) to local emergency managers, planners, etc.
- State, district-level, and local meetings, hearings, training sessions, conferences, etc.
- The Michigan Citizen-Community Emergency Response Coordinating Council.
- Ongoing assistance to and feedback from local emergency management programs (direct and indirect).
- Coordination with state agency emergency management coordinators and MSP district coordinators.
- Coordination with planning and emergency management agencies (e.g. MEMA).
- Coordination with other agencies who also work with local communities (e.g. Michigan's regional planning offices, MSU extension centers located in each county throughout the state, U.S.G.S. and National Weather Service offices, Silver Jackets, etc.).
- Numerous other contacts and information sources that are present during the various meetings and business conducted by, or attended by, relevant MSP/EMHSD planning staff (e.g. Michigan Climate Coalition).

Current FEMA guidance materials for hazard mitigation planning were considered suitable for use throughout Michigan, without any special adjustments, given that the Michigan Hazard Analysis and previous editions of the MHMP have provided extensive information about Michigan-specific risks and hazard vulnerabilities. Although the MHMP plan update schedule was expanded to a 5-year cycle instead of the previous 3-year cycle, it was found that there was still a heavy work burden on personnel during the final 2 years of the update process, due in part to an increase in the number of emergency and disaster activations, including state and federal declarations. Please refer to **Appendix 4** for a more detailed discussion of planning challenges and opportunities.

For guidance on various aspects of the local hazard mitigation planning process, local communities and agencies have frequently been referred to (or provided with) copies (printed or digital) of the books in FEMA's "How To Guides" series (https://www.fema.gov/media-library/resources-documents/collections/6). For guidance on the requirements of local hazard mitigation plans and their review standards, communities and agencies have regularly been referred to (or provided with) FEMA's "Local Mitigation Plan Review Guide" book, available at http://www.fema.gov/media-library/assets/documents/23194?id=4859 and their companion publication, "Local Mitigation Planning Handbook," available at http://www.fema.gov/media-library/assets/documents/31598?id=7209). It is considered that these books provide guidance to local planners and emergency managers that is sufficiently comprehensive and timely for their use in developing local hazard mitigation plans, and that there was no need yet for the existing state guidance document (EMHSD Pub. 207, "Local Mitigation Planning Handbook") to be updated. The FEMA documents came out in 2011 and 2013, and still contain the most up-to-date and authoritative guidance about official plan review standards.

As stewards of both state and local mitigation planning in Michigan, the MSP/EMHSD and the MCCERCC have used their unique positions to foster and arrange for state/local plan coordination through these methods, plus new and updated plans, materials, policy memoranda, training, plan reviews, interagency communication and collaboration, coordination meetings, and joint problem identification. Please refer to Appendix 3 and Appendix 5 for details about coordination, meetings, and other events that have been used to promote local planning, state planning, and coordination between the two. Future efforts will involve similar activities, with improvements made where possible.

Searchable Hazard History Tool

Previous editions of this plan have referred to a searchable collection of past hazard event information, as compiled by the MSP/EMHSD and designed to help provide relevant and useful information to local jurisdictions' planning processes, regarding their hazards. The stated goal was the development of a searchable "hazard history" list that allows incidents to be tracked by county, based on information from the Law Enforcement Information Network (LEIN), media reports, and other available sources. This information, although only partially organized to-date, has periodically been used to assist various local communities in describing previous occurrences of hazardous events within their jurisdictions' local plans and hazard analyses. It was hoped that this tool could, after additional development and formatting, be able to systematically provide additional detail about local hazard impacts, risks, damages, etc. and would supplement the state maps/overviews and National Climatic Data Center sources that have typically been used in local planning efforts since 2000, but which had remained focused upon natural hazards rather than a full array of technological and human-related hazards. Some work has continued toward this goal, but it requires such extensive work by EMHSD staff, and has usually only been partially available in cases when that staff is directly assisting with local hazard mitigation planning. New innovations during recent years that have suggested that a change in approach is required for this information-processing to actually become more widely useful. A great amount of information about natural hazards is available through alternative sources, such as the NCEI Storm Events Database (online). USGS online tools (as well as those of the National Weather Service) have provided extensive flood and weather information. As more efficient means of obtaining, collecting, and processing hazard and risk information are discovered or created, MSP/EMHSD intends to make the best use of such efficiencies. This type of flexibility serves the interests of all involved parties. Although a hazard history tool is still technically in development, its practical uses now appear to be limited to technological and human-related hazards that are not already covered systematically by alternative sources. However, its form is still incomplete and can be improved upon only with considerable staff time (which has not been available because of higher-priority competing activities in recent years). If staff time allows, collected information can become organized well-enough to become very useful for hazards such as hazardous materials incidents, plane crashes, and homeland security events. Such progress is not expected until at least 2020, however.

Direct Planning Assistance

The process and timeframe for reviewing local plans will be a continuation of current procedures. A great number of counties currently have planning grants to update their plans, and one of the goals for MSP/EMHSD planning staff that had been included in past editions of the MHMP involved the provision of direct planning assistance to communities that had been unable to complete a FEMA-approved local hazard mitigation plan. Some progress has occurred toward that goal, with the approval of an Osceola County plan in 2016 and a Monroe County plan in 2017, and substantial progress toward the completion of a Montcalm County plan by 2019. However, as mentioned previously, EMHSD personnel has found it increasingly difficult to oversee local plans, update the state plan, <u>and</u> provide such extensive "direct assistance" for specific local plans that had not felt able to make use of planning grant funds through the HMA program. The slowed schedule of this direct assistance will not necessarily come to a halt, but at this time, no additional counties can be added to the list of those remaining from the initial goal (Montcalm, Mecosta, Ionia, St. Joseph, and Branch Counties). With the probable exception of Montcalm, whose plan is close to complete as of early 2019, if those counties are able to apply for HMA planning grants, or to make progress on their plans through other means, they are encouraged to do so, since it is no longer clear how long it would take for these plans to be completed with the direct assistance of available MSP/EMHSD staff.

As always, preliminary reviews of draft materials will still be provided upon request and full advisory reviews will be provided upon receipt of a submitted plan. Occasional delays must result when staff time is already committed to higher-priority activities, such as active disasters, updating the state hazard mitigation plan, or grant-related deadlines. In these cases, FEMA staff may be requested to officially review such plans without being preceded by a state review. Plans that are judged as needing enhancement in order to meet federal planning requirements will result in the provision of guidance and advice to local jurisdictions and/or their consultants. In some cases, with the approval of involved stakeholders, MSP/EMHSD staff will provide suggested language, procedures, methods, guidance, editing and proofreading assistance to support the successful completion of local plans. When such plans are completed, they are forwarded to FEMA for official review. Completed FEMA reviews are promptly relayed to appropriate local stakeholders upon receipt, along with any advice deemed pertinent to the federal review.

The following approximate timeframe for anticipated planning activities is as follows:

- April 2019 – Official adoption of the 2019 Michigan Hazard Mitigation Plan update.

- 2019 to 2023 – Further coordination of state and local plans, in two directions, as further described below: (1) assistance and guidance provided to local planning efforts, and (2) the use of information from local hazard mitigation plans to inform the Michigan Hazard Mitigation Plan, improve its information base, find new ideas for mitigation needs and actions, prioritizing project funding, informing future refinements to the methods for prioritizing communities, accounting for development pressures, etc. As shown in Appendix 16, an element within the final section of Michigan's local plan review form seeks to encourage local plans to coordinate their activities with the goals and objectives in this state plan.

- 2019 to 2024 – Ongoing assistance with local mitigation planning, plan review activities, and planning grant administration, to promote the successful completion of as many local hazard mitigation plans as possible (including all those that had received funding support), and with some effort (as staff time permits) to provide direct assistance to the remaining Michigan counties that had not yet completed any FEMA-approved local hazard mitigation plan. Continued administration of available planning grant funds for local communities that need to update their approved hazard mitigation plans. Coordination between state agencies and their partners continues, through the MCCERCC, the state agency emergency management coordinators meetings, Silver Jackets, MSP/EMHSD training activities, disaster outreach activities, and other staff contacts and activities.

- 2019 to 2024 – Maintain and bolster coordination with the USGS, National Weather Service, regional planning offices, Michigan Climate Coalition, Silver Jackets, Michigan's many public universities, and agencies such as the Michigan Association of Counties, Michigan Townships Association, and Michigan Municipal League, and the Michigan Association of Planning, to promote and facilitate hazard mitigation planning which is a prerequisite for many project activities and funding.

- 2019 to 2024 – Continuing provision of training through regularly scheduled MSP/EMHSD training courses, direct training provided by MSP/EMHSD planning staff, and outreach and presentations (at conferences, meetings, and university settings).

- 2019 to 2024 – Making use of local hazard mitigation plan information now compiled into Appendix 13 of this Michigan Hazard Mitigation Plan.

- 2019 to 2022 – MSP/EMHSD planning staff will meet with, provide information to, and offer assistance to all local emergency management coordinators, through the regularly scheduled MSP district coordinator meetings. At these meetings, staff will present relevant and information, guidance, and resources for use in local plan development and update processes. During past state planning cycles, this type of outreach has tended to be focused upon the time immediately after the state plan has been updated, and for staff time to focus upon the state plan update during the last part of the state planning cycle.

- 2020 to 2024 – As staff time permits, refinement of the previous goal involving the (initially LEIN-based) searchable hazard history tool; investigating and developing more efficient methods to document technological and human-related hazard events not already covered by the activities and products of the USGS, National Weather Service, and other agencies. If successful, this information would eventually be available to assist with local and state hazard mitigation planning and hazard analysis processes.

Michigan Hazard Mitigation Plan:
10. Implementation, Monitoring, and Maintenance

2019 Plan Adoption and Promulgation

The 2019 MHMP process led to official adoption and promulgation by the MCCERCC, the State Director and Deputy State Director of Emergency Management and Homeland Security (the two highest ranking emergency management and homeland security officials in Michigan), and Governor Gretchen Whitmer. The final dates for these parts of the process can be found on the official promulgation letters that appear at the beginning of this document (immediately following the Table of Contents, before page 1). Sections of the plan were submitted electronically for FEMA review starting in February 2019, and that process was completed in April 2019, with a final version of the MHMP submitted in its entirety to the FEMA Region V office in Chicago. With that submission, approval was requested as a Standard State Hazard Mitigation Plan under the standards of the Disaster Mitigation Act of 2000, and based upon FEMA's feedback from advance drafts of the document. The plan may be further revised during 2019 and 2020, as appropriate for compliance with the Emergency Management Accreditation Program, to support Michigan's re-accreditation goals.

Plan Distribution

The final plan will be published online, and also available upon request (or distributed under certain conditions) in alternative formats, such as digital media. Notification of availability will be provided to members of the emergency management and homeland security communities, MCCERCC members and their agencies, as well as professional planning agencies and registered MSP/EMHSD course attendees. Only some of the content in Attachment A is withheld from online posting and other general distribution. Distribution procedures assure that all of MSP/EMHSD's most important partnering agencies, along with interested members of the general public will receive copies of the plan and be encouraged to provide comments and feedback. Copies will also be distribution in accordance with state law). This plan document itself encourages interested parties to submit comments and suggested revisions to MSP/EMHSD planning staff for consideration in future updates. The MSP/EMHSD Publications web site and other contexts of MHMP distribution are also designed to invite such feedback.

Implementation of Objectives

The MSP/EMHSD and the MCCERCC Hazard Mitigation Committee are jointly responsible for initiating and monitoring the implementation of the mitigation objectives listed in this plan. Council members and MSP/EMHSD staff involved with each objective will report (when appropriate) on implementation status at MCCERCC Hazard Mitigation Committee meetings, regular MCCERCC meetings, or other activities connected with the monitoring and update of this plan. Specific implementation actions taken are highlighted in Chapter 9's "Mitigation Opportunities, Recommendations, and Implementation" section within this plan, and a table in that chapter provides more detail involving either targeted completion years, or the continuation of work that has been classified as a high, ongoing priority. In addition, some implementation actions may be highlighted and discussed in MCCERCC's Annual Plans or other documents, such as MSP/EMHSD Publication 106a "Hazard Mitigation Best Practices: Michigan Success Stories," which have been widely distributed to state agencies, the Governor's office and Michigan Legislature, and posted for public viewing and downloading on the MSP/EMHSD web site. When significant accomplishments are made on a specific project or it has been completed, the MSP/EMHSD and MCCERCC may (at the discretion of the MCCERCC Chair) issue a media release that highlights those accomplishments and the overall benefits derived from the project (a mitigation "success story").

Integration with Other Ongoing State Planning Efforts

The state mitigation planning effort has been integrated with a number of other, ongoing state-level planning efforts. Various objectives listed under the four goals outlined in the "Mitigation Opportunities, Recommendations, and Implementation" section of Chapter 9 had described an increase in the coordination of state mitigation efforts with other ongoing state programs and planning efforts. Recent enhancement of the Silver Jackets coordination mechanism, participation of MSP/EMHSD in the Michigan Climate Coalition, continued use of urban planning networks, and similar activities, all provide new and potentially expanding means to coordinate with other planning efforts.

The HHPD is coordinated with the objectives of EGLE's Dam Safety Program. Specifically, Objective 2.11 within Chapter 9 of this plan ties in with EGLE's following Dam Safety Program objectives:

- *Objective 1.* **Provide financial assistance for repair, removal, or rehabilitation of eligible high hazard potential dams.** HHPD grants were a new funding source beginning in 2020.
- *Objective 5.* **Reduce the potential consequences to life and property of high hazard potential dam incidents**. The May 2020 Edenville Dam breach initially left a hazardous situation, with the Tobacco River side of the dam holding back 25'-30' of water head. Preliminary life safety mitigation efforts have proceeded and river flow has been restored. Additional dam repair and rehabilitation is still needed.
- *Objective 7.* **Reduce the overall number of high hazard potential dams that pose an unacceptable risk to the public.** Applying, receiving, and successfully using HHPD funds to rehabilitate eligible dams will lower the number of dams presenting an unacceptable public risk.

As documented in **Appendix 5**, personnel have advocated for hazard mitigation principles when participating in processes involving state transportation planning, MDMVA military facility planning, climate change assessments and conferences, an urban planning conference and class sessions, an MSU Extension meeting and webinar, and so on. Similar opportunities will be identified and made use of in the future.

Integrating Hazard Mitigation into Comprehensive Planning Processes

For example, one of the most basic priorities outlined in this plan is the statewide integration of hazard mitigation principles and practices into the comprehensive planning process at the local government level. If such integration were to be achieved on a statewide basis, the state of Michigan could reduce the number of new developments and structures or redeveloped areas that are at risk to a variety of hazards. This effort is being approached from several angles in this plan, including:

- Educating professional and lay planners about mitigation principles and practices to enhance plan integration efforts.
- Encouraging the effective use of land use and land development (regulatory) tools to mitigate hazards.
- Developing and disseminating planning guidance that provides instruction on the integration of mitigation into comprehensive planning.
- Continued participation in national, regional, state, and local efforts to integrate hazard mitigation into land use and land development mechanisms (e.g., through the American Planning Association, Michigan Association of Planning, Michigan Land Use Leadership Council, etc.).
- Coordinating state and local hazard mitigation planning efforts.

(Refer to "Goal 2: Reduce Property Damage" in Chapter 9 for more detailed background information on and specific objectives related to these integration efforts.)

Integrating Hazard Mitigation into the Michigan Emergency Management Plan

The Michigan Emergency Management Plan (MEMP) is the state's emergency operations plan developed pursuant to 1976 PA 390, as amended (the Michigan Emergency Management Act). The MEMP, which addresses all phases of emergency management, assigns specific mitigation tasks to state agencies in an effort to reduce the hazard vulnerability of state owned/operated facilities, or local facilities that state agencies may assist in the construction of using state and/or federal grant funding. For example, the Michigan Department of Environmental Quality is tasked in the MEMP to "maintain programs to protect the operational and structural integrity of public water distribution and wastewater treatment systems." Similarly, the Michigan Department of Natural Resources is tasked to "coordinate wildfire mitigation and prevention activities" and "promote urban forestry measures to minimize ice- and storm-related damage," and so forth. A number of state agencies have been assigned similar mitigation tasks in the MEMP, which helps to further institutionalize the concept of hazard mitigation in the state's emergency management program. Simultaneous with the update of this 2019 MHMP, MSP/EMHSD personnel within the same unit have begun to update the MEMP. A January 2019 draft edition of MEMP was reviewed for consistency with the April 2019 MHMP (along with its attached document, the Michigan Hazard Analysis), which in turn informs the continued refinement of the MEMP. In these ways, the state hazard mitigation planning and emergency response planning activities have

coordinated with each other. It should be noted that EMAP accreditation standards require the effective coordination of state-level hazard mitigation and emergency response plans.

State Flood Hazard Mitigation Executive Directive

The state hazard mitigation planning effort also helps ensure that mitigation principles and practices are taken into account when state agencies site and construct public facilities and infrastructure such as state buildings and roads and bridges. In fact, for flooding, this has been mandated through the issuance of the Governor's Executive Directive 2001-5, "State Flood Hazard Mitigation" (which can be found in **Appendix 15**). This Executive Directive, issued on September 11, 2001, requires all Michigan state agencies to adhere to the provisions found in the State's original flood hazard mitigation plan—Executive Order 1977-4, dated May 13, 1977—which requires state agencies to evaluate flood hazards when planning and constructing state facilities and avoid flood-prone areas to the extent practicable. Executive Order 1977-4 (included as **Appendix 15**) also requires state agencies to flood proof existing facilities whenever practical and economically feasible, attach deed restrictions to flood-prone state lands being sold or distributed to the public, and take flood hazards into consideration when evaluating land use plans submitted for programmatic purposes.

From a practical standpoint, the effectiveness of these two gubernatorial edicts to prevent state agency development in flood hazard areas will be a function of a number of factors, including the willingness of each Governor and the state agencies to enforce the basic hazard mitigation principles, the costs associated with property development in an alternate area, the level of knowledge, understanding and acceptance of mitigation by all involved parties, and the political, social and economic environment in place at the time the decision has to be made. Simply put, a Gubernatorial Executive Order or Directive might be considered only as effective as those involved at the time want it to be. Although essentially carrying the weight of law, such edicts can be rescinded by future Governors or neglected after sufficient time has passed. If subsequent Governors do not enforce the measures through cabinet-level agency directors and their support staffs, the measures can easily become ineffective. On the other hand, if the Governor in office at the time of the development decision diligently enforces the provisions, these two documents can be very effective at limiting or eliminating state-sponsored development in flood hazard areas.

Plan Approval by FEMA and Compliance with the Emergency Management Accreditation Program

Coordination meetings, phone calls, and emails took place with the appropriate FEMA reviewer over the course of many months. Draft materials resulted in a February plan review, allowing a few noncompliant elements to receive additional focus. The plan was refined into a final draft in March, with sections of it submitted as their update process was considered complete. Some EMAP compliance elements were reserved until after FEMA review requirements could be met, so that Michigan's coverage with an approved plan would not lapse. Subsequent to April 2019, additional updates to satisfy EMAP criteria will be included in the MHMP, and the amended plan will be re-submitted to FEMA. The April 2019 edition and its associated Michigan Hazard Analysis focused upon FEMA standards and natural hazards. Follow-up editions of these documents will include updated technological and human-related hazards, and additional MHMP updates aimed toward EMAP re-accreditation. **To see plan review sheets for state plans, local plans, and EMAP compliance standards, please refer to Appendix 16.**

Integration with FEMA's Hazard Mitigation Programs and Initiatives

The process used to develop this plan is necessarily intertwined with numerous FEMA mitigation programs and initiatives in that 1) the mitigation planning requirement originated at the federal level and the planning therefore must follow the established federal guidelines, 2) some of FEMA's programs are frequently used to fund the implementation of some of the specific objectives listed under the four established goals in the plan, and 3) the mitigation strategies that are developed subsequent to a federally declared major disaster in Michigan lead to revised or new planning initiatives addressed or coordinated with in this plan.

Community Rating System – National Flood Insurance Program

An example of a FEMA program that is being used to encourage the achievement of specific objectives is the Community Rating System (CRS), a voluntary incentive program under the National Flood Insurance Program that is being successfully implemented in Michigan by the Michigan Department of Environmental Quality. (The CRS recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions.)

Generally, each participating community has either prepared a flood mitigation plan (in some cases as part of a county- or region-wide planning effort) or is actively working on a more focused strategy for floodplain management. The undertaking of floodplain management activities—such as public information and education enhancement, mapping and floodplain regulations, flood damage reduction, and flood preparedness—all tie in with objectives specified in this state plan.

Federal Hazard Mitigation Grant Programs

The Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), and Pre-Disaster Mitigation Program (PDMP) have all been successfully used to fund hazard mitigation projects covered in this plan or originating in local plans. Other projects have been successfully funded under the annual Emergency Management Performance Grant (EMPG), Homeland Security Grant Program, U.S. Forest Service, etc. Please refer to **Appendix 10** and **Appendix 11** for extensive information about these programs and projects.

Post-Declaration Hazard Mitigation Strategies

The post-declaration mitigation strategy process has also contributed to the development of this plan in that the issues, concerns, and opportunities identified in those strategies have led to revised or new objectives being added to the plan, and new project ideas to fund under the various grant programs. Development of the post-event mitigation strategy necessarily focuses attention on each disaster and its initiating conditions during the short-term recovery period, when mitigation opportunities are available that might otherwise disappear as the long-term recovery process begins. The mitigation strategies were jointly developed by FEMA and the MSP/EMHSD (with input from other involved federal, state and local agencies) and are signed by both parties as a commitment to implement the strategy to the extent that resources and circumstances allow.

The mitigation strategies developed all previous federally declared disasters are summarized in **Appendix 14** of this plan and have been incorporated, where appropriate, into specific objectives listed under one or more of the four plan goals. (Prior to Federal Disaster 1181 in Michigan, states were required to develop a more formalized plan, rather than the shorter strategy document, to meet the requirements set forth in Section 409 of the Stafford Act. Selected recommendations from Michigan Section 409 plans from Federal Disasters 0774, 1028 and 1128 are still referenced within this document, although they may have changed over time. Please refer to **Appendix 12** for more detail.)

Since it can take some time for after-action reports and hazard mitigation strategies to be developed after a disaster occurs, it is therefore important to have promoted and obtained a widespread awareness of hazard mitigation opportunities and their value during response and recovery efforts. Even if such awareness is only achieved among a portion of the involved responders, emergency managers, and crew leaders, the benefits gained are still notable and important for reducing or preventing future problems. For example, during disaster #1028 (the Northern Michigan Deep Freeze), broken water pipes that needed immediate replacement (a response action) were fortified with freeze-resistant properties so as to prevent future damage from that type of hazard. This was due to a recognition that simple restoration of the pipes would leave them vulnerable to breaks during the next freeze event.

Similarly, any hazard mitigation activities funded under Section 406 can also serve as recognized, documented examples of post-declaration hazard mitigation projects executed as part of a response/recovery phase of emergency management, because Section 406 provides funding for "mitigation measures in conjunction with the repair of the disaster-damaged facilities…performed on the parts of the facility that were actually damaged by the disaster." Michigan has had numerous (post-disaster/recovery) hazard mitigation projects funded under this source, and new details about them have been included in this plan. **Appendix 11 and Appendix 14 provide more information.**

Cooperating Technical Partner Program (NFIP Floodplain Mapping)

EGLE worked with local communities for which floodplains were being mapped—the "Cooperating Technical Partner" (CTP) Program enabled states and local communities with demonstrated resources and expertise to be delegated the authority to review and publish National Flood Insurance Program (NFIP) studies without the need for further federal review. The state and local communities, as CTPs, could also process revisions to existing NFIP studies and then re-map the floodplain. Local community resources could include labor, funding, in-house information, the gathering of field data, and technical support for printing floodplain maps. EGLE devotes staff time and technical expertise to develop hydraulic models and produce the NFIP reports and associated digital floodplain

maps which are then made available on EGLE and FEMA web sites. This information can provide the basis for the community's flood hazard mitigation planning and floodplain management efforts.

Plan Maintenance and Mitigation Monitoring

Plan Maintenance

The MSP/EMHSD and MCCERCC are jointly responsible for the continuous maintenance and revision of this plan, although the MCCERCC's role is strictly advisory in nature. The MCCERCC continually examines planning-related issues at its meetings (full council meetings and committee meetings) and makes recommendations to MSP/EMHSD staff to conduct research as necessary and make appropriate revisions to the plan based on the Council's suggestions. Within the MCCERCC, plan maintenance responsibilities rest primarily with the Hazard Mitigation Committee. The MCCERCC Hazard Mitigation Committee and MSP/EMHSD mitigation staff will continue to meet periodically to review and evaluate parts of the plan. MSP/EMHSD and other agencies that are referenced, either directly or indirectly, in the list of MHMP Objectives will monitor progress in achieving or reassessing those objectives. If deemed necessary and appropriate by the Hazard Mitigation Committee, representatives from local government, involved state and federal agencies, and nongovernmental organizations that participated in the plan development and/or that are impacted by the plan may be invited to participate in this review process. The Hazard Mitigation Committee will analyze the overall success and progress in implementing the plan, as well as the appropriateness of the plan's content. Criteria that will be used to evaluate the plan include but are not necessarily limited to:

- The relevance and appropriateness of the plan goals and objectives to current conditions,
- The nature, scope and magnitude of hazard-related problems in the state and country,
- The type and amount of resources available to implement the plan,
- The current and projected capabilities of the assigned implementing agencies,
- Relevant deadlines, priorities, and other considerations of the scarcity of available resources,
- Plan implementation problems that have occurred or that may occur, such as technical, political, legal, social, or coordination issues, and
- The overall success of actions that have been implemented.

One of the dilemmas in past plan updates, including this one, is that of finding ways to more evenly distribute heavy work burdens throughout the available timeframe for this large plan, and its associated hazard analysis document, in coordination with multiple agencies and their subject matter experts. After completing the initial MHMP in 2004-2005, the Michigan Hazard Analysis was updated in 2006 but already felt out-of-date by 2008, leading to the inclusion of an updated hazard analysis within the 2008 and 2011 editions of the MHMP. Another update of the Michigan Hazard Analysis was then published in 2012, but felt out-of-date by 2014 and therefore again had all of its content updated and included with the 2014 MHMP. The work undertaken to update the hazard analysis in advance did <u>not</u> result in a relieved work burden during each MHMP update. Key MSP/EMHSD personnel has identified the likeliest solution to these problems: the maintenance of shared files that must be updated whenever new information becomes available, and that can quickly be assembled into a full publishable document on an as-needed basis. Both the Michigan Hazard Analysis and the Michigan Hazard Mitigation Plan must be re-organized for this kind of ongoing maintenance. Periodic distribution of the updated contents to subject matter experts and partnering agencies (as well as online postings of the newest consolidated document), for feedback, would have to occur periodically—not so soon that the review feels unnecessary, but soon enough that MHMP deadline problems and workloads can be relieved. Thus, for example:

1. The April 2019 MHMP gets officially adopted and receives FEMA approval. Its attached document, Michigan Hazard Analysis, is included as a part of this plan, and provides chapters on all of Michigan's natural hazards.
2. Each chapter of the Michigan Hazard Analysis must be set up, in editable form, on a shared platform that allows for multiple editors, but these chapters are also regularly checked for quality and backed-up regularly. Each chapter and appendix of the MHMP is similarly set up for shared editing in this way.
3. Authorized personnel and subject matter experts (SME) may edit the content of these documents as needed. For example, if a new grant program becomes available, the information about that program will be edited into

the appropriate files in both publications. If a department or agency's name changes, edits will immediately be made so that the new agency name is found and replaced in all the appropriate points of both documents. Only in this way can the update work become better distributed across the entire available time frame.

4. The content of the 2019 Michigan Hazard Analysis will need to have its technological and human-related hazard chapters (previously published in the 2014 MHMP) fully updated, and then added to the shared document platform to make those available for edits along with the natural hazard chapters already placed there. After EMAP re-accreditation in 2020 or 2021, an adjusted MHMP could go through the FEMA review and official publication process.
5. Periodically then, about every 2 years thereafter, all the continually maintained chapters of the Michigan Hazard Analysis will need to be distributed for SME and partner agency review prior to consolidation for publication and general re-distribution.
6. Similarly, the full MHMP would have its continually maintained components reviewed by appropriate SMEs and agencies, and these revised components would be quickly consolidated into a full document that can be sent for FEMA review (along with the most current edition of the Michigan Hazard Analysis), and through the administrative process that results in the authorization and signature of Michigan's governor. The proposed timeframe for this MHMP cycle would be every 4 years (approximately one plan update for every 2 updates of the associated Michigan Hazard Analysis).

The MCCERCC and its Hazard Mitigation Committee would be an important part of this periodic review process, as well as the source of current information that needs to be identified as meriting revisions to these key documents. The MCCERCC Hazard Mitigation Committee will also review the implementation methods for each objective to determine which methods worked (or may work) well. In addition, the Committee will examine any difficulties encountered, assess how well coordination efforts are proceeding, and determine which methods need to be revised or strengthened. The Hazard Mitigation Committee will compile its findings and create a list of recommended changes that need to be made to the plan content or implementation. Detailed information about hazards and events would need to be compiled continually by MCCERCC agencies and submitted to support staff for timely editing into the appropriate documents. New partnerships, information sources, and analytic methods will continue to be sought, tested, used, maintained, and improved.

The State Planner, lead Hazard Mitigation Planner, and other staff within the State Support Unit of the MSP/EMHSD are the key personnel who would receive recommendations and information, make the necessary changes to the appropriate documents, oversee the distribution processes involved in periodic document review, and also oversee the process of periodically consolidating the files into a consolidated publishable form. The MSP/EMHSD State and Local Support Section staff and members of the MCCERCC Hazard Mitigation Committee will present the revised plan to the MCCERCC for its review, approval and adoption. The revised plan will then be submitted to the 1) Deputy State Director of Emergency Management and Homeland Security, 2) State Director of Emergency Management and Homeland Security, and 3) Governor for review, approval, and official adoption and promulgation by the State of Michigan. The newly revised and adopted plan will be submitted to FEMA for approval under the federal Disaster Mitigation Act of 2000 plan revision process—currently on a five-year cycle. Once approved by FEMA, the drafted sections of the plan will (subject to sensitivity considerations) be replaced by final versions on the MSP/EMHSD web site. The finalized 2014 plan had been available for public review and comment for the entire five years until its update process was completed, and it will be replaced with the finalized 2019 edition, when that is approved. Hardcopy editions of the plan may be produced at the discretion of the MSP/EMHSD and MCCERCC.

Post-Incident Plan Review

As appropriate, the plan will be reviewed after Michigan receives a major disaster or emergency declaration under the federal Stafford Act. Multiple such events had taken place since the 2014 edition of this plan had been completed, and their strategies have been summarized within **Appendix 14**. The MSP/EMHSD and MCCERCC will jointly determine if additional review is required, and the extent of the review, based on the situational circumstances at the time of the declaration. (Similar consideration is given to the Michigan Emergency Management Plan, which serves as the response plan for the state.) The incident-specific hazard mitigation strategy document developed jointly with FEMA may in this way become incorporated into appropriate elements of plan structure. Changes to the plan's goals or objectives, or the prioritization of or implementation methods for the objectives, will be made if there is a compelling need to expedite the implementation of specific hazard mitigation measures. Objectives for the 2019 update have been

changed, guided in part from a consideration (or reprioritization) of activities and events that have occurred within Michigan during the past five years. Any routine or non-urgent changes noted during the post-incident plan review are to be made during the next scheduled plan revision cycle, but may be immediately logged within the draft documents maintained by MSP/EMHSD personnel.

For non-federally declared incidents involving natural, technological, or human-caused hazards that cause a need for SEOC activation or significant government involvement, the MSP/EMHSD will, at its discretion based on incident circumstances, review the plan for possible mitigation opportunities during the incident recovery period. In those instances, the MCCERCC may be consulted for its advice, expertise, and resources as determined necessary and appropriate by the MSP/EMHSD. Hazard mitigation opportunities will be pursued, at the discretion of the MSP/EMHSD or another state, local, or federal agency with regulatory or stewardship authority over the hazard, if deemed appropriate and potentially effective to mitigate future such incidents and their associated negative impacts and consequences. Such mitigation actions may be reported in the Incident Action Plan (IAP), Incident After-Action Report (if one is developed), or in similar reports. In some cases (at the discretion of the MSP/EMHSD or other regulatory/steward agencies), a specific report or strategy document may be developed to outline the problems encountered, the need for mitigation actions, the specific actions taken, and by whom. If such a report is developed, it may (at the discretion of the MSP/EMHSD) be appended to this plan for monitoring, implementation and historical record purposes. Again, routine or non-urgent matters are best handled through the ordinary five-year MHMP update cycle, since this provides the greatest opportunity for coordination and feedback involving many agencies as well as the general public.

Post-incident review for possible mitigation opportunities could be recorded in the following format, to provide an historical record for the reviews and activities that occurred:

Post-Incident Hazard Mitigation Plan Reviews, by Incident

1. Incident type and date.
2. Name of reporting person and agency.
3. Brief description of the incident and its specific impacts observed by the agency and its partners.
4. Specific hazard mitigation actions implemented.
5. Name(s) of implementing agency (agencies).
6. Additional hazard mitigation needs identified (including specific locations and details, if available and appropriate to report).

Hazard Mitigation Plan Monitoring

The responsibility for monitoring and tracking the progress of mitigation actions and project closeouts rests primarily with the MSP/EMHSD staff for activities that involve HMA funding, while other Objectives involve the activities of agencies such as the MDNR and EGLE, who would thus handle the monitoring for these activities and report either through direct contact with MSP and other relevant agencies, or through their MCCERCC representatives. The MSP/EMHSD mitigation staff has always carried significant project monitoring and tracking responsibilities as the grant managers for the Hazard Mitigation Assistance (HMA) program (including HMGP, FMAP, and PDMP), which are often used to fund projects or actions listed in this plan (or which this plan supports for implementation by local communities in conjunction with their own plans).

MCCERCC's Annual Report and Plan

A significant component of the MCCERCC monitoring process involves the update of the mitigation elements in its Annual Report and Plan. This report is updated each year and serves as an official record of MCCERCC-related mitigation achievements for each year. The Annual Plan and its updates are made available to the Governor, state agencies, and the state's local emergency management and homeland security programs. The annual reports have also been made available on the associated MSP/EMHSD and MCCERCC web site for viewing and downloading by the general public and other interested parties. Once projects or objectives are completed and closed out, they will be removed from the "active" objectives in the MHMP by the MSP/EMHSD and reported on, as appropriate, in the MCCERCC Annual Plan, sometimes taking the form of a mitigation "success story." Many projects, however, are ongoing rather than fully completed, and in these cases, the MHMP reports the current status (i.e. any progress achieved since the previous MHMP update in 2014).

As indicated above in the "Plan Maintenance" section, the MCCERCC Hazard Mitigation Committee and MSP/EMHSD mitigation staff do meet regularly to review various sections of the plan (and its hazard analysis) during the five years between update deadlines for the MHMP's FEMA-mandated cycle. Part of that process includes a thorough review of the plan goals, objectives, prioritization criteria, and selected implementation details. The MSP/EMHSD charts progress on each objective, reports this to the MCCERCC Hazard Mitigation Committee in the MCCERCC Annual Plan and during explicit MHMP update activities, and the results are summarized in the updated MHMP Objectives. The MSP/EMHSD State Hazard Mitigation Officer (SHMO) will be primarily responsible for continually tracking and monitoring the progress of implementation of the various projects and actions listed under each plan objective. As part of the MCCERCC annual plan update, the SHMO or his associated staff will follow up with the involved parties throughout the year to determine the implementation progress and status. As appropriate, periodic reports (verbal or written) will be requested on each project's status, conducted site visits, media reports, conference calls or meetings held, or other methods used as necessary to obtain status information.

Project Tracking, Monitoring, and Closeout

Mitigation projects listed in the MHMP that are being funded under the HMA (HMGP, FMAP, PDMP) are tracked, monitored and closed out by MSP/EMHSD mitigation staff in accordance with applicable federal and state laws and guidelines and the provisions set forth in the FEMA-approved State Administrative Plan and program guidance documents for the funding program. The status of each of these projects will be reported on periodically by the SHMO at MCCERCC Hazard Mitigation Committee meetings. Progress is also reported in quarterly reports to FEMA, per federal program requirements. All projects are closed out in accordance with the requirements set forth at the time of close-out by FEMA. In general, the closeout process for these grant projects involves reconciling financial documentation, processing the final payment, conducting a site visit, photographing the project site, geo-locating the project, completing all required closeout paperwork (including environmental documentation), and submitting a closeout request package to FEMA. These activities are the responsibility of the SHMO and are sometimes carried out with the assistance of the Assistant SHMO, other staff, or a FEMA Disaster Assistance Employee (DAE).

As the SAA for the HHPD Program Grant, EGLE is responsible for project tracking, monitoring, and closeout. The EGLE DSP would minimally measure grant performance evaluation based on the following outcomes: (1) Increased understanding of risk posed by recipient dams through studies, planning, and engineering that addresses ongoing stability, hydraulic deficiencies, or other associated vulnerabilities, (2) Successful mitigation through the repair or rehabilitation activities of recipient dams, and (3) Consequence reduction by the removal of, if any, future targeted eligible dams.

Monitoring Acquired Land

Another component of the grant program project closeouts involves the long-term monitoring of acquired lands. The State is required to provide a report to the FEMA Regional Administrator every three years certifying that acquired lands continue to be maintained, consistent with the open-space grant requirements of 44 CFR Part 80. To achieve this obligation, the MSP/EMHSD corresponds with each jurisdiction where land has been acquired, for confirmation of compliance. The MSP/EMHSD maintains a table of acquired properties and points of contact for each jurisdiction. Every three years, the MSP/EMHSD reviews and updates the contacts and then sends out correspondence reminding each jurisdiction of their 44 CFR Part 80 obligations, provides them with a list of properties they are responsible for on a "3-year Open Space Property Certification" form, and establishes a deadline by which they need to return the completed form and photographs of the vacant parcels. The MSP/EMHSD then compiles a report for FEMA.

The MSP/EMHSD maintains a comprehensive data base of all HMA (HMGP, FMAP, PDMP) projects funded in Michigan, which it uses to track and monitor the projects and which also serves as a historical record of all projects funded under each program. A summary of those databases (in table format) can be found in **Appendix 11** in this plan.

Implementation Status of Hazard Mitigation Objectives: 2014-2019

Some of the mitigation objectives under each goal from the 2014 edition of this plan have been implemented, some have not, and many are still in process (or designed to be ongoing processes). Information related to implementation status for each objective is generally contained in the "Comments" for each goal in the "Mitigation Opportunities,

Recommendations, and Implementation" section (in Chapter 9). In addition, the section titled "Compendium of Addressed Objectives" (**Appendix 12**) contains a complete listing of those objectives that have either been completed or removed from further consideration due to non-feasibility, consolidation, or some other reason. The State of Michigan will continue to work toward the successful implementation of the updated objectives during the five-year revision cycle for this plan as time, resources, priorities, and circumstances permit, as estimated within the table toward the end of Chapter 9, and its associated lists of planning-oriented tasks and timeframes.

A number of factors influenced the implementation of state-level mitigation objectives in Michigan during the period from 2014-2019, although conditions were generally recovering from a previous series of negatively impacting factors during the "great recession" period that had limited or hindered the full implementation of all scheduled objectives. Currently identified factors include:

- Lack of available state and local funds for project cost-sharing and general project implementation due to state and local budget limitations. (Note: Nationally, Michigan had recently been ranked last or near the bottom in various state-level economic vitality indicators, and was also the only state to lose population between the 2000 and 2010 censuses.) In recent years, Michigan has seen the recovery of most of its lost population, a drop in unemployment rates, and an uptick in various fiscal and financial indicators.
- Competing projects within the MSP/EMHSD and other agencies which address hazard mitigation activities, whether from disasters or other required emergency management activities, staff departures and reassignments, cross-training needs to prepare for the possibility of such departures or reassignments, documentation requirements, increases in planning standards, difficulties in application processing, etc.
- The unreliability and reductions in homeland security, emergency management, and other grant funding sources experienced in recent years by MSP/EMHSD and other agencies, creates additional work to find compensating or substitute sources of funding, or to calculate cheaper and more efficient means of accomplishing planned tasks with reduced funds and staff. In addition, an ever-increasing complexity of program requirements, and correspondingly shorter timeframes for successful development and completion of activities under the various grants or mandates (e.g. THIRA), have created tremendous challenges.
- The general complexity and time-consuming nature of the DMA 2000 state mitigation planning requirements themselves, such that during the latter half of each update cycle, limited staff time is less able to be devoted to local plan oversight and actual implementation activities, and instead dedicated to updating the plan.
- The statewide local hazard mitigation planning effort still has challenges in justifying the extensive efforts that are required to develop or update a plan, and then to attempt long and complicated application processes that might not be successful under nationally competitive selection processes. Local efforts are many ways the more natural level of government to be able to address hazards and implement specific projects in the field (or through land use regulatory functions, which are primarily held by local levels of government), but some counties have become inactive with regard to developing or updating their local plans.

Please refer to Chapter 9 for a comprehensive discussion of the plan's goals, objectives, recent implementation status, and implementation methods. In addition, please refer to **Appendix 4** for a discussion of challenges and problems involving state resources, program coordination, and implementation impediments.

Applicant Assurances

The State of Michigan will comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c) and will amend its plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

At the time of application for FEMA mitigation grant funds, applicants sign FEMA Form 20-16 certifying that they will comply with applicable standard assurances as follows: (FEMA Form 20-16A) Assurances for Non-Construction Programs, (FEMA Form 20-16B) Assurances for Construction Programs, (FEMA Form 20-16C) Certifications Regarding Lobbying; Debarment, Suspension, and other Responsibility Matters; and Drug-Free Workplace Requirements, and (FEMA SF-LLL) Disclosure of Lobbying Activities. **At the time of grant award** for FEMA mitigation grant funds, recipients sign a grant agreement officially certifying that they will administer the grant in accordance with federal regulations including (but not limited to) Titles 2, 31, and 44 of the Code of Federal Regulations, OMB Circulars, and applicable State laws and statutes.

Michigan Hazard Mitigation Plan: Appendices

Appendix 1: Glossary of Selected Hazard Mitigation Terms

ACQUISITION/RELOCATION: A voluntary program offered through the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), and Pre-Disaster Mitigation Program (PDMP) in which repetitively flooded structures may be acquired by a municipality in order to remove the structure from the floodplain. The property owner is given a fair pre-flood market value for the property. The municipality then clears the property of the structure and maintains the property as open space in perpetuity. The State is the administrator of the grant throughout this process and monitors the municipality in maintaining this property as open space.

ASSISTANCE: Any form of federal grant to implement cost-effective mitigation measures that will reduce the risk of future damage, hardship, loss, or suffering as a result of major disasters.

BASE FLOOD: A flood having a one percent chance of being equaled or exceeded in any given year. This has commonly been called the "100-year" flood, but efforts have been underway to discourage that phrase so that it is not interpreted as a recurrence interval. A proposed replacement term would refer instead to the 1%-chance flood level.

COMMUNITY: Any state or area or political subdivision thereof, or any Indian Tribe or authorized tribal organization, or authorized native organization which has the authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction.

COUNTY OR LOCAL EMERGENCY MANAGEMENT COORDINATOR: A person appointed pursuant to Act 390, P.A. 1976, as amended, to coordinate emergency management activities for a county or municipal emergency management program. Often commonly called "County EM," "Local EMC," or "Emergency Manager."

DAMAGE ASSESSMENT: The systematic process of determining and appraising the nature and extent of the loss, suffering, or harm to a community resulting from an emergency/disaster.

DISASTER FIELD OFFICE (DFO): The location established within the disaster area that functions as the joint federal-state center for all response and recovery activities.

DISASTER MITIGATION ACT (DMA) OF 2000: Public Law 106-390, signed into law on October 30, 2000, which amended sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and placed new hazard mitigation planning requirements on states and local governments in order to obtain Stafford Act disaster relief assistance.

DISASTER RECOVERY CENTER (DRC): A location established within the disaster area that functions as a "one-stop" information source for disaster recovery and hazard mitigation-related issues. DRCs are staffed by personnel from FEMA and other federal agencies, state and local agencies, and private, voluntary relief organizations.

DISTRICT COORDINATOR: The Michigan State Police Emergency Management and Homeland Security Division uniformed employee serving at any of eight State Police District Headquarters, whose primary job is to work directly with local communities on emergency management activities.

DRY FLOODPROOFING: Any combination of adjustments and/or additions to structures that are intended to eliminate or reduce the potential for flood damage by preventing water from entering the structure. (Examples: waterproof walls and floors; permanently or contingently seal doors, windows, or other openings; build a berm higher than the floor level.)

ELEVATION: A voluntary program offered through the HMGP, FMAP, and PDMP to raise the first floor of a structure at least one-foot above the recorded base flood elevation. Utilities and mechanical equipment are also elevated above the base flood elevation to reduce or prevent damage to them.

EMERGENCY MANAGEMENT AND HOMELAND SECURITY DIVISION (EMHSD): The division within the Department of State Police that coordinates the comprehensive emergency management activities (mitigation, preparedness, response and recovery) and homeland security activities of state and local government and maintains the Michigan Emergency Management Plan and Michigan Hazard Mitigation Plan. The Emergency Management and Homeland Security Division is also the primary state coordinating agency for the HMGP, FMAP, and PDMP, and serves as the administrative arm of the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC).

ENVIRONMENTAL ASSESSMENT: A document that is prepared when an HMGP, FMAP, or PDMP project does not qualify categorically for exclusion, and determines whether an Environmental Impact Statement is needed.

ENVIRONMENTAL IMPACT STATEMENT: A document that is prepared for all actions significantly affecting the environment.

EXECUTIVE ORDER 1977-4: A Michigan Executive Order issued by Governor William G. Milliken on May 13, 1977 that 1) designated an administering state agency for the state flood hazard management program, 2) directed state agency directors to prevent uneconomic uses and the development of the State's floodplains, and 3) directed state agency directors to reduce the risk of flood losses in connection with state lands and installations and state financed or supported improvements. This Executive Order is still in effect and continues to provide a foundation for the state's floodplain management efforts, in conjunction with Executive Directive 2001-5 (see below).

EXECUTIVE ORDER 1998-5: A Michigan Executive Order issued by Governor John Engler on July 29, 1998 that established the Michigan Hazard Mitigation Coordinating Council (MHMCC) and assigned administrative functions associated with the council to the Emergency Management and Homeland Security Division, Department of State Police. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council. See next definition below.)

EXECUTIVE ORDER 2007-18: A Michigan Executive Order issued by Governor Jennifer Granholm on May 2, 2007 that established the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC) and assigned administrative functions associated with the council to the Emergency Management and Homeland Security Division, Department of State Police. The Michigan Citizen-Community Emergency Response Coordinating Council replaces the Michigan Citizen Corps Council, the Michigan Emergency Planning and Community Right-to-Know Commission, and the Michigan Hazard Mitigation Coordinating Council. The MCCERCC is responsible for developing and implementing emergency response and hazard mitigation plans for the state. The council also acts as the state emergency response commission as required by federal statute. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council.)

EXECUTIVE DIRECTIVE 2001-5: A Michigan Executive Directive issued by Governor John Engler on September 11, 2001 that directed the Michigan Department of Environmental Quality, as the lead state agency, and the Michigan Hazard Mitigation Coordinating Council and various other state agencies to develop a statewide, interagency flood mitigation strategy to assure compliance with the State Flood Hazard Mitigation Plan (see Executive Order 1977-4 above). (Note: the Michigan Citizen-Community Emergency Response Coordinating Council has replaced the Michigan Hazard Mitigation Coordinating Council, per Executive Order 2007-18. See definition above.)

EXECUTIVE ORDERS 11988 AND 11990: The requirements to avoid direct or indirect support of floodplain development and to minimize harm to floodplains and wetlands. Federal decision-makers are obligated to comply with these orders, accomplished through an eight-step decision-making process.

EXECUTIVE ORDER 12699: Requires that new construction of federal buildings must comply with appropriate seismic design and construction standards.

EXECUTIVE ORDER 12898: Requires federal agencies to make environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States.

FACILITY: Any publicly or privately owned building, works, system, or equipment, built or manufactured, or an improved and maintained natural feature. Land used for agricultural purposes is not a facility.

FEDERAL COORDINATING OFFICER (FCO): The person appointed by the President to manage the federal response to a major disaster or emergency, including the provision of hazard mitigation assistance to a state.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA): The federal agency that coordinates emergency planning, preparedness, mitigation, response and recovery within the federal government. FEMA has been delegated primary responsibility for administering the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), and the Pre-Disaster Mitigation Program (PDMP).

FEDERAL HAZARD MITIGATION OFFICER (FHMO): The FEMA employee responsible for representing the agency for each declaration in carrying out the overall responsibilities for hazard mitigation, including coordinating post-disaster hazard mitigation actions with other agencies of government at all levels.

FEDERAL-STATE AGREEMENT: The document that states the understandings, commitments, and conditions for assistance under which FEMA disaster assistance shall be provided. This agreement imposes binding obligations on FEMA, the State, and local governments in the form of conditions for assistance which are legally enforceable.

FINDING OF NO SIGNIFICANT IMPACT: A determination that an action will have no significant impact on the environment.

FLOOD MITIGATION ASSISTANCE PROGRAM (FMAP): A grant program created under the National Flood Insurance Reform Act of 1994 to provide mitigation planning and project grants to states and communities. The program is funded through flood insurance policy fees. The amount of funds available varies from year to year.

FLOODPLAIN: The lowland and relatively flat areas adjoining inland or coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year (the "base flood").

FLOODPLAIN MANAGEMENT: An overall community program of corrective and preventive measures for reducing flood damage. These measures take a variety of forms and generally include zoning, subdivision or building requirements, or special purpose flood ordinances.

GRANT: An award of financial assistance.

GRANTEE: The government to which a grant is awarded and which is accountable for the use of the funds provided. The State of Michigan is the grantee for the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), and Pre-Disaster Mitigation Program (PDMP).

HAZARD MITIGATION: Any action taken to reduce or permanently eliminate the long-term risk to human life and property from natural, technological and human-related hazards.

HAZARD MITIGATION ASSISTANCE (HMA): An "umbrella" program that contains sources of grant funds for hazard mitigation activities: the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. Please refer to the subsection entitled "Funding Sources for Implementation of Mitigation Projects," found within the "Mitigation Strategy" section of this plan.)

HAZARD MITIGATION GRANT PROGRAM (HMGP): A grant program authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act that provides funding for hazard mitigation projects that are cost-effective and complement existing post-disaster mitigation programs and activities by providing funding for beneficial mitigation measures that are not funded through other programs.

HAZARD MITIGATION STATE ADMINISTRATIVE PLAN: The plan developed by the State to describe the procedures for administration of the Hazard Mitigation Grant Program and Flood Mitigation Assistance Program. These State Administrative Plans are separate, stand-alone support plans to the Michigan Hazard Mitigation Plan.

HAZARD MITIGATION STRATEGY: The report developed by the State, FEMA, other federal agencies, and affected local governments that identifies mitigation measures for implementation and recommends issues to be addressed in the State Hazard Mitigation Plan, including those measures recommended for funding under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), and other applicable programs. Hazard Mitigation Strategies developed for each Presidentially declared disaster become addenda to the Michigan Hazard Mitigation Plan. Sometimes referred to as "Disaster Strategies." Recommendations from these documents have been included in Appendix 14 of this plan.

HIGH HAZARD POTENTIAL DAM (HHPD): Fully named the Rehabilitation of High Hazard Potential Dam Grant Program, but going by a shorter acronym, this federal program provides technical, planning, design, and construction assistance to an authorized State Administrative Agency (i.e., EGLE) for the repair, removal, or rehabilitation of eligible high hazard potential dams.

INTERAGENCY HAZARD MITIGATION TEAM (IHMT): The mitigation team that is activated following flood-related disasters pursuant to the Office of Management and Budget directive on Nonstructural Flood Protection Measures and Flood Disaster Recovery, and the subsequent December 15, 1980 Interagency Agreement for Nonstructural Damage Reduction.

LOCAL EMERGENCY MANAGEMENT COORDINATOR: The person appointed pursuant to 1976 PA 390, as amended, to coordinate emergency management activities for a county or municipal emergency management program. Also, commonly called a County EMC or Local "Emergency Manager."

LOCAL GOVERNMENT:

a. Any county, city, village, town, district, regional authority, public college or university, or other political subdivision of any state, any Indian Tribe or authorized tribal organization; and
b. Any rural community or unincorporated town or village or any other public entity for which an application for assistance is made by a state or political subdivision.

MAJOR DISASTER: Any natural catastrophe (including any hurricane, tornado, storm, highwater, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any flood, fire, or explosion, in any part of the United States which in the determination of the President cause damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

MICHIGAN EMERGENCY MANAGEMENT PLAN (MEMP): The plan developed and continually maintained by the Emergency Management and Homeland Security Division, Department of State Police, pursuant to 1976 PA 390, as amended, for the purpose of coordinating the emergency management activities of mitigation, preparedness, response and recovery within the state.

MICHIGAN CITIZEN-COMMUNITY EMERGENCY RESPONSE COORDINATING COUNCIL (MCCERCC): The body established on May 2, 2007 by Executive Order 2007-18 to replace the Michigan Hazard Mitigation Coordinating Council (see definition below), the Michigan Citizen Corps Council, and the Michigan Emergency Planning and Community Right-to-Know Commission. The MCCERCC is responsible for developing and implementing emergency response and hazard mitigation plans for the state. The council also acts as the state emergency response commission as required by federal statute. Executive Order 2007-18 assigned administrative functions associated with the MCCERCC to the Emergency Management and Homeland Security Division, Department of State Police.

MICHIGAN HAZARD MITIGATION COORDINATING COUNCIL (MHMCC): The body established by Executive Order 1998-5 and composed of representatives from key state agencies, local units of government, the planning industry, and the property and casualty insurance industry, which is responsible for evaluating hazards, identifying and developing strategies, coordinating resources, and implementing measures that will reduce the risk and vulnerability of people and property in Michigan from natural, technological and human-related hazards. (Note: Executive Order 2007-18 rescinded Executive Order 1998-5 and abolished the Michigan Hazard Mitigation Coordinating Council. See definition above.)

MICHIGAN HAZARD MITIGATION PLAN (MHMP): The plan developed and continually maintained by the Emergency Management and Homeland Security Division, Department of State Police, which describes and coordinates the hazard mitigation activities of state agencies designed to reduce or eliminate the effects of disasters and emergency situations on Michigan citizens and communities.

MICHIGAN STATE POLICE (MSP): State government organization that includes emergency management functions, especially through EMHSD (q.v.).

MITIGATION MEASURE: Any hazard mitigation project, activity, initiative or action proposed to reduce risk of future damage, hardship, loss, or suffering from disasters. Also known as a hazard mitigation strategy, or, more specifically, as "projects" or "alternatives." Please refer to Chapters 6 through 9 and Appendix 13 within this plan.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): Public Law 91-190, as amended, which requires that actions affecting the environment comply with specific policies and procedures. NEPA requires that environmental information be available to public officials and citizens before decisions are made and actions are taken.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP): The program established in 1968 under the National Flood Insurance Act to provide property owners in floodplains with federally subsidized flood insurance in those communities that implement ordinances to reduce future flood losses. The National Flood Insurance Reform Act of 1994 revised and strengthened many aspects of the program.

PRELIMINARY DAMAGE ASSESSMENT (PDA): An assessment conducted by teams of federal, state and local officials to determine the severity and magnitude of a disaster and also to identify capabilities and resources of state, local and other federal agencies. Identification of hazard mitigation opportunities is a key part of the PDA process.

PRE-DISASTER MITIGATION PROGRAM (PDMP): The program authorized under Section 203 of the Stafford Act the provides funding to states and local communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

PROJECT: All mitigation work performed at a single site or multiple sites as described on a project summary.

PUBLIC ASSISTANCE (PA): Federal financial assistance provided through the Public Assistance Grant Program (PAGP) to state and local governments or to eligible private nonprofit organizations for disaster-related requirements. Cost-effective hazard mitigation measures may be funded under the PAGP as part of public facility repair, restoration or reconstruction project.

RECORD OF ENVIRONMENTAL REVIEW: A document that is prepared for all Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), and Pre-Disaster Mitigation Program (PDMP) projects to detail that potential environmental concerns will be addressed. This document serves to determine if an Environmental Assessment is needed.

REPETITIVE FLOOD CLAIMS PROGRAM (RFCP): An historical grant program authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 that provided funds to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that had one or more

claim payments for flood damages. RFCP funds could only be applied to structures that were located within a State or community that cannot meet the cost share or management capacity requirements of the Flood Mitigation Assistance Program (FMAP).

SECTION 404: The section of the Stafford Act that authorizes the Hazard Mitigation Grant Program (HMGP). The HMGP provides funding for cost-effective hazard mitigation measures.

SECTION 406: The section of the Stafford Act that authorizes the Public Assistance Grant Program (PAGP). This program provides grants to repair, restore, or replace damaged facilities belonging to public and private non-profit entities, and other associated expenses, including emergency protective measures and debris removal. Cost-effective hazard mitigation measures are eligible for funding under the PAGP.

SEVERE REPETITIVE LOSS PROGRAM (SRLP): An historical grant program authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 that provided funds to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the National Flood Insurance Program (NFIP). An SRL property was defined in section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a, as a residential property covered under an NFIP flood insurance policy, and that had reached certain damage thresholds within a particular timeframe.

SILVER JACKETS: An organization that allows coordination between federal agencies, such as the U.S. Army Corps of Engineers, state agencies such as the Michigan Department of Environmental Quality, and other interested parties, meeting regularly to discuss and coordinate on hazard mitigation activities. Originally oriented toward flood mitigation in other states, Michigan's Silver Jackets charter (established in 2016) opted for a general multi-hazard approach. The group has been meeting regularly in Lansing, about 6 times per year.

STAFFORD ACT: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988. The Stafford Act amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act was amended by the Disaster Mitigation Act (DMA) of 2000 (PL 106-390), signed into law on October 30, 2000.

STANDARDS: Codes, specifications or standards for the construction of facilities to include legal requirements for additional features.

STATE COORDINATING OFFICER (SCO): The person appointed by the Governor to manage all aspects of a federally declared disaster, in cooperation with the Federal Coordinating Officer (FCO). The Division Commander or Assistant Division Commander of the Emergency Management and Homeland Security Division, Department of State Police is normally appointed to this position.

STATE HAZARD MITIGATION OFFICER (SHMO): The person appointed by the State Coordinating Officer to serve as the primary point of contact with FEMA, other federal and state agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities (including management of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program.

STATE INDIVIDUAL ASSISTANCE OFFICER (SIAO): The person appointed by the State Coordinating Officer to serve as the primary point of contact with FEMA, other federal and state agencies, and private, voluntary agencies and organizations in the provision of disaster relief assistance to individuals and families.

STATE PUBLIC ASSISTANCE OFFICER (SPAO): The person appointed by the State Coordinating Officer to manage the Public Assistance Grant Program on behalf of the State.

STATUTORY ADMINISTRATIVE COSTS: Under the Stafford Act, administrative costs for the preparation of applications for mitigation assistance, progress reports, audits, etc., are reimbursable based on a percentage of financial assistance received.

SUBGRANT: An award of financial assistance under a grant by a grantee to an eligible subgrantee.

SUBGRANTEE: The government or other legal entity to which a subgrant is awarded and which is accountable to the grantee for the use of the funds provided.

WET FLOODPROOFING: Permanent or contingent measures applied to a structure and/or its contents that automatically prevent or provide resistance to damage from flooding by intentionally allowing water to enter the structure. (Examples: Moving all electrical outlets above expected flood levels; installing floodwalls and protection closets around equipment [i.e., furnace, water heater] that cannot be relocated.)

WETLANDS: Those areas which are inundated or saturated by surface or ground water with a frequency sufficient to support, or that under normal hydrologic conditions does or would support, a prevalence of vegetation or aquatic life typically adapted for life in saturated or seasonally saturated soil conditions.

Appendix 2: Development Trends and Pressures in Michigan

Although development does not always correspond to population changes, there is a connection between the two, in that population increases can be assumed to correspond with increases in development. Although an area of stable population can also see increases in development (as the wealth that generates that development increases even if the number of residents remains stable), nevertheless this analysis is based on a preliminary categorization that identifies which sections of the state are most rapidly growing (compared to Michigan norms, which, statewide, are of extremely slow population growth – stemming from a pattern in which the rate of natural increase is offset by enduring patterns of net out-migration).

The two types of communities that are assumed to have development pressures are (1) those that have actually experienced significant population growth in recent years (showing both a demand for living there as well as the existence of space or developments that had the capacity to support that population growth), and (2) those that have experienced significant population declines (suggesting that since there had been existing infrastructure and land capable of supporting a larger population, the local community is likely to experience pressures that would encourage it to accept new developments to slow, halt, or reverse its decline). These two types of development pressures might be called external and internal development pressures. In the former case, some demand exists on the part of new residents or potential residents who desire to live in the area, encouraging the community to accommodate such demands by taking action that would satisfy it. In the latter case, the existing infrastructure, land, governmental structure, budgeting considerations, and other factors related to a fear of decline, would be likely to cause the community itself to seek and encourage new developments in contradiction of existing population or market trends. In both these cases, situations can be imagined in which either internal or external development pressures cause certain types of developments to be allowed that may not otherwise have been permitted in the absence of such pressures. In those cases in which decisions might potentially overlook hazard considerations, the long-term impacts can be very substantial, and the very point of hazard mitigation is to determine how current and future hazard vulnerability may be reduced. By considering the impacts of development pressures, and the possibility that some new developments may need to have special design requirements if they will occur in hazard-prone areas, hazard risks and vulnerabilities can be successfully reduced below what they otherwise would have been, as a result of the considerations given to the subjects in (a) this State plan, (b) local planning efforts inspired by, guided by, and coordinated with State hazard mitigation activities and efforts, and (c) local comprehensive (master) plans, to the extent that they have coordinated with local hazard mitigation planning or at least been able to incorporate useful information or consideration of hazards, as suggested either by local hazard mitigation plans or by other documents or activities of local emergency management programs aimed toward accomplishing similar objectives.

The following list describes the criteria used to identify communities that experience development pressures:

1. Any community that sees a sufficient <u>percentage increase</u> (5% or more) in its population can be reasonably considered to qualify as a "**significant growth**" community that is subject to "external" (i.e. market demand) development pressures, as long as that percentage equates to at least 500 persons. (In cases of small communities with populations fewer than 10,000 residents, a larger percentage increase of 50% was considered sufficient to denote growth pressures for that community, even if this translates to only a few dozens or hundreds of people).
2. Although some communities may not have increased enough to qualify as having "significant growth" in terms of an increase relative to its overall size, there may exist pockets of significant growth within that community that are subject to rapid development trends or significant development pressures. An <u>absolute increase</u> in population growth that was equivalent to at least a small village (500 persons or more) was considered sufficient to suggest the presence of significant development pressures tied to at least some specific locations within that community, such as a new subdivision, apartment complex, or mobile home park. Although actual specific locations could not be analyzed in this State-level plan, their presence may become part of later analyses and guidance for local planning considerations—as local hazard mitigation plans get updated, and as local comprehensive planning processes become increasingly aware of and informed by the need for hazard mitigation considerations. An absolute increase of at least 500 persons was considered sufficient to denote growth pressures for at least some part of a community, even if this represented only a very small percentage of that community's total population.
3. Any community that sees a sufficient <u>percentage decrease</u> (5% or more) in its population, corresponding to a sufficient <u>absolute decrease</u> (500 persons or more), can be reasonably assumed to be subject to "internal" development

pressures of the type that might be called "**crisis temptation**" decisions and outreach, which seeks to attract residents and employers (including riskier industries) through the use of incentives, tax abatements, technical assistance, zoning changes, variances, or unusually permissive attitudes toward any other part of the normal development or redevelopment process. In cases involving small communities (with a population below 10,000), a population decline of at least 30% was considered sufficient to denote substantial redevelopment pressures for that community, even if the absolute number of persons declined by only a few dozen or hundred.

4. Communities of sufficiently **large population** might be considered to have the potential to contain the sort of localized development pressures described in #2 or #3, or both, and therefore the possibility of development pressures should not be automatically ruled out if overall population trends appear flat. Rather, a more detailed analysis (such as a consideration of census tracts or city wards) should be performed by local communities in order to more accurately assess the presence or absence of strong development pressures in that jurisdiction. Although the staff resources to accomplish this are not currently in place at the state level (or are already occupied with higher-priority tasks), a more detailed analysis of census information and photographic images (e.g. Google maps aerial and street views) could allow a more detailed analysis of neighborhood-level development trends. A round figure of 10,000 population (in the 2010 census) was selected as the threshold for classifying a municipality as "large." (Note that a growth or decline of 500 persons is equal to a 5% rate of change for a population of 10,000. The criteria had been chosen to allow them to fit together in this way.)

For this 2019 plan update, although the main comparison was between official census population figures for 2000 and 2010, some consideration was also given to American Community Survey 1-year population estimates for 2017 (as a rough indicator of whether trends for communities have increased, stalled, or reversed). In almost all cases, the names of the municipalities readily matched up and allowed a straightforward comparison. The one exception involved the City of Stambaugh, in Iron County, which was merged into the City of Iron River in the year 2000. In this case, the revised 2000 census total for both cities was compared to the 2010 total for the consolidated City of Iron River.

For communities larger than 10,000 persons, an absolute increase of 500 persons is treated as not necessarily significant in its effect on overall growth pressures for the community, nor necessarily causing specific locations within that community to have unusual development pressures. Due to their already large size, these communities were examined for a 5% population change, rather than the larger 30% or 50% values applied to small communities. Large communities are encouraged to analyze growth trends at a more detailed level than the entire community, to better assess whether development pressures exist, of what type, whether they are concentrated in specific areas, and if so, where these areas exist and whether they are hazard-prone.

These criteria were intended to establish a norm for comparison in the average type of local community in Michigan – a lightly developed, fairly rural or exurban township. All large cities or more heavily populated townships (10,000 population or greater) were considered to be at least potentially exposed to significant development pressures on a localized level within their jurisdictional boundaries, but such potential is best analyzed either in local planning efforts or with use of more detailed information than was made a part of this preliminary analysis. Among small jurisdictions, the norm is one that has grown less than 500 persons and also less than 50% during the previous decade, but also that has not shrunk by more than 500 persons or by 30% during that same period. Thus, the norm in this analysis was a local community of less than 10,000 population, whose change in population between 2000 and 2010 was between -500 and +500, and greater than -30% but less than +50%. This means that the vast majority of rural townships fell in the "normal" category as not subject to unusual development pressures. A list of population information by county sub-jurisdictions, for the census years of 2000 and 2010 and including decennial changes both in absolute and percentage terms, was used as the information source for this analysis, and resulted in the list that follows later in this section. **PLEASE NOTE THAT THESE LISTS DO NOT INCLUDE VILLAGES, WHOSE POPULATIONS ARE ALL FAIRLY SMALL AND HAD THEREFORE BEEN INCLUDED WITHIN THE POPULATION FIGURES FOR THE TOWNSHIPS IN WHICH THEY ARE LOCATED.** The lists show which communities are considered likely to be subject to significant development pressures, or to have actually experienced significant growth during the recent period from 2000 to 2010. Each listed community has explanatory information describing the type of development pressures, according to the following key:

LG: Community is listed because its size (10,000 population or more) makes it likely to contain specific locations that are subject to significant development pressures of some kind, although such a condition needs to be verified either through local means or through a more detailed population analysis.

SG: Community is listed because it has experienced significant growth during the period from 2000 to 2010, either in percentage terms (at least 50%) or absolute terms (at least 500 persons), that suggest the likely existence of "external" development pressures on the community or significant locations within it (such locations requiring further analysis to pinpoint). For large communities, a 5% population increase (being at least 500 persons) is considered sufficient to imply the potential for at least one specific location within that community to experience significant development pressures.

CT: Community is listed because it has experience significant levels of population decline during the period from 2000 to 2010, either in percentage terms (at least 30%) or absolute terms (at least 500 persons), that suggest the probability of some sort of "internal" development pressures directed toward the halting or reversal of perceived community decline. For large communities, a 5% population decrease (being at least 500 persons) is considered sufficient to imply the potential for at least one specific location within that community to experience development pressures of the "internal" variety.

N: (not listed) Communities not listed here are not known to have any unusual development pressures. Relevant information to the contrary should be included in local plan development activities, or may be provided to MSP/EMHSD staff for consideration in future updates of this plan.

Some communities in the list have had their entries presented in **boldface** type. This means that they have met all three of the main criteria: (1) they are large communities with more than 10,000 population, (2) they have seen an absolute population change of at least 500 persons during the decade between censuses, and (3) their population changes have amounted to at least 5% of their earlier (2000) population size.

Michigan's 2010 population was officially stated to be 9,883,640, which was 0.6% smaller than the previous 2000 (revised) census figure of 9,938,480. This was the first time that the state's population had actually declined between one census and the next. The 2017 population estimate (ACS 1-year) for Michigan was back up to 9,925,568, however, which is very close to the state's 2000 population figure. The trend of decline has evidently reversed and Michigan's population would be expected on this basis to return to, and even to slightly exceed, its 2000 level by 2020.

List of Communities (by County) That Meet the Stated Criteria for Development Pressures
(or potential development pressures at selected locations within their boundaries)

NOTE: The following counties are not included in the list because they contained no communities that met the criteria for unusual development pressures between the 2000 and 2010 census: Alcona, Alger, Antrim, Baraga, Charlevoix, Cheboygan, Clare, Gladwin, Hillsdale, Huron, Iosco, Kalkaska, Lake, Leelanau, Luce, Mackinac, Manistee, Mason, Missaukee, Montmorency, Newaygo, Oceana, Ogemaw, Ontonagon, Osceola, Otsego, Presque Isle, Roscommon, and Sanilac. A large "LG" classification is listed only for communities that do not also have "SG" or "CT" development pressures being noted.

ALLEGAN COUNTY

Community	Reason for listing	Associated population trend
Dorr Township	SG	+860 persons
Leighton Township	SG	+1,282 persons
Otsego Township	SG	+748 persons
Salem Township	SG	+960 persons
Saugatuck Township	SG	+581 persons

ALPENA COUNTY

Community	Reason for listing	Associated population trend
Alpena City	**CT**	**-7%, -828 persons**
Alpena Township	CT	-721 persons

ARENAC COUNTY

Community	Reason for listing	Associated population trend
Standish City	CT	-587 persons

BARRY COUNTY

Community	Reason for listing	Associated population trend
Irving Township	SG	+568 persons
Thornapple Township	SG	+1,199 persons

BAY COUNTY

Community	Reason for listing	Associated population trend
Bangor Township	**CT**	**-6%, -906 persons**
Bay City	**CT**	**-5%, -1,885 persons**
Frankenlust Township	SG	+1,032 persons
Monitor Township	**SG**	**+7%, +698 persons**

BENZIE COUNTY

Community	Reason for listing	Associated population trend
Almira Township	SG	+834 persons

BERRIEN COUNTY

Community	Reason for listing	Associated population trend
Benton Township	**CT**	**-9%, -1,507 persons**
Benton Harbor City	**CT**	**-11%, -1,292 persons**
Chikaming Township	CT	-578 persons
Lincoln Township	**SG**	**+5%, +742 persons**
Niles City	CT	-602 persons
Niles Township	**SG**	**+6%, +839 persons**
Oronoko Township	CT	-650 persons
Royalton Township	SG	+875 persons
St. Joseph Township	LG	population 10,028

BRANCH COUNTY

Community	Reason for listing	Associated population trend
Coldwater City	**SG**	**+5%, +544 persons**

CALHOUN COUNTY

Community	Reason for listing	Associated population trend
Albion City	CT	-528 persons
Battle Creek City	CT	-1,017 persons
Emmett Township	LG	population 11,770

CASS COUNTY

Community	Reason for listing	Associated population trend
Milton Township	SG	+1,232 persons
Ontwa Township	SG	+684 persons

CHIPPEWA COUNTY

Community	Reason for listing	Associated population trend
Kinross Township	CT	-579 persons
Sault Ste. Marie City	LG	population 14,144

CLINTON COUNTY

Community	Reason for listing	Associated population trend
Bath Township	**SG**	**+54%, +4,057 persons**
DeWitt Township	**SG**	**+19%, +2,236 persons**
East Lansing City (pt)	SG	+1,877 persons
Watertown Township	SG	+676 persons

CRAWFORD COUNTY

Community	Reason for listing	Associated population trend
Grayling Township	CT	-658 persons

DELTA COUNTY

Community	Reason for listing	Associated population trend
Escanaba City	CT	-529 persons

DICKINSON COUNTY

Community	Reason for listing	Associated population trend
Iron Mountain City	CT	-542 persons

EATON COUNTY

Community	Reason for listing	Associated population trend
Delta Township	**SG**	**+9%, +2,794 persons**
Windsor Township	CT	-502 persons

EMMET COUNTY

Community	Reason for listing	Associated population trend
Bear Creek Township	SG	+932 persons

GENESEE COUNTY

Community	Reason for listing	Associated population trend
Atlas Township	SG	+736 persons
Burton City	LG	population 29,999
Davison Township	**SG**	**+11%, +1,853 persons**
Fenton City	**SG**	**+11%, +1,164 persons**
Fenton Township	**SG**	**+20%, +2,584 persons**
Flint City	**CT**	**-18%, -22,509 persons**
Flint Township	**CT**	**-5%, -1,724 persons**
Flushing Township	LG	population 10,640
Genesee Township	**CT**	**-11%, -2,535 persons**
Grand Blanc Township	**SG**	**+26%, +7,681 persons**
Linden City	SG	+1,130 persons
Mt. Morris Township	**CT**	**-9%, -2,224 persons**
Mundy Township	**SG**	**+24%, +2,891 persons**
Richfield Township	SG	+560 persons
Swartz Creek City	SG	+656 persons
Thetford Township	CT	-1,228 persons
Vienna Township	LG	population 13,255

GOGEBIC COUNTY

Community	Reason for listing	Associated population trend
Ironwood City	CT	-903 persons
Marenisco Township	SG	+64%, +676 persons

GRAND TRAVERSE COUNTY

Community	Reason for listing	Associated population trend
Blair Township	SG	+1,754 persons
East Bay Township	**SG**	**+8%, +744 persons**
Fife Lake Township	SG	+84%, +1,274 persons
Garfield Township	**SG**	**+17%, +2,415 persons**
Green Lake Township	SG	+775 persons
Long Lake Township	SG	+1,014 persons
Paradise Township	SG	+521 persons
Peninsula Township	SG	+925 persons
Traverse City (pt)	LG	population 14,482

GRATIOT COUNTY

Community	Reason for listing	Associated population trend
St. Louis City	SG	+913 persons

HOUGHTON COUNTY

Community	Reason for listing	Associated population trend
Houghton City	SG	+646 persons

INGHAM COUNTY

Community	Reason for listing	Associated population trend
Delhi Township	**SG**	**+15%, +3,381 persons**
East Lansing City (pt)	LG	population 46,610
Lansing City (part)	CT	-4,918 persons
Mason City	SG	+1,079 persons
Meridian Township	SG	+583 persons

IONIA COUNTY

Community	Reason for listing	Associated population trend
Boston Township	SG	+748 persons
Ionia City	LG	population 11,394
Portland Township	SG	+968 persons

IRON COUNTY

Community	Reason for listing	Associated population trend
Iron River City	CT	-11%

ISABELLA COUNTY

Community	Reason for listing	Associated population trend
Mt. Pleasant City	LG	population 26,016
Union Township	**SG**	**+70%, +5,316 persons**

JACKSON COUNTY

Community	Reason for listing	Associated population trend
Blackman Township	**SG**	**+6%, +1,246 persons**
Grass Lake Township	SG	+1,098 persons
Jackson City	**CT**	**-8%, -2,782 persons**
Leoni Township	LG	population 13,807
Spring Arbor Township	SG	+690 persons
Summit Township	SG	+979 persons

KALAMAZOO COUNTY

Community	Reason for listing	Associated population trend
Comstock Township	**SG**	**+7%, +1,005 persons**
Cooper Township	**SG**	**+16%, +1,360 persons**
Kalamazoo City	CT	-2,883 persons
Kalamazoo Township	LG	population 21,918
Oshtemo Township	**SG**	**+28%, +4,702 persons**
Portage City	SG	+1,395 persons
Richland Township	SG	+1,086 persons
Schoolcraft Township	SG	+954 persons
Texas Township	**SG**	**+35%, +3,778 persons**

KENT COUNTY

Community	Reason for listing	Associated population trend
Ada Township	**SG**	**+33%, +3,260 persons**
Algoma Township	SG	+2,342 persons
Alpine Township	CT	-640 persons
Byron Township	**SG**	**+16%, +2,781 persons**
Caledonia Township	**SG**	**+38%, +3,368 persons**
Cannon Township	**SG**	**+10%, +1,261 persons**
Cascade Township	**SG**	**+13%, +2,027 persons**
Courtland Township	SG	+1,861% persons
East Grand Rapids City	LG	population 10,694
Gaines Township	**SG**	**+25%, +5,034 persons**
Grand Rapids City	**CT**	**-5%, -9,764 persons**
Grand Rapids Township	**SG**	**+19%, +2,604 persons**
Grandville City	CT	-885 persons
Kentwood City	**SG**	**+8%, +3,448 persons**
Lowell Township	SG	+730 persons
Nelson Township	SG	+588 persons
Oakfield Township	SG	+727 persons
Plainfield Township	SG	+757 persons
Rockford City	SG	+1,087 persons
Solon Township	SG	+1,347 persons
Vergennes Township	SG	+578 persons
Walker City	**SG**	**+8%, +1,695 persons**
Wyoming City	SG	+2,744 persons

KEWEENAW COUNTY

Community	Reason for listing	Associated population trend
Eagle Harbor Township	CT	-40%
Houghton Township	CT	-35%

LAPEER COUNTY

Community	Reason for listing	Associated population trend
Almont Township	SG	+542 persons

LENAWEE COUNTY

Community	Reason for listing	Associated population trend
Adrian City	**CT**	**-5%, -1,171 persons**
Madison Township	SG	+1,016 persons
Raisin Township	SG	+1,052 persons

LIVINGSTON COUNTY

Community	Reason for listing	Associated population trend
Brighton City	SG	+714 persons
Brighton Township	LG	population 17,791
Conway Township	SG	+814 persons
Genoa Township	**SG**	**+25%, +3,955 persons**
Green Oak Township	**SG**	**+12%, +1,858 persons**
Hamburg Township	SG	+538 persons
Handy Township	SG	+1,002 persons
Hartland Township	**SG**	**+33%, +3,667 persons**
Howell Township	SG	+1,044 persons
Iosco Township	SG	+762 persons
Marion Township	SG	+3,252 persons
Oceola Township	**SG**	**+43%, +3,574 persons**
Putnam Township	SG	+748 persons
Tyrone Township	**SG**	**+19%, +1,561 persons**

MACOMB COUNTY

Community	Reason for listing	Associated population trend
Bruce Township	SG	+542 persons
Chesterfield Township	**SG**	**+16%, +5,976 persons**
Clinton Township	SG	+1,148 persons
Eastpointe City	CT	-1,635 persons
Fraser City	**CT**	**-5%, -817 persons**
Harrison Township	LG	population 24,587
Lenox Township	**SG**	**+24%, +2,037 persons**
Macomb Township	**SG**	**+58%, +29,102 persons**
Mt. Clemens City	**CT**	**-6%, -998 persons**
New Baltimore City	SG	+63%, +4,687 persons
Richmond City (pt)	SG	+845 persons
Roseville City	CT	-830 persons
Shelby Township	**SG**	**+13%, +8,645 persons**
St. Clair Shores City	**CT**	**-5%, -3,381 persons**
Sterling Heights City	SG	+5,228 persons
Warren City	CT	-4,191 persons
Washington Township	**SG**	**+32%, +6,051 persons**

MARQUETTE COUNTY

Community	Reason for listing	Associated population trend
Forsythe Township	SG	+1,340 persons
Marquette City	**SG**	**+641 persons**
Marquette Township	SG	+602 persons

MECOSTA COUNTY

Community	Reason for listing	Associated population trend
Big Rapids City	LG	population 10,601
Big Rapids Township	SG	+962 persons
Morton Township	SG	+714 persons

MENOMINEE COUNTY

Community	Reason for listing	Associated population trend
Menominee City	CT	-532 persons

MIDLAND COUNTY

Community	Reason for listing	Associated population trend
Larkin Township	SG	+671 persons
Midland City	SG	population 41,706

MONROE COUNTY

Community	Reason for listing	Associated population trend
Bedford Township	**SG**	**+8%, +2,239 persons**
Berlin Township	SG	+2,375 persons
Frenchtown Township	LG	population 20,428
Monroe City	**CT**	**-6%, -1,343 persons**
Monroe Township	**SG**	**+8%, +1,077 persons**
Raisinville Township	SG	+905 persons

MONTCALM COUNTY

Community	Reason for listing	Associated population trend
Eureka Township	SG	+739 persons
Reynolds Township	SG	+1,031 persons

MUSKEGON COUNTY

Community	Reason for listing	Associated population trend
Dalton Township	SG	+1,253 persons
Fruitport Township	**SG**	**+9%, +1,065 persons**
Muskegon City	CT	-1,704 persons
Muskegon Heights City	**CT**	**-10%, -1,193 persons**
Muskegon Township	LG	population 17,840
Norton Shores City	**SG**	**+7%, +1,467 persons**

OAKLAND COUNTY

Community	Reason for listing	Associated population trend
Auburn Hills City	**SG**	**+8%, +1,575 persons**
Berkley City	CT	-561 persons
Birmingham City	SG	+806 persons
Bloomfield Township	CT	-1,875 persons
Brandon Township	LG	population 15,175
Clawson City	**CT**	**-7%, -905 persons**
Commerce Township	**SG**	**+15%, +5,373 persons**
Farmington City	LG	population 10,372
Farmington Hills City	CT	-2,378 persons
Ferndale City	**CT**	**-10%, -2,209 persons**
Groveland Township	CT	-674 persons
Hazel Park City	**CT**	**-13%, -2,541 persons**
Highland Township	LG	population 19,202
Holly Township	**SG**	**+13%, +1,325 persons**
Independence Township	**SG**	**+7%, +2,111 persons**
Lyon Township	**SG**	**+32%, +3,491 persons**
Madison Heights City	CT	-1,407 persons
Milford Township	LG	population 15,736
Novi City	**SG**	**+17%, +7,838 persons**
Oakland Township	**SG**	**+28%, +3,708 persons**
Oak Park City	**CT**	**-10%, -3,076 persons**
Orion Township	**SG**	**+6%, +1,930 persons**
Oxford Township	**SG**	**+28%, +4,519 persons**
Pontiac City	**CT**	**-12%, -8,046 persons**

Rochester City	**SG**	**+22%, +2,272 persons**
Rochester Hills City	SG	+2,142 persons
Royal Oak City	CT	-2,828 persons
Southfield City	**CT**	**-8%, +6,557 persons**
Southfield Township	LG	population 14,547
South Lyon City	**SG**	**+13%, +1,304 persons**
Springfield Township	SG	+595 persons
Troy City	LG	population 80,980
Waterford Township	LG	population 71,707
West Bloomfield Township	LG	population 64,690
White Lake Township	**SG**	**+6%, +1,803 persons**
Wixom Township	LG	population 13,498

OSCODA COUNTY

Community	Reason for listing	Associated population trend
Big Creek Township	CT	-553 persons

OTTAWA COUNTY

Community	Reason for listing	Associated population trend
Allendale Township	**SG**	**+59%, +7,666 persons**
Georgetown Township	**SG**	**+13%, +5,327 persons**
Grand Haven City	**CT**	**-7%, -756 persons**
Grand Haven Township	**SG**	**+14%, +1,900 persons**
Holland City	**CT**	**-7%, -1,811 persons**
Holland Township	**SG**	**+23%, +6,715 persons**
Jamestown Township	SG	+1,972 persons
Park Township	LG	population 17,802
Spring Lake TownshipSG		**+9%, +1,160 persons**
Tallmadge Township	SG	+694 persons
Zeeland Township	SG	+2,358 persons

SAGINAW COUNTY

Community	Reason for listing	Associated population trend
Bridgeport Township	**CT**	**-10%, -1,195 persons**
Buena Vista Township	CT	-1,640 persons
Kochville Township	SG	+57%, +1,835 persons
Saginaw City	**CT**	**-17%, -10,284 persons**
Saginaw Township	SG	+1,183 persons
Thomas Township	LG	population 11,985
Tittabawassee Township	SG	+2,020 persons

ST. CLAIR COUNTY

Community	Reason for listing	Associated population trend
Algonac City	CT	-523 persons
Casco Township	CT	-642 persons
Clay Township	CT	-738 persons
Columbus Township	CT	-545 persons
Fort Gratiot Township	LG	population 11,108
Ira Township	CT	-1,788 persons
Kimball Township	SG	+730 persons
Port Huron City	**CT**	**-7%, -2,154 persons**
Port Huron Township	**SG**	**+24%, +2,093 persons**

ST. JOSEPH COUNTY

Community	Reason for listing	Associated population trend
Sturgis City	LG	population 10,994

SCHOOLCRAFT COUNTY

Community	Reason for listing	Associated population trend
Seney Township	CT	-34%

SHIAWASSEE COUNTY

Community	Reason for listing	Associated population trend
Owosso City	CT	-519 persons

TUSCOLA COUNTY

Community	Reason for listing	Associated population trend
Indianfields Township	CT	-547 persons

VAN BUREN COUNTY

Community	Reason for listing	Associated population trend
Almena Township	SG	+766 persons
Antwerp Township	**SG**	**+13%, +1,369 persons**
South Haven City	CT	-615 persons

WASHTENAW COUNTY

Community	Reason for listing	Associated population trend
Ann Arbor City	CT	-723 persons
Augusta Township	SG	+1,932 persons
Chelsea City	SG	+529 persons
Dexter Township	SG	+775 persons
Lima Township	SG	+825 persons
Milan City	SG	+701 persons
Pittsfield Township	**SG**	**+16%, +4,696 persons**
Saline City	SG	+770 persons
Saline Township	SG	+598 persons
Scio Township	**SG**	**+28%, +4,394 persons**
Superior Township	**SG**	**+22%, +2,318 persons**
Webster Township	SG	+1,586 persons
York Township	SG	+1,320 persons
Ypsilanti City	**CT**	**-13%, -2,808 persons**
Ypsilanti Township	**SG**	**+9%, +4,186 persons**

WAYNE COUNTY

Community	Reason for listing	Associated population trend
Allen Park City	**CT**	**-1,238 persons**
Brownstown Township	**SG**	**+33%, +7,638 persons**
Canton Township	**SG**	**+18%, +13,807 persons**
Dearborn City	LG	population 98,153
Dearborn Heights City	LG	population 57,774
Detroit City	**CT**	**-25%, -237,493 persons**
Ecorse City	CT	-1,717 persons
Flat Rock City	SG	+1,390 persons
Garden City	**CT**	**-8%, -2,355 persons**
Grosse Ile Township	CT	-523 persons
Grosse Pointe Park City	**CT**	**-7%, -888 persons**
Grosse Pointe Woods City	**CT**	**-6%, -945 persons**

Hamtramck City	CT	-553 persons
Highland Park City	**CT**	**-30%, -4,970 persons**
Huron Township	**SG**	**+16%, +2,142 persons**
Inkster City	**CT**	**-16%, -4,746 persons**
Lincoln Park City	CT	-1,864 persons
Livonia City	CT	-3,603 persons
Melvindale City	LG	population 10,715
Northville Township	**SG**	**+36%, +7,461 persons**
Plymouth Township	LG	population 27,524
Redford Township	**CT**	**-6%, -3,260 persons**
River Rouge City	**CT**	**-2,014 persons**
Riverview City	**CT**	**-6%, -786 persons**
Romulus City	SG	+1,010 persons
Southgate City	LG	population 30,047
Sumpter Township	CT	-2,307 persons
Taylor City	CT	-2,737 persons
Trenton City	CT	-731 persons
Van Buren Township	**SG**	**+22%, +5,262 persons**
Wayne City	**CT**	**-8%, -1,458 persons**
Westland City	CT	-2,508 persons
Woodhaven City	LG	population 12,875
Wyandotte City	**CT**	**-8%, -2,123 persons**

WEXFORD COUNTY

Community	Reason for listing	Associated population trend
Cadillac City	LG	population 10,355

Conclusions

Practically all of the major metropolitan areas in the state can be considered to have developmental pressures stemming either from the "external" market demands associated with the value of land with good access to urban amenities and infrastructure or from the "internal" desire to maintain the status quo in terms of a community's size, resources, budget, services, etc. in the face of potential or actual population declines. This is usually true even for some parts of declining central cities within those metropolitan areas—some parts of Detroit, for example, have been redeveloping even while the population of the city as a whole has kept declining.

It is unclear which types of development pressures are of greater concern in terms of hazard mitigation considerations—although the "external" pressures are probably more widespread in their forms and the number of actors involved, the effects of "internal" pressures would seem instinctively to be nearly as great because the entire point of various policies to prevent "decline" is to create an environment that is equal or more attractive than new "greenfield" locations, and communities that envision themselves to be in a state of "crisis" may be tempted to offer extensive incentives to promote development without necessarily considering the hazard-related risks that may face such developments. There is far more planning literature that deals with the problems of growing communities (the subtopic of "growth management") and the encouragement of redevelopment ("economic development," "infill development," and "neighborhood preservation" subtopics, among others) than there is with the concept of encouraging a declining area to accept a new, more modest status for its future. This is understandable because of the profit and growth-oriented nature of the American economy and its associated culture.

However, it may make sense for some geographic areas to be "undeveloped" in cases where declining communities can no longer afford the costs of providing and maintaining the previous levels of services that those areas enjoyed when they were thriving. This is something that the City of Detroit has been planning and implementing for several years. In cases where the choice is either to accept fallow areas (or devalued areas with correspondingly lightened zoning classifications) in a declining community or to allow development that under better conditions would not be considered acceptable, it may be better to maintain the old standards, reject questionable forms of redevelopment, and focus on re-organizing a community's budget and focusing its services so as to more effectively operate on the smaller

scale that external market forces have encouraged. Although this runs counter to the customary development-oriented thinking for municipalities, given the number of dubious (and even unprofitable) incentives that have been offered in desperation, with debatable results, it makes good sense for shrinking communities to consider a "decline management" orientation that emphasizes good fiscal practices, maintaining a good credit rating, prioritizes services to emphasize the most vital and valuable, and concentrates on maintaining or improving the area's quality of life (improving its environment, schools, maintaining and emphasizing its current and future competitive advantages, converting selected areas of abandonment into historic and tourist attractions related to past glories rather than attempting desperate redevelopment efforts that may further harm an area's image, infrastructure, or declining residential base). One book that has been published on the topic of "Legacy Cities" includes numerous Michigan examples: "Rebuilding America's Legacy Cities: New Directions for the Industrial Heartland," by Alan Mallach (2012). In the preceding table, communities marked CT or LG are likely to be considering these sorts of dilemmas and tradeoffs (or how to avoid them), which is the main source of "internal" development pressures in communities or their subareas that are facing declines.

At the fringes of most metropolitan areas are communities and more specific locations that are experiencing "external" development pressures and growth trends, due primarily to the patterns associated with metropolitan change (primarily the rise of the automobile and the lessening of the cost of outlying development which often no longer needs services that, historically, could only be provided by cities) that have caused the average family to live in areas that have lower population densities than was true in the past. Although foreign immigration has long been a characteristic of American life that has promoted growth within central cities, the great historic population shift from American rural areas into those cities, which characterized the first half of the twentieth century, has essentially reversed itself, with many persons now moving or seeking to move back into more rural areas, or at least traditional "suburban-style" areas of only moderate development densities (despite the increasing automotive transportation problems that have been associated with such a trend in recent decades, a problem that has been exacerbated by occupational commuting patterns, increases in the number of second homes, and the number of seasonal resort areas in large areas of the state). Even though urban residences and lifestyle have seen an increased appeal within recent decades, and this trend might only apply to portions of the buyer's market (i.e. younger adults without children), the overall population trends in Michigan have not a large portion of the population shifting back to the traditional central cities—although some such as Grand Rapids and Ann Arbor have shown a potential for such expansion in past decades, and again in the most recent population estimates.

Recent land use trends have seen a continued growth of lesser-density outlying areas at the fringe of metropolitan areas throughout the state, or even in rural areas that have road access considered acceptable for the needs of the select number of residents who decide to and can afford to live so far away from employment centers, hospitals, and various urban conveniences. This is the common pattern with the listed SG communities – most of which are not large cities but small or moderate sized townships and their associated small cities and villages within them. It is true also for metropolitan areas that have many of their older core communities declining in population.

The vast majority of growing communities in Michigan are those that are associated with, but outside the center of larger metropolitan areas. The growth of these communities while older, more central ones decline, is indicative of broader development patterns (and neighborhood cycle and "filtering" effects) that are characteristic of most subsections surrounding any large city in recent decades. (For example, family areas reach a population peak when the resident parents are, on average, in their most active years of child-raising, but when children leave home they typically move either to more affordable areas or to other cities for educational or employment purposes, leaving fewer residents per household in the original area which then appears to have experienced a decline, in terms of population, school enrollment, associated retail sales, etc.)

To maximize the effectiveness of efforts to coordinate hazard mitigation efforts with land use planning and future development decisions and regulations, it makes sense to prioritize these efforts in communities that have the largest absolute amount of growth (affecting the largest number of persons) rather than merely those with a high growth percentage. At the same time, it must not be forgotten that there are other forms of development pressures, besides those that actually result in rapid growth, which may cause the approval of projects that are insufficiently hazard-conscious. The likeliest combination of development pressures involves the communities that had been **boldfaced** in the list, which met all three criteria for either growth or decline: being a large community of at least 10,000 persons, and having the greatest population changes both in terms of absolute numbers as well as a percentage of

growth/decline. In the table above, these communities would seem the most appropriate to prioritize with regard to their development pressures.

A subsequent level of prioritization that seems to make sense would be to rank the communities' population changes in terms of the absolute number of persons, perhaps prioritizing communities whose change is positive (and thus demonstrating actual growth). In order of absolute population change, therefore, the following large communities are considered to have the most substantial development pressures (communities with a change of less than 2,000 are not included in this prioritized list):

Community	County	Type	Associated population trend		2017 estimate – 2010 pop.
Detroit City	Wayne	CT	-25%	-237,493 persons	679,865 – 713,777 = -33,912
Macomb Township	Macomb	SG	+58%	+29,102 persons	86,710 – 79,580 = +7,130
Flint City	Genesee	CT	-18%	-22,509 persons	97,810 – 102,434 = -4,624
Canton Township	Wayne	SG	+18%	+13,807 persons	90,345 – 90,173 = +173
Saginaw City	Saginaw	CT	-17%	-10,284 persons	43,366 – 51,508 = -8,142
Grand Rapids City	Kent	CT	-5%	+9,764 persons	195,355 – 188,040 = +7,315
Shelby Township	Macomb	SG	+13%	+8,645 persons	77,650 – 73,804 = +3,846
Pontiac City	Oakland	CT	-12%	**-8,046 persons**	60,039 – 59,515 = **+524**
Novi City	Oakland	SG	+17%	+7,838 persons	58,835 – 55,224 = +3,611
Grand Blanc Township	Genesee	SG	+26%	**+7,681 persons**	36,720 – 37,508 = **-788**
Allendale Township	Ottawa	SG	+59%	+7,666 persons	23,460 – 20,708 = +2,752
Brownstown Township	Wayne	SG	+33%	+7,638 persons	31,026 – 30,627 = +399
Northville Township	Wayne	SG	+36%	+7,461 persons	28,838 – 28,497 = +341
Holland Township	Ottawa	SG	+23%	+6,715 persons	37,581 – 35,636 = +1,945
Southfield City	Oakland	CT	-8%	**-6,557 persons**	73,228 – 71,739 = **+1,439**
Washington Township	Macomb	SG	+32%	+6,051 persons	26,919 – 25,139 = +1,780
Chesterfield Township	Macomb	SG	+16%	+5,976 persons	44,726 – 43,381 = +1,345
Commerce Township	Oakland	SG	+15%	+5,373 persons	42,258 – 40,186 = +2,072
Georgetown Township	Ottawa	SG	+13%	+5,327 persons	50,613 – 46,985 = +3,628
Union Township	Isabella	SG	+70%	+5,316 persons	13,540 – 12,927 = +613
Van Buren Township	Wayne	SG	+22%	**+5,262 persons**	28,303 – 28,821 = **-518**
Sterling Heights City	Macomb	SG	+4%	+5,228 persons	131,996 – 129,699 = +2,297
Gaines Township	Kent	SG	+25%	+5,034 persons	26,532 – 25,146 = +1,386
Highland Park City	Wayne	CT	-30%	-4,970 persons	10,955 – 11,776 = -821
Lansing City (part)	Ingham	CT	-4%	**-4,918 persons**	110,459 – 109,563 = **+896**
Inkster City	Wayne	CT	-16%	-4,746 persons	24,670 – 25,369 = -699
Oshtemo Township	Kalamazoo	SG	+28%	+4,702 persons	22,658 – 21,705 = +953
Pittsfield Township	Washtenaw	SG	+16%	+4,696 persons	37,818 – 34,663 = +3,155
New Baltimore City	Macomb	SG	+63%	+4,687 persons	12,315 – 12,084 = +231
Oxford Township	Oakland	SG	+28%	+4,519 persons	21,626 – 20,526 = +1,100
Scio Township	Washtenaw	SG	+28%	**+4,394 persons**	17,305 – 20,081 = **-2,776**
Warren City	Macomb	CT	-3%	**-4,191 persons**	135,147 – 134,056 = **+1,091**
Ypsilanti Township	Washtenaw	SG	+9%	+4,186 persons	54,721 – 53,362 = +1,359
Bath Township	Clinton	SG	+54%	+4,057 persons	12,339 – 11,598 = +741
Genoa Township	Livingston	SG	+25%	+3,955 persons	20,113 – 19,821 = +292
Texas Township	Kalamazoo	SG	+35%	+3,778 persons	16,391 – 14,697 = +1,694
Oakland Township	Oakland	SG	+28%	+3,708 persons	18,494 – 16,779 = +1,715
Hartland Township	Livingston	SG	+33%	+3,667 persons	14,900 – 14,663 = +237
Livonia City	Wayne	CT	-4%	-3,603 persons	94,708 – 96,942 = -2,234
Oceola Township	Livingston	SG	+43%	+3,574 persons	13,395 – 11,936 = +1,459
Lyon Township	Oakland	SG	+32%	+3,491 persons	18,172 – 14,545 = +3,627
Kentwood City	Kent	SG	+8%	+3,448 persons	51,154 – 48,707 = +2,447
Delhi Township	Ingham	SG	+15%	+3,381 persons	26,777 – 25,877 = +900
St. Clair Shores City	Macomb	CT	-5%	**-3,381 persons**	59,865 – 59,715 = **+150**

Caledonia Township	Kent	SG	+38%	+3,368 persons	13,799 – 12,332 = +1,467
Ada Township	Kent	SG	+33%	+3,260 persons	14,191 – 13,142 = +1,049
Redford Township	Wayne	CT	-6%	-3,260 persons	47,356 – 48,362 = -1,006
Marion Township	Livingston	SG	+48%	+3,252 persons	10,668 – 9,996 = +672
Oak Park City	Oakland	CT	-10%	**-3,076 persons**	29,824 – 29,319 = **+505**
Mundy Township	Genesee	SG	+24%	**+2,891 persons**	14,616 – 15,082 = **-466**
Kalamazoo City	Kalamazoo	CT	-4%	**-2,883 persons**	75,833 – 74,262 = **+1,571**
Royal Oak City	Oakland	CT	-5%	**-2,828 persons**	58,973 – 57,236 = **+1,737**
Ypsilanti City	Washtenaw	CT	-13%	**-2,808 persons**	20,804 – 19,435 = **+1,369**
Delta Township	Eaton	SG	+9%	+2,794 persons	32,849 – 32,408 = +441
Jackson City	Jackson	CT	-8%	-2,782 persons	32,875 – 33,534 = -659
Wyoming City	Kent	SG	+4%	+2,744 persons	75,124 – 72,125 = +2,999
Taylor City	Wayne	CT	-4%	-2,737 persons	61,648 – 63,131 = -1,483
Grand Rapids Township	Kent	SG	+19%	+2,604 persons	17,978 – 16,661 = +1,317
Fenton Township	Genesee	SG	+20%	**+2,584 persons**	15,288 – 15,552 = **-264**
Hazel Park City	Oakland	CT	-13%	**-2,541 persons**	16,587 – 16,422 = **+165**
Genesee Township	Genesee	CT	-11%	-2,535 persons	20,780 – 21,581 = -801
Westland City	Wayne	CT	-3%	-2,508 persons	82,172 – 84,094 = -1,922
Garfield Township	Gd. Traverse	SG	+17%	+2,415 persons	17,017 – 16,256 = +761
Farmington Hills City	Oakland	CT	-3%	**-2,378 persons**	81,235 – 79,740 = **+1,495**
Berlin Township	Monroe	SG	+34%	**+2,375 persons**	9,201 – 9,299 = **-98**
Zeeland Township	Ottawa	SG	+31%	+2,358 persons	10,864 – 9,971 = +893
Garden City	Wayne	CT	-8%	-2,355 persons	26,889 – 27,692 = -803
Algoma Township	Kent	SG	+31%	+2,342 persons	11,186 – 9,932 = +1,254
Superior Township	Washtenaw	SG	+22%	+2,318 persons	13,660 – 13,058 = +602
Sumpter Township	Wayne	CT	-20%	-2,307 persons	9,359 – 9,549 = -190
Rochester City	Oakland	SG	+22%	+2,272 persons	12,987 – 12,711 = +276
Bedford Township	Monroe	SG	+8%	**+2,239 persons**	30,992 – 31,085 = **-93**
DeWitt Township	Clinton	SG	+19%	+2,236 persons	14,750 – 14,321 = +429
Mt. Morris Township	Genesee	CT	-9%	-2,224 persons	20,698 – 21,501 = -803
Ferndale City	Oakland	CT	-10%	**-2,209 persons**	20,159 – 19,900 = **+259**
Port Huron City	St. Clair	CT	-7%	-2,154 persons	29,285 – 30,184 = -899
Huron Township	Wayne	SG	+16%	**+2,142 persons**	15,764 – 15,879 = **-115**
Rochester Hills City	Oakland	SG	+3%	**+2,142 persons**	73,458 – 79,740 = **-6,282**
Wyandotte City	Wayne	CT	-8%	-2,123 persons	25,175 – 25,883 = -708
Independence Township	Oakland	SG	+7%	+2,111 persons	36,242 – 34,681 = +1,561
Port Huron Township	St. Clair	SG	+24%	**+2,093 persons**	10,408 – 10,654 = **-246**
Lenox Township	Macomb	SG	+24%	+2,037 persons	10,686 – 10,470 = +216
Cascade Township	Kent	SG	+13%	+2,027 persons	18,522 – 17,134 = +1,388
Tittabawassee Township	Saginaw	SG	+26%	+2,020 persons	9,803 – 9,726 = +77
River Rouge City	Wayne	CT	-20%	-2,014 persons	7,559 – 7,903 = -344

These are the communities that should seriously consider hazard mitigation concepts in their land use planning and development decisions. A new column has been added to the 2019 edition of this plan, providing the most recent census population estimates (ACS 2017 1-year estimates) as a rough indicator of whether the previous trends may have grown, lessened, or reversed. In the majority of cases, existing trends had continued, but the exceptions have both population trend statistics emphasized **in boldface font**.

For state planning purposes and state-local coordination, the following subsection provides a brief analysis of how development trends appear to shape hazard vulnerabilities within Michigan. (Note: This subsection is connected with the column within the hazards summary table appearing in Chapter 5 of this plan.)

Implications of Development Trends for Michigan's Hazards

Overall development trends involve land use patterns in which greenfield development patterns are still very common, even though heartening signs of urban redevelopment have also been observed in selected areas. The likely problems

foreseen with greenfield development is that of a still-increasing amount of developed land per person, which is still considered to generally increase the area covered by impervious surfaces and extent of required infrastructure systems such as roads and sewer systems. For weather hazards whose impacts are felt upon essentially random locations, such as thunderstorms, tornadoes, severe winds, and hail, an increasing amount of Michigan's land area containing built structures and infrastructure means that some sort of development is more likely to exist in a location where these hazards occur. Impervious surfaces cause increased quantities and rates of water runoff from precipitation, either from rain or from melted snowpack, or combinations thereof, which increases the risk of flooding and the burden upon existing drainage infrastructure. Lakefront development is still popular within Michigan, including the continued occupation of older flood-prone structures that might not have been considered compliant with the newest building codes if they had been constructed in recent years. Similar concern exists with hazards such as subsidence and wildfires. Since the extent of old mining areas is not yet fully known, some new structures might be built in locations vulnerable to subsidence. Construction sites within wooded are still very popular, and not all such developments are required to be "Firewise." An increasing amount of enclosed space per person also suggests an increased demand for heating, cooling, and energy. These may increase the area's power-system blackout vulnerabilities during heat waves, and lead to increased vulnerability to energy shortages (as seen during the early 2019 extreme cold event).

On the bright side, a pattern of additional structures and floor area, for a fairly stable population statewide, may suggest a decreased risk from hazards such as pandemic illness, public health emergencies, nuclear attack, structural fires, terrorism that tend to have more severe impacts within areas of high population or development density. Further research is needed to estimate the implications of development for Michigan's vulnerability to such hazards as drought, invasive species, and cyber-attack. **Appendix 7** has extra information on development trends/pressures.

On page 41, a column in the Hazard Analysis Summary Table provides a general estimate of the net effect of Michigan's development trends upon various hazards. The rationale for these entries in the table will be explained within the following descriptive text, for each natural hazard.

1. Hail: Since the locations impacted by hail are effectively random, this means that a given quantity and frequency of severe hail events is more likely to cause damages within Michigan if an increasing amount of the land area in the state has been developed. Although Michigan's population had declined slightly in the 2010 census, recent estimates suggest that this population loss may have been nearly recovered from. A general trend still persists in which new structures are built as a result of economic growth (or business efforts), even if a population level is stable. Construction also occurs that is designed to replace aging houses and to accommodate market patterns supplying an increasing amount of residential square footage per resident. Commercial developments also tend to occur within or near growing residential areas. For these reasons, although severe hail is uncommon, when it does eventually recur it is slightly more likely to cause damage to the extent that additional lands contain development that may randomly receive such hail.
2. Lightning: Following the same reasoning as hail, one might propose that lightning strikes are random and therefore would be more likely to damage a structure over time, even if development is occurring very slowly. However, since the pace of development in Michigan has been only moderate, and since lightning locations are not completely random, the net effects have been estimated as approximately neutral. Lightning tends to occur where electrical charges build up, and these charges also favor the shortest paths for the lightning currents to travel along. Some of Michigan's recent development patterns have involved larger buildings which are often designed to take lightning into account since tall structures are known to be at higher risk. Many of the tallest buildings attract lightning but are not truly damaged by it, and the discharge of lightning to their lightning protection systems provides a very slight benefit to surrounding areas less likely to be struck. Research has not yet proven a significant relationship between climate change and lightning frequency.
3. Ice storms, sleet storms, snowstorms: As additional weather hazards that occur at essentially random locations, like hail, these hazards have been assessed as having slightly greater impacts as a result of development. In addition, consideration was given to the effects of increased vehicle use, but research on that subject suggests that the annual miles traveled per vehicle and driver is very similar to what it had been 10 years ago, so that was considered not to be a significant factor in this assessment, although it is worth keeping in mind in case that trend changes in the future. In addition, since ice storms tend to occur when temperatures are at or near the freezing mark, the most heavily populated geographic area of Michigan (the southern Lower Peninsula) currently appears to be at an increased risk of ice storms, due to increasing winter temperature fluctuations that cause the freezing point to be more frequently approached and crossed. During most of the 20th Century, it

used to be common for Michigan winters to arrive and keep temperatures below freezing for the entire season. Today, mid-winter thaws and freezing rain have become commonplace.

4. Severe winds and tornadoes: For reasons similar to hail and winter storms, Michigan's severe wind hazards essentially strike at random locations and even a slight increase in developed lands can be expected to result in a proportional increase in the likelihood of wind hazards causing damage. An interesting aspect to consider is whether the gradual statewide increase in this type of development-driven risk might be offset by a sufficient number of persons moving out of the highest-risk counties of the state. For example, Genesee County lost just over 10,000 persons between 2000 and 2010. However, the 2010 census also shows that the number of housing units in the county increased by nearly 10,000 during that same time. Vacant or less-heavily packed houses can still be damaged even if fewer persons are living in them, so the net effect of development is still considered positive even in higher-risk areas with a modest decline in population.
5. Extreme heat: Although some urban redevelopment has occurred, which could cause an increase in the human health impacts of heat waves within areas that experience a heat-island effect, the general development pattern still appears to involve an increasing number of persons living in less dense areas outside of the central cities. Although some central cities have seen growth in recent census estimates, most such growth has been slow, while Detroit continues to lose thousands of persons per year due to out-migration. This hazard has not been assessed to have a net effect from Michigan's development patterns.
6. Extreme cold: Similarly, no clear development-related effect is apparent for extreme cold events. If the number of miles driven per person had increased, or the size of the population had increased to result in more vehicle-miles involving a risk of stranded motorists, then the developmental effect might have been considered positive, but recent statistics suggest no significant increase in miles driven even while census estimates suggest that Michigan is probably recovering much of the approximately 1% population decline from the previous decade.
7. Fog: The assessment for fog just barely falls into the category of a slight association between Michigan's development trends and higher risks. Specifically, Michigan still sees new development patterned along lakes and shorelines that provide a ready source of moisture for fog to appear. Intuitively, if lakeshore development patterns are still popular and increasing, then the number of miles driven through fog is probably increasing over time, with a potentially detectable increase in travel-related risks expected to result.
8. Flooding: The risks from floods are increasing. One part of this trend toward increasing impacts comes from a substantial decline in the number of flood-insured structures under the NFIP. The majority of all structures are not insured against flooding. Although good steps have been taken by many planners to mitigate flood risks through a consideration of mapped floodplain areas, water retention and detention projects, and the consideration of green infrastructure, it currently appears that the effects of such laudable efforts have not yet become sufficient to offset the rise in risks from pluvial (or urban) flooding which is not limited to floodplain areas, and the severe challenges for Michigan's current stormwater systems have again been seen within the five years since the previous update of this plan was completed.
9. Great Lakes Shoreline Hazards: Lakeshore developments, a decline in the number of flood insurance policies, reported damages to flood protection structures along the shoreline, and continued problems with shoreline erosion and harmful algal blooms have caused the current development trends to be estimated as exacerbating risks from these hazards. Since 2014, Lake Erie algae caused some drinking water near Toledo to be temporarily declared unfit for normal use. A new shoreline hazard has also been identified during the winter season (ice shoves), on the basis of damage caused in Bay County. Current development patterns are leading to worsened shoreline risks, as well as an increase in algal blooms since they are exacerbated by nutrient runoff from agricultural areas.
10. Dam (and levee) failures: Although an increased use of structural flood protection measures can be a good thing to prevent regular flood damages, it does also involve an acknowledged increase in risks from flash floods, should there be a failure of the protective structures. This has especially been of concern for the City of Grand Rapids, whose already substantial flood walls have come under discussion for further enhancement. On the bright side, some obsolete dams do get removed and thus reduce the threat of flash floods in their area, but the overall risk trend still appears to be an increasing one, given the number of urban areas susceptible to damaging runoff from rain events along Michigan's rivers and drains.
11. Drought: Any relationship with development patterns has been unclear. On the one hand, increased development could be expected to cause an increase in consumer demand for water, but on the other hand, Michigan has seen an increase in precipitation that could help Michigan's agricultural sectors supply their

crops without so much need to irrigate or purchase water from a human network. Michigan's current concern is most heavily focused on having too much water, rather than too little. The key variable appears to involve the availability of water during the warm seasons, when evaporation occurs the fastest, rather than a development-driven phenomenon.

12. Wildfires: There are still problems with residences in the wildland interface, narrow roads difficult for emergency vehicles to access, long driveways, and the seeming desirability of hilltop locations (which may reduce flood risks but will generally exacerbate wildfire risks). Development trends seem to involve increases in wildfire risk over time, and will be of particular concern if annual cycles of summer drought do indeed appear in Michigan, as projected by many climate analysts within the coming decades.
13. Invasive species: This is another case in which the risks would be increasing if there was a clear increase in the number of miles being traveled, as vehicles are a common way for invasive species to be transported into new areas. Instead, this hazard is another that has been labeled as having unclear development-related impacts at this time.
14. Earthquakes and subsidence: The risks from subsidence appear to have increased, as time continues to pass and wear continues to accumulate in both the old mining structures as well as so much of Michigan's infrastructure. The risks from subsidence would probably be compounded by any substantial seismic event, even if an earthquake alone is not normally expected to do much direct damage. Areas that have already had their ground support weakened, particularly within cities, may turn out to be the most earthquake-vulnerable locations, and current patterns have already revealed increasing risks from subsidence even without any seismic causes.
15. Meteorites and other impacting objects: Although the risks are slight, within the time-frame of this plan, nevertheless there is a slight association between the increase in built structures and developed land and the possibility that impacting objects (a geographically random phenomenon) might come down in those developed locations.
16. Space weather: Increasing reliance upon digital communications for navigation, transportation, and other systems suggests a modestly increasing vulnerability to geomagnetic storms. Although automobile use appears to be stable, there has been an increase in airline travel over time, and therefore space weather phenomena is likelier to affect more persons over time as such trends continue. Similarly, more of our communication, business transactions, and even home entertainment have come to rely upon global communication networks involving satellites that could become inoperable during a solar storm event.

One of the few salient age-related demographic patterns involves the continued increase in the average age in northern Michigan. This pattern exceeds that for the population as a whole. Michigan's media age in 2017 was 39.8 years, but most of the counties in Michigan's north have notably higher median ages. Alcona County is now estimated to have a median age of more than 57 years, the highest among the recent estimates. This suggests an increasing level of vulnerability within the vast rural areas of Michigan's north. The Upper Peninsula does have a higher proportion of its residents living in cities, compared to the Northern Lower Peninsula.

APPENDIX 3: State Support for Local Hazard Mitigation Planning

Historical overview since 2000

Technical assistance has included the provision of state-specific mitigation planning guidance (MSP/EMHSD Publication 207, "Local Hazard Mitigation Planning Workbook"), presentations, assistance with local meetings and group-input activities, assistance with locating data and planning resources, as well as direct "hands-on" assistance with the various steps of the planning process—up to and including the drafting, editing, and proofreading of final plans for adoption and approval. MSP/EMHSD first employed a dedicated local hazard mitigation planning specialist in the beginning of the year 2000, and shortly afterward, the Disaster Mitigation Act of 2000 began to mandate the development of local hazard mitigation plans as a pre-condition for the receipt of federal hazard mitigation grant funds (a requirement only in effect a few years later). The first direct planning assistance activities were provided by MSP/EMHSD personnel, in support of plan development within Alcona and Macomb Counties. A second hazard mitigation planner was often employed (subject to budgeting, hiring, and staffing constraints) as a hazard mitigation specialist during much of the following decade. Between 2000 and 2004, it was calculated that more than 200 meetings had taken place involving the MSP/EMHSD planning specialist(s), to provide direct assistance to communities and planners, and over 30 additional meetings also provided indirect support for these activities. State and federal guidance materials were produced and distributed, and over a dozen presentation and training sessions took place to teach hazard mitigation planning techniques. A few local hazard mitigation planning pilot projects were funded under FMAP during the 1990s, and then additional grants using HMGP and PDMP followed the Detroit flood disaster of September 2000 (Federal Disaster #1346).

That start-up phase of statewide hazard mitigation plan development led into the initial editing of the FEMA-approved Michigan Hazard Mitigation Plan in March 2005. The FEMA mandate for local hazard mitigation plans, as a condition of project grant eligibility, began to take effect. More than 45 Michigan meetings or sessions took place, involving the direct outreach on the part of MSP/EMHSD staff, during the period in which that initial MHMP was in effect. In early 2005, a hazard mitigation plan was also developed for Robinson Township (Ottawa County) through the direct assistance of MSP/EMHSD planning staff. By 2008, the original MHMP had been successfully updated, federal guidance had stronger requirements for local hazard mitigation plan review, and the Flood Mitigation Assistance Program requirements were revised so that all communities were encouraged to produce all-hazard plans (rather than just flood-oriented plans). MSP/EMHSD capacity for direct assistance was also demonstrated in its extensive support for the completion of initial plans for Bay, Gratiot, and Saginaw Counties. However, field visits have tended to decline in frequency over time since the initial MHMP was completed in early 2005. This is because of state budget cutbacks, transportation cost increases, economic declines within the State, limited staffing, and the periodic need to prioritize mandatory state-level planning and response activities.

By 2010, even before the initial set of local plans had been completed, the first of the required local plan updates began to come due under the five-year cycle mandated by the Disaster Mitigation Act of 2000. Far less state staff time could be devoted to local assistance, because of increased state planning activities, including Michigan's successful compliance with Emergency Management Accreditation Program requirements. Unfortunately, the same level of funding was simply not available at that time as there had been for the initial period of plan creation. Homeland security funds started shrinking each year. In addition, as a result of economic problems and property value collapses, many community budgets found it much more difficult to arrange for the required local match portions of grants. This difficulty not only affected the ability to successfully apply for local plan development funds, but also the ability to support hazard mitigation project funds—one of the motivating "carrots" that was available to reward the successful completion of a local hazard mitigation plan. A few communities have succeeded in updating their plans on schedule, without the use of any additional planning grant funds, but with some help from MSP/EMHSD staff. MSP/EMHSD staff only has the ability to assist a limited number of communities at a time, and in the light of increased federal plan review requirements that have also been observed since 2008, Michigan seemed to be entering a phase in which a great number of its approved local hazard mitigation plans would expire due to insufficient funding, a dearth of local match resources, and limited staff resources available at MSP/EMHSD.

Nevertheless, a certain level of local assistance and outreach activities have been able to be maintained by MSP/EMHSD staff, providing training and hazard mitigation planning and grant activities. Between the March 2011 edition of the MHMP and the April 2014 edition, various meetings, presentations, conference calls, and other outreach were participated in or led by MSP/EMHSD planning staff in support of local hazard mitigation planning. Not including ordinary phone calls, faxes, and emails (which were extensive and often involved data compilation, planning instruction, and document editing), at least 23 presentations, 19 meetings, and 14 conference calls were logged during that three-year time-frame. (Numerous additional activities involving the MCCERCC, or on behalf of state-level planning, are described elsewhere in this plan, especially **Appendix 5**.) The period from 2011 to 2014 also involved new FEMA guidance for local plans. (MSP/EMHSD opted to continue using a more detailed plan review sheet for its reviews, but approved of the quality of the new FEMA guidance documents.) MSP/EMHSD also began to regularly provide direct planning assistance to help communities with local plans. MSP/EMHSD staff were instrumental in the development of a consolidated regional plan for the Metropolitan Grand Rapids area in 2011-2012, developing an initial Cass County plan by 2011, enabling a Kalamazoo County plan update in 2012-2013, and completing an Ann Arbor plan in 2011-2012. A 2013 framework was also proposed for further direct assistance, which was included within the 2014 MHMP along with prioritization guidelines that would favor the completion of county plans in places where none had yet been developed.

The following list documents a combination of general and detailed activities through which MSP/EMHSD staff have continued to specifically support the development of local hazard mitigation plans since March 2014 (in addition to its training, grant coordination, and EM program support roles). Listings that specify a distinct date (or date range) denote contact or outreach activities, as described. Listings that are credited to one or more entire months involve longer-term efforts that were not limited to just a single specific activity, as well as contacts made during that time period (so that the list isn't overloaded with dates for every email and phone call). For example, direct planning assistance involves numerous ongoing communications and arrangements with the involved local emergency management program(s) and their constituent communities, but not all of these need to be described in detail if the meaning of these "monthly" listings is well-understood. The following are activities in which MSP/EMHSD planning staff had been in contact with local representatives or directly worked to help them develop a local plan or plan update.

MSP/EMHSD staff outreach to promote hazard mitigation planning among local emergency management programs, local officials, other professionals, and the general public, from March 2014 to March 2019:

NOTE: References to "districts" refer to MSP/EMHSD 8 districts unless otherwise specified, while references to "regions" refer to 14 Michigan's regional planning organizations. A shorthand abbreviation has been used as follows: D for district and R for region, followed immediately by the number of that district or region (e.g. D2N means MSP District 2N, but R2 means planning region 2).

- March 2014: Contact with the counties of Clare, Monroe. Respond to public inquiry about flooding from an MSU student.
- March 14, 2014: MI-CEMKR presentation on hazard mitigation.
- April 7, 2014: Plan feedback provided to Lake County.
- May 5, 2014: Plan assistance provided to Lapeer County.
- May 8, 2014: Reviewed the changes made to the Osceola County plan.
- May 22, 2014: MI-CEMKR presentation on hazard mitigation.
- April and May 2014: Reviewed the Macomb County plan.
- May 2014: Edits contributed to a draft of the Mecosta County plan.
- May and June 2014: Reviewed the Luce County plan.
- June 2014: Reviewed the Mackinac County plan.
- July 2014: Reviewed the Genesee County plan.
- July 2014: Reviewed the Allegan County plan.
- August 7, 2014: Presentation on hazard mitigation at MTPA conference in Port Huron.
- July, August and September 2014: Edits made to a draft of the St. Joseph County plan.
- September 18, 2014: MI-CEMKR presentation on hazard mitigation at LSSU in Sault Ste. Marie.

- April and September 2014: Reviewed the Lapeer County plan.
- November and December 2014: Reviewed the Oceana County plan.
- January 2015: Reviewed the City of Detroit plan.
- January and February 2015: Reviewed the St. Clair County plan.
- February and March 2015: Reviewed the Benzie County plan.
- March 2015: Reviewed the Manistee County plan.
- March 18, 2015: MI-CEMKR presentation on hazard mitigation.
- March and April 2015: Reviewed the Lake County plan.
- April 21, 2015: Conference call with St. Joseph County (coordinated with RiskMAP).
- April 23, 2015: Planning meeting with R6. Conference call re: Henry Ford Hospital plan annex.
- April 24, 2015: Berlin Township conference call (for Monroe County plan development).
- April 30, 2015: Raisinville Township conference call (for Monroe County plan development).
- April and May 2015: Reviewed the Menominee County plan.
- April and May 2015: Reviewed the Newaygo County plan.
- May 21, 2015: Planning conference call with FEMA and R10.
- May 29, 2015: Meeting with EMC for Charlevoix, Cheboygan, and Emmet Counties, plus their planning consultant.
- May and June 2015: Reviewed the Delta County plan.
- June 2015: Reviewed the Alger County and Schoolcraft County plans.
- June 12, 2015: Conference call MHMP staff connection to Detroit flood mitigation outreach meeting.
- June 22, 2015: Conference call on R14 Green Infrastructure Conference. Conference call with Tuscola County planning consultants.
- June and July 2015: Reviewed the Marquette County plan.
- July 14, 2015: Conference call with R14, Oceana County, and Assistant SHMO re: planning grant.
- July 21, 2015: MI-CEMKR presentation on hazard mitigation.
- June, September, October and November 2014; and August 2015: Editing the draft Monroe County plan.
- August and September 2015: Reviewed the Monroe County plan.
- September 10, 2015: MHMP staff participation at Monroe County planning meeting.
- September and October 2015: Reviewed the Van Buren County plan.
- December 2014; January, July, August, September, October and November 2015: Editing Dickinson County draft plan.
- September, October and November 2015: Reviewed the Tuscola County plan.
- March 9, 2016: MI-CEMKR presentation on hazard mitigation.
- April 11, 2016: Montcalm County planning meeting.
- April 18, 2016: Ionia County planning meeting.
- December 2015; January, February, March and April 2016: Editing the draft Branch County plan.
- April 2016: Editing the draft Montcalm County plan.
- May 9, 2016: Mecosta County planning meeting.
- May and June 2016: Reviewed the Roscommon County plan.
- May and June 2016: Reviewed the Charlevoix, Cheboygan, and Emmet County regional plan.
- July 14, 2016: MI-CEMKR presentation on hazard mitigation.
- June and July 2016: Reviewed the Iosco County plan.
- July 14, 2016: MI-CEMKR presentation on hazard mitigation.
- August 8 and 10, 2016: Planning meetings with Shiawassee County.
- August 23, 2016: Ionia County planning meeting.
- July and August 2016: Reviewed the Isabella County plan.
- September 8, 2016: Planning meeting with Kent and Ottawa Counties.
- August and September 2016: Reviewed the Livingston County plan.
- November 16, 2016: MI-CEMKR presentation on hazard mitigation.
- April, May, September, October and November 2016: Editing the draft Ionia County plan.
- February 7, 2017: MI-CEMKR presentation on hazard mitigation.

- January and February 2017: Reviewed the Ogemaw County plan.
- February and March 2017: Reviewed the Kent and Ottawa regional plan.
- March and April 2017: Reviewed the Saginaw County plan.
- April and May 2017: Reviewed the Bloomfield Township plan.
- May and June 2017: Reviewed the Calhoun County plan.
- June 2017: Reviewed the Calhoun County plan, including for tribal organization compliance.
- August 23, 2017: MI-CEMKR presentation on hazard mitigation.
- June, July and August 2017: Reviewed the City of Lansing plan.
- October 2017: Reviewed the City of Ann Arbor plan.
- January 16, 2018: Montcalm County conference call re: plan development.
- January 17, 2018: Ionia County planning call.
- January 30, 2018: Montcalm County planning call and follow-up.
- February 14, 2018: Montcalm County planning call.
- February 22, 2018: MI-CEMKR presentation on hazard mitigation.
- February 27, 2018: Dickinson County planning call regarding subsidence risks (for local and state plans).
- March 1, 2018: Ionia County planning call.
- February and March 2018: Reviewed the Oakland County plan.
- January 2017; and March and April 2018: Reviewed the Dickinson County plan.
- June 6, 2018: MI-CEMKR presentation on hazard mitigation.
- May and June 2018: Reviewed the City of Royal Oak plan.
- June and July 2018: Reviewed the Cass County plan.
- August 17, 2018: Montcalm County planning conference call.
- September 19, 2018: MI-CEMKR presentation on hazard mitigation.
- December 19, 2018: Conference call with Midland and FEMA, about the Midland County plan.
- November and December 2018: Reviewed the Midland County plan.
- December 2018: Reviewed the Clare County Hazard Vulnerability Assessment.
- January and February 2019: Reviewed the Hillsdale County plan.
- March 2019: Feedback provided to Montcalm County on their draft action plan chapter, and to Sanilac County on their draft community profile update.
- April 8, 2019: MI-CEMKR presentation on hazard mitigation.

These types of planning assistance are expected to continue throughout the five-year period (2019-2024) covered by this plan. As explained earlier, most assistance has shifted toward phone and email communications, as a cheaper and often more efficient means of outreach, although some of that phone and email assistance has still been quite extensive. Please recall that these planning efforts are supported by training activities delivered by MSP/EMHSD (the MSP/EMHSD's lead local mitigation planner regularly gives presentations on mitigation planning and hazard analysis within the MI-CEMKR course), the provision of guidance materials (including internet-downloadable copies), the administration of HMA grants available for hazard mitigation planning, and the routine processing of adoption resolutions, FEMA reviews, and FEMA approval letters. **Some of these local planning activities necessarily overlap with the state planning activities described in Appendix 5, in cases where local and state planning activities were synergistically reinforcing and informing each other**.

Since early 2014, the following local plans (or plan updates) have been completed, some of which have involved direct assistance from EMHSD staff: Alcona County, Alger County, Allegan County, Alpena County, Ann Arbor, Antrim County, Benzie County, Bloomfield Township, Calhoun County, Charlevoix County, Cheboygan County, Chippewa County, Clare County, Clinton County, Crawford County, Delta County, Detroit, Dickinson County, Eaton County, Emmet County, Estral Beach, Genesee County, Gladwin County, Grand Traverse County, Grand Traverse Reservation, Ingham County, Iosco County, Isabella County, Kalkaska County, Kent County, Lake County, Lansing, Lapeer County, Leelanau County, Livingston County, Luce County, Mackinac County, Macomb County, Manistee County, Marquette County, Mason County, Menominee County, Michigan State University, Midland County, Missaukee County, Monroe County, Montmorency County, Muskegon County, Newaygo County, Oakland County, Oceana County, Ogemaw County, Osceola County, Otsego County, Ottawa County,

Presque Isle County, Roscommon County, Royal Oak, Saginaw County, Schoolcraft County, Shiawassee County, St. Clair County, Tuscola County, Van Buren County, Wayne County, and Wexford County.

Although the noted activities had included work to provide direct assistance with specific plans as noted in the 2014 MHMP (counties that had not yet had any FEMA-approved plan completed in the past: Branch County, Ionia County, Mecosta County, Montcalm County, St. Joseph County), and had helped Monroe and Osceola receive FEMA approval, EMHSD personnel then found that they had to shift their time toward numerous disaster response and recovery activities (see **Appendix 6** for a partial listing for officially declared emergencies and disasters), and then the required state plan update. The remaining counties were contacted with a notification of limited MSP/EMHSD staff resources, and a request was made for the local coordinators from those areas to confirm their continued need for direct planning assistance, and to describe a basis for prioritizing their community over others. As a result, work slowly proceeded (as staff hours allowed) with support for the Montcalm and Mecosta County plan, and Montcalm County's plan had become nearly complete by early 2019. During this time, a large number of planning grants were also put in place to allow dozens of counties to have their plans updated using whatever appropriate resources they chose to access when using these grants.

Appendix 4: Critical Assessment of Resources, Processes, and Programs

Notes on Funding, Organizational, and Resource Challenges for Hazard Mitigation Activities

Planning funds have not in the past been prioritized in terms of favoring specific jurisdictions. Funds for the development of hazard mitigation plans have been distributed (or offered) throughout the entire state. One of the few counties that hasn't yet completed its local plan had successfully obtained such funds but then made the decision to withdraw from the grant. Project funds have had a history of being widely and fairly distributed throughout the entire state. Funding is obtainable through the Hazard Mitigation Assistance programs for communities to use in completing or updating their local hazard mitigation plans, and for hazard mitigation projects, once approved plans are in place. Some of this funding is offered annually, but a major source (HMGP) is available only as a result of federal disaster declarations within Michigan. Federal requirements for state hazard mitigation plans now ask for a consideration of how to prioritize communities for the receipt of future funds under hazard mitigation programs.

The intention of the State of Michigan is to prefer to continue to provide funds as fairly as possible to communities with a clear need for them, and who have the timely capacity to make use of such funds, which tend to operate within specific timeframes and which also tend to have substantial documentation and local match requirements. As shown by the information in **Appendix 11**, this has not tended to favor specific communities over others, because all of Michigan's 83 counties have significant vulnerabilities of some kind. The valid prioritization of some communities over others would require an incontestable means of "comparing apples with oranges" and, given the current state of research and methods on this subject, it is best to propose, rather than a standardized and overarching statement of priorities, that prioritization favor areas and vulnerabilities that involve substantial risks to life and property, that have a proven history of occurrence or a significant potential for future occurrence, that the proposed means of hazard mitigation is technically feasible, legally and politically acceptable, capable of meeting FEMA application and review requirements, likely to be implemented by the resources available to marshal on behalf of the project's accomplishment, and that is consistent with the goals of this Michigan Hazard Mitigation Plan as well as those stated in local hazard mitigation and comprehensive plans.

Funding for local hazard mitigation planning activities and projects will ideally remain accessible to all communities throughout the state, although there have been cases where certain types of federal post-disaster funds (i.e. HMGP) have been recommended to address the same type of hazard (e.g. flooding, dam failure) that had made the money available. As the project list in **Appendix 11** documents, however, Michigan's prioritization and selection process has allowed every corner of the state to be reached, to accomplish hazard mitigation actions for the full variety of hazards that have been chosen by local Michigan communities themselves in response to state notifications of available funding. Although individual communities do vary in what they have received, this is not due to the favoring of any particular region or type of jurisdiction, but only on the number, quality, and type of individual grant applications that these jurisdictions' emergency management programs have successfully submitted.

In this 2019 update of the Michigan Hazard Mitigation Plan, the inclusion of collected information from local plans has allowed the detailed identification of which communities are significantly affected by which particular hazards, based upon both a "top-down" state analysis and their own "bottom-up" local plans, hazard analyses, and program assessments. As local plans continue to be produced and updated, a method of tracking and comparing their information will need to be developed. Local hazard priorities have not changed quickly—most of the updated county plans have reaffirmed the validity of their initial hazard priorities. **One challenge is that the degree of threat from hazards often does not match the degree and type of funds available for hazard mitigation.**

Regardless of how hazards vary, the current division of funds by phase of emergency management (e.g. preparedness, mitigation, response, recovery) and by hazard type (natural, such as flooding, versus human-related, such as terrorism) has produced a mismatch that seriously constrains the character of hazard mitigation plans. Communities often identify hazards and vulnerabilities with respect to the amount of impact they have had, or threaten to have. The result is a wide array of natural, technological, and human-related hazards identified as posing serious risks. But hazard mitigation plans require communities to identify strategies that are specifically

considered to be "mitigation" (distinct from preparedness activities which may be just as powerful in protecting lives and property), and there is a long history of federal hazard mitigation funds that clearly emphasize flooding—one of the most predictable of hazards.

The character of hazard mitigation planning itself, treated as completely distinct from other phases of emergency management and only required for natural hazards (some of which are far less controllable than technological ones), tends to shift actual planning actions into a very narrow set of possibilities that have been formally recognized as hazard mitigation that is potentially fundable specifically as such. The result is that hazards, after being identified and prioritized on the basis of their actual impacts and threats, often have to be neglected in favor of lesser threats that have clearer possible actions that can potentially be accomplished and funded. This makes the hazard analysis that was performed for a hazard mitigation plan potentially more useful for preparedness and response phases of emergency management, since many of the most natural ideas to reduce hazard impacts involve the procurement of and ability to use equipment, or other actions and procedures (such as dredging and maintenance) that have been declared ineligible for federal hazard mitigation funding.

Some parts of federal policy have also taken one aspect of hazard mitigation—prevention—and declared it to be a separate new phase of emergency management. Federal requirements that demand the time of state planners, such as the Threat and Hazard Identification and Risk Assessment (THIRA) process, have experimented with laborious formal procedures without addressing this essential problem of the artificial separation of potential solutions by emergency management phase and hazard type—in which only a very narrow set of the possibilities can actually be pursued under the official definition and funding opportunities for hazard mitigation.

From the perspective of transportation infrastructure, FEMA and the U.S. Highway Administration have separate funding sources that may steer stakeholders away from holistic needs. Road infrastructure involves many elements, security, potholes, hazard mitigation, and tradeoffs partially seen in terms of grant-defined frameworks rather than an integrated perspective, which each agency must work to identify and somehow promote. Hazard mitigation plans, in coordination with other processes, offer a broader perspective, but it is hard to balance everything in coordination.

Going back to a more general perspective, constraints in resources, conceptualization, and motivation have made it increasingly challenging to keep improving the quality of hazard mitigation plans on both the local and state levels. There is an enormous array of elements to integrate within the plan, yet only selected staff available to periodically coordinate all these concepts and processes. The best-quality planners or firms may do good work, but many stakeholders will seek one specific project or topic already known to them. Most persons do not have the time or interest to fully understand the complex systems that hazard mitigation plans (and comprehensive plans, etc.) try to represent and coordinate. Those who do have the training and interest, especially due to their professional positions, tend to find themselves torn between the enormous array of emergency management tasks that all demand attention and prioritization, especially when the longest-term planning tasks are being handled by the same personnel who may literally have fires to put out, EOC roles to fill, staffing and training needs to serve, and equipment to maintain and update (i.e. all the other phases of emergency management, sometimes termed "mission areas").

Hazard mitigation was originally conceived in terms of flood risks, and only very slowly and laboriously has it expanded beyond that narrow vision to resemble what it can be—an effort to address all actual and potential sources of harm. As noted in **Appendix 10**, there has been improvement by FEMA in broadening the mitigation project eligibility standards and guidance even within the past 5 years, but it will take time for the awareness and effects of these changes to become recognized more broadly.

State and local planners and emergency management personnel who were previously fully dedicated to promoting, assisting with, reviewing, and processing local hazard mitigation plans have instead needed to devote an increasing amount of their time to emergency response and recovery, training requirements, credentials maintenance, plus new and increasing planning requirements (and related processes, such as THIRA) that have sometimes become increasingly abstracted and disconnected from the core ideas that local communities have generated in their local plans.

Local emergency programs, in placing their highest emphasis upon life safety, tend to naturally gravitate toward activities that inform and warn people about potential hazards, train responders to deal with those hazards, obtain equipment that will enhance the ability of local responders to deal with hazards when they occur, and train the involved agencies in the use of that equipment or the inter-agency coordination that is needed during an emergency.

By contrast, federal funding for equipment and preparedness (i.e. previously obtainable through generous homeland security-related sources) has markedly declined. Although this causes increasing interest in hazard mitigation funding sources that are still available, there is also the problem of an increasing recognition of the relative narrowness of hazard mitigation as currently defined by FEMA (which also shapes how lower levels of government treat the subject). The federal emphasis upon hazard mitigation defined in terms of permanent or long-term solutions also has the effect of overlooking short or medium-term activities that could be effective and cost-beneficial new forms of hazard mitigation (in the fullest sense of that term). Gradual changes can be seen, and are greatly appreciated, as with FEMA's laudable allowance for the purchase and use of back-up power generators at critical facilities to be a fundable hazard mitigation project.

Although the cost-effectiveness of FEMA-funded hazard mitigation projects has increased markedly during the past couple decades (from an estimated $2 to $1 ratio to about $7 to $1 within the most recent 2018 study), this might stem from increasing selectivity within a more competitive environment, which may discourage applicants who are uncertain whether their application has enough promise to be worth the extensive process required to obtain funding. In addition, if FEMA's long-term mitigation approach has resulted in such a high level of cost-effectiveness, perhaps some additional medium-term approaches could be accommodated, so long as they prove similarly cost-effective?

Federal and state government agencies may encourage and promote the inclusion of hazard mitigation considerations within comprehensive community plans, but the actual mechanisms by which such changes take place have been slow-moving and difficult to track and verify. Theoretically, a review of local comprehensive plans would need to occur, to assess at-risk areas and the steps needed or taken to reduce such risks. But in practice, locating all existing local plans, and identifying and documenting the appropriate content, has placed such an activity beyond the scope of state level emergency management and planning staff. Such integration might have to be left up to local communities to achieve. The involvement of professional planning organizations has been helpful in recent years, and may be sufficient to accomplish the desired incorporation of hazard mitigation into not just comprehensive planning processes, but the plan review and inspection activities in local departments.

For understandable reasons, most of the action steps identified in hazard mitigation plans tend to either be (1) mere recommendations, (2) narrowly defined to meet current federal definitions, or (3) ineligible for federal funding. This reality limits the amount that this type of plan is able to accomplish, and also limits the quality of revisions made when updating these plans. Initial enthusiasm for the concept of hazard mitigation eventually sobers into disillusionment with the limitations and repetitiveness of the project types actually recognized by FEMA for funding, and the difficulty of getting proposals accepted that are not only multi-hazard but integrate multiple phases of emergency management as well. (These limits appear to be stemming from regulatory and bureaucratic limits rather than the staff members themselves; persons can discuss ideas and make changes, but regulations and organizational arrangements are much more intractable.)

There are different types of plans, in terms of the functions they serve. Some plans are more valuable for their processes than for their content, while other plans may have outstanding content but little or no track record for encouraging documentable implementation. There are reasons for such differences, and both kinds of document may still be valuable. For example, a high-quality local planning document might indeed "sit on a shelf," but its content may have been logged by MSP/EMHSD and prompted a successful grant application in the field. Some plans have resulted in useful projects, even though the plans were not then updated on the designated 5-year schedule.

On the flip side, some local programs may be excellent and may have used a planning process to encourage all sorts of activities invisible to higher levels of government, if the plan itself did not document its process and then pass all

the other review requirements needed for official approval. Some communities need projects more than others, some communities need plans and information more than others, and some communities need vibrant processes more than others. Their goals and needs vary and don't necessarily fit into the boxes that currently exist for plan and program review procedures, and for funding eligibility. This kind of variation might be particularly true for some of Michigan's many rural areas.

Flood Programs in Michigan

RiskMAP is currently extremely active in Michigan. FEMA is in the process of updating the Great Lakes' coastal flooding area for most of the state. There are more than Michigan 20 counties currently in various stages of the RiskMap process. In Michigan, the floodplain regulations for NFIP participation are incorporated in the Michigan Building code. That building code must be used statewide, and is more restrictive than the NFIP requirements in that it requires a 1-foot freeboard. In Michigan, FEMA requires the Flood Insurance Rate Maps (FIRMs) to be adopted at the local level of government (township, city, village), since it is at that level of government that land use authority normally rests within the state. This is different from other states, where land use authority is most often found at the county level, and counties assume the responsibility for adoption and enforcement within their unincorporated areas (located outside of cities).

This standard for Michigan works fine for larger communities, but causes confusion in rural communities where the local unit of government hasn't had any active role in floodplain management. Michigan does still have some unzoned rural areas, and also has areas that have arranged for their land use authority to be handled on their behalf by the county in which they are located. In these areas, it is the county that enforces the floodplain regulations through the building code. The FEMA standard recognizes that this level of local oversight is a choice selected on the part of local units of government, but although Michigan's "home rule" tradition does grant that right of choice to every township, city, and village across the state, the townships with the fewest governmental resources and the smallest populations might feel that there is no practical choice except to allow the county to administer things like this on their behalf. Yet the mandate still exists within even the smallest and most rural areas, such as townships in the Upper Peninsula whose population is less than 100 persons.

Additionally, there is a state floodplain law that is administrated by EGLE under Part 31 of NREPA. Portions of Part 31 are also more restrictive than NFIP minimums, including no residential construction allowed within the floodway portion of the floodplain (at 1% annual flood chance level); and the floodways in MI are defined with a 0.1 foot increase in water surface elevation, compared to FEMA's 1 foot. Additionally, EGLE requires compensating cut for fill placed in the floodplain, which is more restrictive than NFIP minimums.

There are currently just over 1,000 communities participating in the NFIP in Michigan. This number will likely increase slightly as the new coastal maps get rolled out and new floodplains are mapped. There are also just over 20,000 FEMA flood insurance policies in Michigan, with a coverage total of $3,855,700,000. Michigan paid $20,332,853 in premiums last year. There have been 12,255 claims made since 1978, with a total of $89,733,316 paid out since that year. There are currently 25 communities in the Community Rating System. A few have dropped out, several have been downgraded (a reduction in their insurance premium discounts), and a few have improved their ranking (seeing an increased discount). Detailed information on this is found in the Riverine/Fluvial Floods chapter of the Michigan Hazard Analysis. A Cooperating Technical Partners (CTP) grant has involved work to obtain LIDAR for the entire state. The final 19 counties will be flown this year (9 in the lower peninsula and 10 in the upper peninsula). Once done, the entire state will have LIDAR coverage.

Dam Programs

The HHPD is a welcome source of funds for dam repair, removal, and rehabilitation that had not been previously available under FEMA grant options. Because FEMA funds are not allowed to duplicate other federal programs, the amount of funds available for dam safety issues had been limited. Potential hazard mitigation actions involving dam safety were often replaced by projects that could make use of FEMA funds without such "issues of duplication" arising. While the HHPD can now be used, it will require significant preparation work before it can be fully successful. Hazard mitigation plans that satisfy HHPD planning criteria are part of eligibility requirements, but not all local plans easily have such capability. For this reason, EGLE's Dam Safety Program will be an important source to supplement local data given their dedicated expertise. Nevertheless, local communities must be

engaged and willing to coordinate with these efforts, which may present challenges for communities that don't feel they will apply (HHPD eligibility applies to only a qualifying subset of all high hazard dams). Further limitations exist because projects cannot be fully funded by the grant (and must include a local match component).

Local Programs, Policies, and Capabilities

Local emergency management programs vary widely in their resources, expertise, and capabilities, but also in their risks and needs. State agencies have therefore provided various forms of assistance and guidance to these local programs throughout the years (see **Appendix 3**). Land use policies are distinctly local in their nature and tend to be some of the most effective means of achieving hazard mitigation. Local governments and programs vary widely in this aspect, as well. Some have dedicated planning departments, while many others hire external assistance to meet planning requirements on an as-needed basis.

As described in Chapter 2 (state profile), a local community may have a very small population, or a very large one, and in both cases, there can be a wide variation in the quality of services it has available, either on a per-person or a per land area basis. The amount of resources available to county agencies (such as road commissions and drain commissions) also varies throughout the state. Non-profit regional planning agencies exist in Michigan, and have the entire state divided into 14 regions for which these offices collect and provide information. But again, while some offices have excellent staff and resources available to assist with hazard mitigation planning, others do not have any additional resources ready to provide.

Although a great many resources exist within the general Metropolitan Detroit area, the complexity of that area goes beyond any one agency—the municipalities and counties that compose the area do not have the authority to speak (or resources to act) on behalf of the entire metropolitan area, and the Southeast Michigan Council of Governments (SEMCOG) planning office tends to act within limited spheres of coordination and technical assistance.

Although certain kinds of funds are technically available for use in hazard mitigation activities, they require a substantial amount of work to obtain and make use of, which makes their use impractical for certain jurisdictions whose staff and budgets have already been shrinking. Preparedness and response capabilities often receive the most attention—especially since these phases of emergency management have a clearer relevance to most types of hazards, while hazard mitigation has historically been thought of primarily in terms of flood hazards and, to a lesser extent, wildfires and severe winds.

From the perspective of local jurisdictions with limited resources, the preparedness and response phases of emergency management are rational ones to favor for most types of threats and hazards. For more than 10 years, state guidance has identified hazard mitigation actions for all types of hazards, but the most relevant often involve activities that may technically be deemed preparedness activities. All important hazards can be prepared for, but when it comes to their prevention or mitigation, actual authorities and capacities often involve the private decisions of individuals and firms, and the efforts of government (at all levels) to try to regulate or place requirements upon these individuals and firms, without exceeding their political authority to do so. A compelling need is required in order to make strong regulations politically feasible and justifiable, yet when it comes to Michigan's array of hazards and threats, it often requires informed study to produce a reasonable understanding of their risks, with which it becomes possible to justify various costs. And yet, a large number of citizens do place great value upon individual responsibility (for which public awareness and educational actions are deemed most appropriate for government to take, as a kind of advisory role rather than a compulsory one), while resisting the capacity of government to strongly regulate what people are allowed to do with their own property.

The value of higher levels of government for assisting local communities in dealing with a disaster is widely recognized, but the right of government to impose preventive regulations and policies, even if well-intentioned and demonstrably effective, often is not—particularly when accompanied by many sets of bureaucratic procedures and conditions. In cases involving clearly defined natural risks in specific areas, such as floodplains, efforts and costs are easier to justify (even though many persons have difficulty understanding the probabilistic aspects of flood risks). However, a great amount of planning activity has been occurring at all levels for years, in order to examine other types of hazards that are less clearly defined in Michigan. (Major natural hazards such as tsunamis, sea-level

rise, hurricanes, and earthquakes, which are huge priorities in other states, are not particularly relevant for Michigan's communities.)

Many hazard-prone areas are associated with appealing features. For example, floodplain locations are often very scenic and desirable places to be, except when a flood actually occurs. Woodlands are also scenic and desirable, except when devastated by wildfires. Many other hazards threaten all locations in Michigan, even if some are far more threatened than others. But the levels of expectation, preparedness, and resilience also vary from community to community. Snowstorms, for example, have greater magnitude in the northern parts of Michigan, but do less damage there than in southern parts of the state, according to official records. This is seemingly due to greater preparedness in the north. Would similar levels of preparedness be considered as cost-effective in the southern parts of the state? Perhaps not. This is a tricky thing to calculate, except at the local level.

Hazard mitigation planning is technically not required to consider the benefits of preparedness activities, even if those are far more cost-effective than any of the available "mitigation" ideas for some types of hazard. The hazard analysis component of a hazard mitigation plan may therefore be far more useful for emergency management programs' preparedness and response activities than it is for the "mitigation" options that are offered for most of Michigan's hazards. The multi-hazard benefits of a good hazard analysis have been widely acknowledged, but programs are still working to deal with the more limited range of fundable hazard mitigation projects.

In Michigan, hazard mitigation's well-established record seems to emphasize flood risks, which are indeed Michigan's most damaging natural hazard. But part of this emphasis is due to the way that hazard mitigation has been defined to distinguish it from "preparedness." Within the guidelines for hazard mitigation specifically, most local programs understandably focus upon activities that are actually eligible for federal funding. As seen in **Appendix 11**, these tend to involve flood mitigation projects and the installation of warning systems. These are useful activities, and even though warning may be considered to be a preparedness or response activity, it is important that it has been recognized as hazard mitigation (in recognition of its protective effects upon human safety).

Previous critical assessments had noted where hazard mitigation had seemed to place a greater emphasis upon the protection of property rather than human life, but many helpful changes have better accommodated the need for life safety within recent years. It is now possible to justify the expense of storm shelters, the retrofitting of structures to be more wind-resistant, the installation of generators at critical facilities, and the installation of warning sirens. It is still difficult to fund the re-design of infrastructure to be more freeze and earthquake-resistant, and technically ineligible to fund most maintenance and repair activities under available federal funds, even when those would be plainly useful for hazard mitigation purposes (as when dredging drainage channels and proactively clearing them of ice or woody debris). Further consideration should be given to how such additional activities might be included for funding, in cases where they are found to be very cost-effective in preventing or reducing damages and threats to life.

When tasked with identifying and achieving hazard mitigation actions, local programs have felt constrained to operate within certain pre-defined boundaries that may not be immediately evident when the concept of hazard mitigation had originally presented it in terms of an all-hazards approach. It has been useful to suggest that where there is a risk, there must surely be a corresponding risk mitigation strategy. However, available strategies for some hazards may not be the type for which any hazard mitigation funding is available.

The goal of integrating hazard mitigation concepts into other types of planning is meant to open up some alternatives to FEMA's hazard mitigation grants. What cannot be directly accomplished through available FEMA funds might be something that other funding sources can accomplish, or that can be addressed by more evenly distributing the costs of a solution among the array of underlying design, planning, political, and regulatory factors, rather than having them all hinge upon a specific, corrective project, after vulnerabilities have already been revealed. The down-side to the integrated planning approach is that there are a great many communities for whom comprehensive plans are merely an occasional legally mandated requirement, rather than something that is seen as a vital force in shaping their community. This perspective, although it may seem like a very limited one to planners, is not an unreasonable one—especially for small communities whose character barely changes from

decade to decade. Urban planning originated in a period of rapid population growth and economic industrialization. Over time, it was more broadly conceived in terms that made regional, state, and national planning seem to be equally viable, but there have always been practical limits upon what each level of government plan is authorized and appropriate to accomplish. In circumstances where a community's plan accurately reflects local opinions, it might correctly be designed in a way that does not accomplish much except to try to preserve those things that many persons in the community admire and desire—the things that attracted them to (or kept them in) that community or geographic area. In a different community, a plan might be very aggressive in rapidly promoting changes that are widely considered to be justified. From a plan review perspective, it is not clear that an objective distinction is made between different types of communities and their corresponding planning preferences—all plans have been assessed according to the same standards, in which the smallest communities with the fewest resources might find compliance more difficult to achieve. To address this difficulty, clearer guidance needs to be produced by FEMA regarding its newer plan review elements, requiring the description of "existing authorities, policies, programs, and resources available," and the description of hazard mitigation actions in terms of such descriptions.

The limits to the idea of integrating hazard mitigation into local plans is that only a minority of local plans are covering communities whose people desire (and are comfortable with) a particularly active or imposing approach to this type of regulation. And even in those communities, things are usually not accomplished without some costs. Where these involve costs that become privatized, individually opted for, or very well-distributed among all taxpayers, then hazard mitigation objectives may indeed be served. But this is achievable only very slowly, probably as a result of the public education and awareness-building activities as much as anything else, and not something that receives immediate recognition and support, especially if it involves greater taxpayer expense.

Greater incorporation of hazard mitigation concepts, designs, and activities into insurance policies and rates should probably be encouraged, as a way to more quickly achieve protective results (or an adequate distribution of the costs of safety improvements) than most local plans can probably provide. There are quite a few communities throughout Michigan that have plans (and financial resources) which could serve the goals of hazard mitigation. But when the most concrete risk-reduction activities are those that involve the design of private structures, or an awareness and preparedness-building approach, then a hazard mitigation plan might not do any better than to point in those directions, without the means to connect those actions with designated hazard mitigation funds or to use those parts of its plan to comply with federal review requirements, which ultimately call for the identification of projects that do meet funding eligibility guidelines.

These are the dilemmas within which local hazard mitigation plans have been developed in Michigan for about the past 15 years. At the same time, community comprehensive plans are reluctant to impose private costs upon individuals and firms (or to recommend major capital improvements that might be too burdensome upon local budgets) in order to serve the often-abstract estimates of risks versus benefits, sometimes with very uncertain distinctions between individual level risks and responsibilities and those of community and government agencies, and for this reason, most such plans do not greatly add to the capacity for hazard mitigation in its fullest sense. FEMA has defined a "benefit" very broadly, indifferent to whether those benefits are realized by government itself, private stakeholders, or some combination thereof. This broad definition is a very good thing, but not necessarily one that has been shared by all agencies that have the capacity to promote hazard mitigation. For-profit insurance companies, for example, do need to justify costs in terms of their own direct benefits (i.e. reduced disaster payouts), and therefore some hazard mitigation opportunities are being lost.

While anything that promotes public education and awareness on the subject of hazard risks and vulnerabilities is surely helpful, many of the things that could reduce risks from the full array of identified hazards do not fall within readily defined areas for which specific actors can (or are willing to, or are able to) take specific palliative actions. There have also been widespread misunderstandings about how the development of local hazard mitigation plans do or do not tie in with various government mandates. For example, it is often believed or claimed that the lack of a local hazard mitigation plan will make communities and their members ineligible for any disaster assistance from higher levels of government. Although this is untrue, it also seems certain that this mistaken belief is one of the things that has encouraged many local hazard mitigation plans to be developed and updated during the past 10 years. For those who perceive the main reward for completing a local plan in terms of the ability to access grant

money to allocated specifically and solely to carefully defined forms of hazard mitigation projects, the incentive of local communities to go through the increasingly rigorous process of developing these plans is likely to decline, if they can reasonably calculate that the agency's benefits from developing a plan are less than the agency's costs to develop a plan. In some instances, the effort to clarify these misunderstandings, as well as the rather involved regulatory standards for local hazard mitigation plans, has *decreased* the willingness of some planning agencies to get involved in the activities.

In other words, hazard mitigation planning, and the potential for project funds that come from the successful completion of such a plan, must be realistically perceived as being worth the efforts that it requires, in order for local support for the activity to continue. For some communities, operating under limited resources, a benefit-cost calculation may result in a decision not to undertake this type of planning. The local share requirements of the grants may make local projects seem too difficult to fund even when a plan is in place, and the bureaucratic requirements involved in obtaining such grants may be a third obstacle that may feel too difficult to overcome. Michigan has been exploring its capacity to operate a state-level hazard mitigation fund (see Chapter 9) that might help to address issues such as expensive non-federal match requirements for expensive projects, but this capacity for systematic state-level funding is not yet in place.

Local programs are to be greatly applauded for the degree that they have succeeded in developing and maintaining updated local plans over the past 10 years, in spite of the great (and often increasing) challenges. It probably feels more clear-cut and compelling to focus on the more immediate and mandated tasks of responding to an event and increasing one's preparedness to do so. Fortunately, the development of a hazard mitigation plan does in most cases help agencies and communities to understand their hazards and thereby prepare and respond better to their next emergencies. It is not clear in many cases whether the potential benefits (i.e. if selected for funding) of hazard mitigation projects always outweigh the preparedness and response benefits that are realized through the plans' analysis of local hazards, and therefore which aspect of a local hazard mitigation plan is considered more beneficial for a community.

Appendix 5: Details of Planning Processes

Initial Plan Development: Before the Disaster Mitigation Act of 2000

From a historical perspective, this plan was initially developed as a planning product under the Emergency Management Performance Grant (EMPG) from the Federal Emergency Management Agency (FEMA), and was initially approved as such by FEMA Region V on November 2, 2000, subsequent to Federal Disaster 1346-DR-MI. That plan was developed prior to the enactment of the federal Disaster Mitigation Act (DMA) of 2000 and the subsequent publication of its implementing rules in the Federal Register on February 26, 2002. The initial version of this plan followed existing federal hazard mitigation planning guidance available at the time of its development.

Significant New Planning Requirements Unveiled in the early 2000s

When DMA 2000 Interim Final Rules were published in the Federal Register on February 26, 2002, significant new planning requirements were placed upon the states and their local governments. The most important change was the requirement that states have a FEMA-approved mitigation plan in place by no later than November 1, 2004 in order to remain eligible for all non-emergency forms of federal relief assistance under the Stafford Act. In addition, the new DMA 2000 planning standards were considerably more detailed than were the standards recommended in previous editions of federal mitigation planning guidance. As a result, the state of Michigan had to initiate a complex planning process, involving numerous individuals and agencies, in a relatively short time period in order to meet the initial November 1, 2004, plan approval deadline under DMA 2000. (Note: the November 1, 2004, deadline was later extended by FEMA to May 1, 2005, which allowed the MSP/EMHSD a bit more flexibility in completing the planning process.) Michigan's plan was completed by the end of March 2005.

Unfortunately, while that was going on there was also an enormous effort to place considerable planning, training, exercising, and coordination requirements on the state in order to improve local and state capabilities to respond to and recover from terrorism and related threats in the aftermath of September 11, 2001. These new efforts caused a significant diversion of state and local agency attention, time and resources away from more traditional emergency management and hazard mitigation activities. Tight federal timelines for the various weapons of mass destruction (WMD) grants that were quickly implemented in the post-9/11 period forced the MSP/EMHSD (like other state emergency management agencies around the country) to divert significant numbers of staff to homeland security work. Therefore, completion of the initial version of this plan necessarily took a back seat to other more pressing priorities during much of 2002 and 2003. It is against that backdrop that the development of this plan to meet the DMA 2000 planning requirements began in February of 2004.

Synopsis of 2004-2005 Planning Process

The planning effort for the 2004-05 initial plan development revolved around the Michigan Hazard Mitigation Coordinating Council (MHMCC)—the state's hazard mitigation coordinating body in existence at the time. The 10-member MHMCC joined with the MSP/EMHSD and a wide array of stakeholders (refer to the 2004-05 edition for specifics) to form a large, multi-agency plan development team. The team worked for several months to develop the initial DMA 2000 hazard mitigation plan for the state of Michigan. The plan was officially adopted and formally promulgated by the MHMCC on October 19, 2004, and the State Director and Deputy State Director of Emergency Management and Homeland Security on December 15, 2004 (the two highest ranking emergency management / homeland security officials in Michigan). Governor Jennifer Granholm adopted the plan on behalf of the state of Michigan on March 4, 2005. The plan was subsequently approved by FEMA as a Standard State Hazard Mitigation Plan under the DMA 2000 on March 28, 2005.

Synopsis of 2007-2008 Planning Process

The planning effort for the 2007-08 plan revision was similar in nature to the 2004-05 process, except that staff shortages caused a focus purely upon natural hazards, and entailed a substantial reformat of the plan, to make it less cumbersome and more self-contained. What had previously been separate documents, referred to as attachments, instead had their content made a part of the main planning document, with sections called attachments now functioning more as appendices in a single document. The process was spearheaded by the lead Hazard Mitigation Planner of the MSP/EMHSD, with assistance provided by the other MSP/EMHSD staff (i.e., State Support Unit Manager / State Planner, State Hazard Mitigation Officer and Assistant State Hazard Mitigation Officer, and three

planners from the Local Support Unit). The lack of an active hazard mitigation council for several months of 2007 (the MHMCC was abolished on May 2, 2007 and replaced by the new MCCERCC, which met for the first time on January 29, 2008) hampered the effort from the start. Fortunately, the MSP/EMHSD was able to contact key stakeholders and receive input through the state agency Emergency Management Coordinators and/or the subject matter experts in their respective agencies for each natural hazard addressed in the plan. The new MCCERCC membership also had the opportunity to review and comment on the various plan sections as they were revised, as did key MSP/EMHSD subject matter experts and subject matter experts from applicable federal agencies and nongovernmental organizations. Collectively, these individuals constituted the planning team for the 2008 MHMP revision. Due to these many challenges, the decision was made for 2008 plan to focus upon natural hazards and thus limit the amount of work required within the 3-year expiration timeframe that was then in place.

Synopsis of 2009-2011 Planning Process

The subsequent cycle of plan maintenance involved a more complete update process than was possible in the previous (2008) cycle. First, the Michigan Hazard Mitigation Plan was restored to a full and balanced consideration of all hazards—natural, technological, and human-related. Second, there were no problematic circumstances involving the status of Michigan's official hazard mitigation council (MCCERCC), which met regularly and was heavily involved in the plan update process, along with various partners and associated agencies. Third, the planning staff levels at MSP/EMHSD were back up to a level that allowed the full plan to be updated on schedule. The 2011 update process was enhanced by collective staff activities to meet the additional standards of the Emergency Management Accreditation Program (EMAP), which granted Michigan's emergency management framework a conditional accreditation that is expected to be expanded into full accreditation in 2011. Finally, the plan update was assisted by the accumulated availability of FEMA-approved local hazard mitigation plans in the vast majority of Michigan's 83 counties.

Synopsis of 2011-2014 Planning Process

A lack of time for the plan update was recognized as an ongoing problem. To address this, the Michigan Hazard Analysis was immediately worked on and again published separately in July 2012 (its previous publication as a separate document had been in 2006). Unfortunately, the hazard analysis goes out of date faster than the plan does, and the entire hazard analysis content was again updated when included in the 2014 plan, again causing a severe time crunch as the plan's expiration date approached. Some of the earlier formatting choices for the plan had caused the page count of the document to increase dramatically, such as the inclusion of every post-disaster hazard mitigation strategy document, in their entirety. The combined hazard analysis and plan had good-quality content, but had reached a length of about 950 pages, and the organization of the plan had become increasingly disorganized. Proposed legislation offered to extend the expiration date for state plans, from 3 years to 5 years, but that legislation did not go into effect until after Michigan's plan expiration date, and therefore various shortcomings in organization had to wait until the next update process to be addressed.

General Development Process for the 2019 Michigan Hazard Mitigation Plan

The previous edition of the Michigan Hazard Mitigation Plan was completed and adopted in April of 2014, and it was recognized that the next update needed to (1) improve the organization of the plan, (2) improve the consistency of the formatting used throughout the hazard analysis, (3) accommodate various improvements identified during the previous update process, including new FEMA and EMAP requirements added to their updated guidance and review standards, and (4) to reduce the sheer bulk of the document, making it less overwhelming and easier to use. The initial focus was upon the separate publication of the Michigan Hazard Analysis, with a consistent format finally imposed upon each of the standard natural hazard chapters within that document, and new content added to comply with additional EMAP standards and identified improvement areas. Work on the initial chapters began in 2014. Supplemental material for EMAP re-accreditation was produced during 2015 as an Annex to the 2014 MHMP, and this material was eventually incorporated into the 2019 Michigan Hazard Analysis but had to be updated after the passage of nearly 4 years. The planned improvements to the natural hazard chapters were successfully made, including the addition of new chapters on climate change and urban (pluvial) flooding—one of the new FEMA requirements was for state plans to address climate change, and two of Michigan's largest federal disasters had involved urban flooding.

Although the new 5-year plan expiration date had at first promised sufficient time to accommodate all four of the desired improvements, some unanticipated problems developed. First, a dramatic increase in the number and length of emergency activations became a new pattern. Many SEOC activations took place in addition to those that ultimately resulted in the official emergency and disaster declarations (listed in **Appendix 6**, and also described below). Second, the MSP/EMHSD facility itself relocated during 2016, taking considerable staff time to achieve. Third, the only staff continuity between the 2014 and 2019 editions turned out to be the two dedicated hazard mitigation planners, with all managers above these workers changing at least once during the five-year period, including the State Governor. One of these managers had been with the agency for management for more than 20 years, and had handled the update of the plan's key action plan section during all previous editions. Finally, the local commitments that had been made a part of the outreach and support strategy in the 2014 plan were too ambitious. They had been modeled after the array of direct assistance activities that had been efficiently and successfully implemented during the 2011-2014 plan, during which time at least 4 full local plans were overseen by MSP/EMHSD planning staff, plus various other direct support work provided on 4 other plans. But as described in Appendix 3, an initially strong outreach effort had to be scaled back to accommodate disaster needs, the MSP/EMHSD office move, EMAP re-accreditation, and finally the completion of the 2019 MHMP itself, along with its associated Michigan Hazard Analysis document.

The year 2014 included an unprecedented urban flood event in Metropolitan Detroit (although FEMA standards had been revised after a similar 2000 event, to rule out the inclusion of certain types of flood damage, and therefore this disaster was officially only counted as Michigan's second-largest). Three additional governor's declarations occurred in 2014, two governor's disaster declarations occurred in 2015, along with the start of the lengthy MSP/EMHSD oversight of the Flint Water Contamination Emergency, which stretched throughout 2016 even as EMHSD staff was working to relocate to its new facility (and expanded SEOC). Three additional state declarations occurred during 2016, while the Flint Emergency was still ongoing. Extensive staff efforts were also dedicated to compliance with official oversight and FOIA requirements during that unprecedented event. By 2017, it was recognized that the advantage of a 5-year update period had been lost to this array of disasters and emergencies. **The four federally declared events between 2014 and 2018 matched the number that Michigan had experienced during all previous state plan updates combined (from 2004 to 2013), and had included an additional 14 state-declared events.** The early efforts toward direct local assistance had to be replaced by a focus upon the completion of the state plan, since the same key MSP/EMHSD planning personnel were at the center of both efforts, and since local and state planning are seen as parallel processes that enhance each other. During 2018, five additional state-declared events occurred, and in 2019, four additional state-declared events occurred within the just the first three months of the year, including one that caused the closure of all government offices and required the rescheduling of a MCCERCC meeting that was critical for the timely completion of this plan. Although substantially improved natural hazard chapters had been accomplished within the 2019 Michigan Hazard Analysis (MHA), it was realized that a similar update of the technological and human-related hazard chapters would have to wait until after the MHMP completion deadline.

Any major planning process must have a core team that is responsible for compiling and assessing information, evaluating proposed changes, and doing the actual final editing of the resultant document. MSP/EMHSD personnel acted as a core planning, editing and writing team, while interagency oversight and input opportunities were maintained by the MCCERCC and its hazard mitigation committee, and the State Emergency Management Coordinators group provided access to the state's network of subject matter experts. Progress on MHA and MHMP updates were reported at meetings of MCCERCC and its committees, as a periodic task with which the MCCERCC had been charged by the governor with a key role. MCCERCC members either directly reviewed, or identified known subject matter experts to review, the details of information and text within the hazard analysis and plan. Additional organizations were informed and provided with an opportunity to review and provide feedback on the 2019 MHMP, such as Michigan Silver Jackets Team (whose unofficial meetings were finally formalized with the adoption of the Michigan Silver Jackets charter in 2016) and the Michigan Climate Coalition. MSP/EMHSD planning staff arranged for subject matter experts to give presentations to the MCCERCC on two of the more recent topics that had been added to the plan—space weather and climate change.

With regular updates provided to MCCERCC, planning staff from MSP/EMHSD reviewed all content within the Michigan Hazard Analysis and proceeded to follow up individually with the agencies that possessed relevant

expertise, plus additional contact persons and subject matter experts who were sought out among universities, agencies, authors, websites, and conference and training speakers when considered appropriate for content review and update. For example, authorities from Michigan State University and the University of Michigan (Ann Arbor) were asked to review sections of the hazard analysis or to answer specific questions, as were personnel from a joint agency, Great Lakes Integrated Science and Assessments (GLISA). Subject matter experts who were contacted by MSP/EMHSD were sent information about the hazards and sections of the plan that were considered to be most relevant to their expertise. Feedback took many forms, but most of the information received by MSP/EMHSD was in a form that directly related to specific changes that could be made to the existing text within the plan. For example, typed email responses or revised documents were used to revise the appropriate sections of the MHA and MHMP. MSP/EMHSD staff also monitored media reports, as well as oversaw response activities for some events that were added to the descriptions within the hazard analysis. MSP/EMHSD and its partners contributed to post-disaster hazard mitigation strategies (see **Appendix 14**) that were considered when updating the MHMP. A fairly detailed list of activities is included in this appendix, but does not include every email and information source that was relevant. This description will emphasize the general process that was followed, adding key information about meetings and major milestones as documentation of which agencies were involved. Appropriate passages from MCCERCC meeting minutes are also included within this appendix.

In addition to the process of MSP/EMHSD personnel's own review, research, and work upon the 2019 MHA and MHMP updates, months of outreach, feedback, information and material review was contributed by numerous partnering agencies and stakeholders. These have been documented in the multi-page listing of "Input Agencies and Processes: 2019 Michigan Hazard Mitigation Plan Update," later in this Appendix. Seen from a different perspective, there is also a "Section by Section Summary of Changes" provided here, which focuses upon the process in terms of document reorganization and editing. Much of this current text provides a narrative overview of the philosophy, general process, and methods by which the coordinated efforts of these many contributors were integrated into the 2019 MHA and MHMP update. Annual processes involving Threat and Hazard Identification and Risk Assessment (THIRA) and State Preparedness Report (SPR) were also useful to generate ideas, although these were considered too artificial in their design to substitute for the extensive Michigan Hazard Analyses that have been cumulatively developed for decades and has proven repeatedly useful over many years, at both a state and local level.

In general, an initial focus upon technical details of the Michigan Hazard Analysis then shifted to an evaluation and review of the MHMP itself, in consultation with the MCCERCC hazard mitigation committee but with regular updates to the State Emergency Management Coordinators (SEMC), Silver Jackets, and other interested parties including local emergency managers who attended various monthly webinars offered by MSP/EMHSD in recent years. After extensive reorganization and updates, various materials, draft plans, and finally a full draft plan was distributed to MCCERCC and its hazard mitigation committee for their review and approval in March 2019. Many of these drafts were shared SEMC and Silver Jackets participants, and portions were discussed with dedicated subject matter experts and agencies representatives. A long-planned, systematic review of all the most current local hazard mitigation plans was finally completed for this update. Thus, the input of various agencies since 2014 was gradually consolidated into successive refinements in the draft plan until, by March 2019, a full draft was able to be formally agreed to by the MCCERCC and submitted for FEMA planning requirements review in April 2019. (Any feedback or corrections received too late to be a part of that process will nevertheless be retained by MSP/EMHSD as feedback for consideration under subsequent review and evaluation as the new planning cycle is entered in 2019.) MSP/EMHSD intends to update the MHA and MHMP more frequently than required, in an effort to reduce the deadline pressures that had been felt during all previous update processes.

Popular online and wireless social media was again used by MSP to publicize the MHMP update and refer readers to the EMHSD website where the plan could be reviewed by the whole community, with contact information where comments could be sent directly to the main document editor. Occasional inquiries and comments were received from members of the general public, but the level of detail here does not include every email, phone call, or conversation that might be considered relevant. For example, on February 2, 2015, in inquiry was received to inquire about whether a consideration of "supervolcano" events was included in Michigan's plan. A subsequent FOIA request was later received on February 17, 2015 to request all identifiable references to supervolcano risk

within Michigan documents. These requests were responded to, but such details are too cumbersome to fully document within this plan.

Michigan Hazard Analysis Update Process

The reformatting of the hazard analysis portion of the 2014 plan into an attached document, with chapters formatted for ready distribution, was the first step in the update process. The document is an attachment to this plan but also serves to inform other state documents, most notably the Michigan Emergency Management (response) Plan (MEMP). The January 2019 MEMP was reviewed by planning staff when finalizing the April 2019 MHMP, to ensure consistency, while noting areas from the updated hazard analysis that should be reflected within the subsequent MEMP update. In this manner, both important documents stay fairly closely coordinated with each other (subject to normal delays between editions). Individual chapters were maintained and distributed to subject matter experts for review and feedback. Although some of the initial feedback obtained in 2014 (e.g. lightning hazards) might be considered out-of-date by 2017, the final distribution of the updated 2019 MHA chapters had all occurred within one year before publication. (Detailed information about this distribution and feedback appears later in this Appendix.) Most of its quantitative data now goes up to 2017. Since the large MHA attachment was overseen by the same MSP/EMHSD planning personnel who were involved in the development, research, writing, and editing of the rest of the MHMP, and these same staff also oversee all the submitted tribal and local hazard mitigation plans within Michigan, copies of which are preserved on file there.

The stakeholders for each chapter of the MHA were defined in terms of their expertise in the hazard, or in hazard-related measures, activities, programs, and initiatives. Proactively identified stakeholders included the "steward" agency or organization for the hazard in question within Michigan's government, or at a federal level, or in an associated non-governmental organization (or an academic institution). Most of Michigan's state departments were considered to be stakeholders. In some cases, a federal agency (e.g. U.S. Geological Survey) was identified as a stakeholder, and a request was made to that agency to review one or more relevant chapters. There were also subject matter experts who were contacted in other agencies and academic institutions for information, advice, and recommendations during this process. In some cases, organizations had contributed to the plan without traditional interaction, by posting information upon a web site or providing information at conferences that was then incorporated into the plan. Even in these cases, however, a valuable enough web page or presentation tended to eventually prompt MSP/EMHSD planning personnel to contact a representative at the organization for more insight or assistance in the sources, applications, and limitations of the data that had been provided online or within the original training forum.

Most of the responsibility placed upon the partnering agencies involved the review of previously developed and updated chapters about specific hazards (for the MHA), and then to consider what actions are feasible to reduce risks (for the MHMP). In many cases, the agency was already generally familiar with the material, due to its involvement as a stakeholder in previous MHA and MHMP planning cycles. In other cases, text was newly written or completely revised and therefore had to be considered afresh. The review of each section served to ensure that the basic tone, reasoning, direction, content elements, and implications of the analysis were generally sound, as well as to correct any specific factual or typographic errors, and to add new descriptions of programs and hazard events. In some cases, new maps and data had to be supplied by these reviewing agencies. The emphasis was on an accurate presentation of the nature, scope, magnitude, and actual/potential impacts of each hazard upon Michigan, and means to guard against the hazard, including the identification of any programs or initiatives not already described in previous versions of the section. Input was also accepted regarding recommendations to improve the organization of a section, or to try to seek a better methodological approach to the topic to the extent that time and resources allow in future updates.

Most of the MHA chapters were substantially improved in this 2019 edition. Quantitative data for natural hazards was updated using the National Centers for Environmental Information (NCEI) online database (to allow and maintain consistency), plus other sources. New summarizing tables were added, estimating the priority of all hazards and providing a new analysis by region of the state. Refinements were made to the weather records and risks, based upon feedback from NOAA. Almost every chapter had new events described in the analysis. Some out-of-state events were removed, when sufficient in-state information was judged to be available. The analysis emphasizes Michigan risks whenever possible, although some national-level data has been retained. All county

tables were updated with new records from the NCEI in a consistent format that allowed natural hazard impacts to be compared and prioritized (more details on some of those analyses appear within the MHMP appendices than was considered appropriate for the MHA, including an estimate of losses to state facilities, whose details were judged as requiring confidentiality).

Every page of the MHA was scrutinized and revised in some way. Various new maps were created to reflect new data or new types of information sources. For example, the tornadoes chapter includes a new map of tornado tracks, produced using an ESRI ArcGIS viewer. An updated map of county tornado events was updated to illustrate the updated NCEI data presented in tables. A similar map was added for the following chapter, on severe straight-line wind events. An entirely new table was added to the extreme temperatures chapter, documenting recent agricultural disaster declarations. A new table was added to the winter hazards introduction, documenting recent increases in average temperature and precipitation within Michigan, and helping to tie weather impacts in with Michigan's growing knowledge of climate trends.

The section on hydrological hazards included a new organization and was informed by a recent technical text on hydrology, plus other new sources. Many flood damages are occurring outside of traditionally defined floodplains, and this edition has finally made steps toward addressing these risks. The introduction provides useful general information, and within the chapters that follow, new information is provided about Michigan's watershed areas, stemming in part from the latest RiskMAP activities that continue to proceed with watershed-level analysis (supported by Michigan partners at the state and local level). Three pages of new watershed information was added to the chapter on riverine (fluvial) floods, and new maps show northern Michigan's waterfalls and Houghton-area topographic information, since a 2018 disaster occurred as a result of precipitation-caused mudslides in these areas that have locally steep slopes. The mudslide hazard had not been specifically included within previous editions of the MHA or MHMP. Updated NFIP and CRS information was provided, along with several pages of updated maps showing the floodplain locations that so far have been compiled into official digital maps. Recent advances in stream monitoring have also prompted the inclusion of USGS stream gauge locations, along with new descriptions of real-time programs that have been made accessible through modern internet, social media, and crowdsourcing activities. A new chapter has been added for urban (pluvial) floods, with extensive new text describing flood infrastructure components and the risks and impacts they have experienced, leading to two of Michigan's largest disasters within the past 20 years. The chapter on Great Lakes shoreline hazards has been expanded to include new information about harmful algal blooms (HAB) and ice surges, which had not been previously recognized or described within previous editions. A description of meteotsunamis is also new to this edition. New resources for these hazards include an online site which provided a summary map image of current-related events, and can be referred to by readers as needed. Lake level graphs have been updated along with their descriptive text. New maps of shoreline erosion have been added. The chapter on dam and levee failures has new maps and much-improved text describing current concerns, as extensively discussed with Silver Jackets partner agencies. The chapter on drought has had some descriptive elements simplified to be more useful to non-specialist readers, but also includes a new table describing recent agricultural declarations that had not been included in previous editions. A completely different dataset from NCEI has been extensively analyzed, causing most of the historical information within that chapter to be completely revised.

Similar improvements were made to the MHA sections covering ecological and geologic hazards. New maps more validly represent wildfire risk, based upon improved models from the MDNR. The invasive species chapter is more concisely focused upon specific species most relevant to Michigan, plus diseases that could threaten the state's agricultural sector. The format of the chapter has also finally been made more consistent with the general format of all other hazard-specific chapters. A new 16-page chapter has been added, called "Climate Trends." This chapter was drafted and re-drafted with regular input from the Michigan Climate Coalition, as MSP/EMHSD staff continued to attend relevant conferences and to peruse available literature and data sources—both mainstream and skeptical. The chapter was also informed by academic research showing what types of messages are most effective in reaching different audiences. On this basis, the chapter begins with a two-page introductory discussion, aimed at general readers, followed by the substantive 14-page core analysis that provides all the most relevant information for readers who have a bit more background understanding of the scientific topics involved. The chapter provides a trustworthy and fair assessment of information, including a consideration of contrary perspectives, in a manner that many readers should be able to consider authoritative with respect to our current knowledge. The chapter was

reviewed repeatedly by various stakeholders and subject matter experts, including the State Climatologist (whom the MSP/EMHSD planning staff had arranged to give a special presentation to the MCCERCC in 2014, thus helping to gain acceptance for the inclusion of the topic within the plan, soon mandated by FEMA requirements as well). The subsidence chapter was greatly informed by the direct assistance provided to, and coordination resulting from, the Dickinson County Hazard Mitigation Plan. Recent events and information suggest a significant and growing risk from subsidence—both within well-known mining regions as well as new problems with urban infrastructure failures. It is hoped that the updates to this chapter represent just an initial step in activities to further assess and address this hazard. Finally, the "Celestial Impacts" chapter from 2014 has been split into two chapters that better distinguish and asses the much different risks posed by geomagnetic storms and asteroids (or other impacting objects). The risks from "space weather" are quite substantial and could cause disruptive infrastructure problems in the near future, but the risks from asteroids, comets, falling space vehicles, etc. are much less likely within the near-term. Many improvements were made in these chapters, and an official NASA review was finally received in a way that benefited the chapter on meteorites and other impacting objects. Although a recent consideration within the MHMP, these updated chapters already provided a benefit during the 2018 SEOC activation prompted by the degrading orbit of the Tiangong-1 space station. An updated list of state and federal disaster and emergency declarations was added to the document.

The following information summarizes the subject-matter expert review processes that had been used when reviewing and updating various chapters of the Michigan Hazard Analysis. This information is not exhaustive, but should be used in conjunction with the overall chronological list of "2014-2019 MHA/MHMP Outreach, Input, and Coordination Activities" that appears later in this Appendix.

- The hail chapter was sent to the Department of Agriculture and Rural Development (MDARD) and the National Weather Service (NWS) on 7/17/18. A response was received from MDARD 8/3/18 with suggested changes. NWS response was received on 8/22/18 with suggested changes. A follow-up response was received from NWS on 9/18/18: the chapter looks okay.
- The lightning chapter was sent to Licensing and Regulatory Affairs (LARA) and NWS for review on 7/17/18. LARA response received—no changes identified, but suggested sending the chapter to the Michigan Agency for Energy and the State Fire Marshal. Sent to MAE on 8/8/18, response received 8/17/18 (no changes identified). The National Weather Service response was received on 9/18/18 describing some recommended changes.
- The tornadoes chapter was sent to the Department of Education (MDE) and NWS on 7/17/18. MDE response was received on 7/18/18 (no changes), and NWS responses were received on 8/22/18 and 9/18/18 with changes suggested.
- The severe winds chapter was sent to MDE, Department of Natural Resources (MDNR), and NWS on 7/17/18. A response received from MDE on 7/18/18 (no changes), from MDNR on 8/27/18 (new information provided), and from NWS on 9/18/18 (changes suggested).
- The extreme temperatures chapter was sent to MDE, MDARD, Department of Health and Human Services (MDHHS, both the health and the human services sides), Department of Environmental Quality (MDEQ), and NWS on 7/17/18. A response was received from MDE on 7/18/18 (no changes), from MDARD on 8/3/18 with changes suggested, from MDHHS on 9/5/18 one change suggested, and from NWS on 9/18/18 with changes suggested.
- The ice and sleet storms chapter was sent to MDARD, LARA, MDTMB, Department of Transportation (MDOT), and NWS on 8/8/18. MDARD's response was received 8/10/18 suggesting changes, LARA's response 8/13/18, MDTMB's response 8/30/18 identifying a new resource, MDOT response 9/13/18 suggesting changes, and NWS response 9/18/18 and 10/26/18 suggesting changes.
- The snowstorms and blizzards chapter was sent to LARA, MAE, MDOT, and NWS on 8/10/18. Based on LARA feedback from 8/13/18 and 8/16/18, changes were suggested and the chapter was forwarded to MAE. MAE feedback on 8/17/18 suggested changes. MDOT response received 9/13/18 with changes suggested. NWS response received 9/18/18 with changes suggested.
- The fog chapter was sent to MDOT and NWS on 8/10/18. MDOT responded on 9/13/18 with suggested changes, and NWS responded on 10/26/18 with suggested changes.

- The riverine (fluvial) floods chapter was sent to MDHHS, MDTMB, and USACE on 10/1/18. Received MDTMB response on 10/9/18 (no changes), MDHHS responses on 10/4/18 (1 reference added), and USACE response on 11/14/18 (changes recommended).
- The urban (pluvial) floods chapter was sent to MDHHS, MDOT, and MDTMB from 10/1/18 to 10/5/18.
- An early version of the Great Lakes Shoreline Hazards chapter was shared with researchers from Michigan Technological University's Great Lakes Research Center and discussed with them in April and May 2018. It was also shared with MDNR personnel on April 20, 2018, with feedback provided to MSP/EMHSD on May 29, 2018. MDEQ also received the chapter on May 22, 2018. A thoroughly revised version was then distributed to MDEQ, MDHHS, USACE, and MDTMB from October 1 to 5, 2018. On 10/9/18, MDTMB responded (no changes), MDNR responded and provided a new map on 10/5/18, MDEQ provided feedback on 10/4/18, and the USACE provided many changes on 10/25/18.
- The dam and levee failure chapter was distributed to MDTMB, MDNR, MDEQ, and USACE on 10/5/18. MDEQ feedback on 10/8/18 suggested one change, MDTMB feedback on 10/9/18 had no changes, and USACE feedback on 11/8/18 suggested various changes.
- The drought chapter was distributed to MDARD, MDEQ, MDNR, NWS, and USGS on 12/21/18. On 12/28/18, MDARD provided some general feedback on it.
- The wildfires chapter was distributed to MDNR and 3 offices of the U.S. Forest Service. On 2/14/19, a U.S. Forest Service response said it looked fine, and on 2/15/19, MDNR feedback suggested one change.
- The invasive species chapter was distributed to MDEQ, MDNR, and USGS on 2/4/19. On 2/15/19, MDRQ provided feedback suggesting one change.
- The climate trends chapter was developed through extensive coordination with the Michigan Climate Coalition, over the course of many months. Extensive feedback was provided from U-M (April 3, 2018), GLISA, MDEQ (May 29, 2018) and the MDNR (July 16, 2018), the last leading to the addition of a simpler introduction. The chapter was reviewed by the State Climatologist, provided in advance to FEMA, and also shared with the Michigan Silver Jackets Team (May 8, 2018). Please see the chronology of planning activities later in this chapter, for more details.
- The earthquakes chapter was sent to MDOT, MDTMB, and LARA on 2/5/19, for review and comment.
- The subsidence chapter was sent to MDRQ, USGS, USACE, and to the Dickinson County EM on 2/13/19. On 2/14/19 and 2/19/19, feedback was received from Dickinson County with some changes and then praise, and on 2/25/19, MDEQ feedback suggested some changes.
- The space weather and meteorites chapters were sent to FEMA National Headquarters on 2/22/19, addressed to a subject matter expert. No feedback was received on the materials, no documentation was provided that it was actually shared with the expert, and all follow-up requests were then ignored. On 3/11/19, the chapters were sent to NASA, and extensive feedback was provided on the meteorites chapter on 3/14/19.

During the course of other activities, additional chapters were provided to other agencies for review, but not yet integrated into the MHA because the content involved technological and human-related hazards (not required by FEMA). MDEQ received the 2014 scraps tire fires chapter for review and feedback on 6/13/18, the nuclear power plant emergencies chapter was sent to MDEQ on 7/18/18, and chapters on terrorism and cyber-attack were provided to the MSP MIOC on 10/5/18. The final draft of the Michigan Hazard Analysis was completed in March and offered for administrative approval as an official MSP/EMHSD publication. Changes were made in formatting (during which some additional corrections and feedback were incorporated) during March, and an April publication date was arranged, in conjunction with the 2019 MHMP.

Michigan Hazard Mitigation Plan Update Process

This section provides an overview of the update process for the 2019 Michigan Hazard Mitigation Plan (MHMP). Every page of the 2014 MHMP was reviewed, and clarifying changes in the document's wording were commonplace. If corrections or additions seem to be needed in any part of this document, feedback is welcome and should be sent to Mike Sobocinski at sobocinskim@michigan.gov (or by phone at 517-336-2053).

As can be seen in the chronology provided later in this Appendix, the plan update process actually started as soon as the previous edition of this plan had been completed, approved by FEMA, and adopted officially by the state of

Michigan in April 2014. Even as other types of work were undertaken to assist with local plan development, provide training, and respond to emergencies and disasters, the relevance of the material in the MHMP would often be recalled and considered in the light of new information obtained through local plans, meetings, feedback and questions at workshops, presentations, exercises, and actual events. In addition, the plan review standards for the Emergency Management Accreditation Program (EMAP) were kept in mind for this MHMP update, since a renewal of Michigan's accreditation had occurred in 2016 and various improvements have been incorporated into the format of the hazard analysis, and retained in the MHMP. For example, the new "consequence analysis" requirements have been included within each hazard chapter (e.g. impact of each hazard upon the economic condition of the state) and a special section related to assessing public confidence in state governance has been retained as **Appendix 9** of this plan.

It had become clear from the MCCERCC Hazard Mitigation Committee and other feedback that the 2014 MHMP was considered too cumbersome. Even with pages 60 to 494 removed to a separate volume attached as the Michigan Hazard Analysis, the plan would still be more than 500 pages long, and its format promised an ever-expanding set of disaster-strategy documents that in itself was growing beyond 150 pages in length. A key committee meeting resolved to have the updated 2019 focused upon a core document that would be kept under 100 pages in length, while the bulk of the plan's more detailed content would be shifted into appendices. After a couple of preliminary drafts, in which all the content of the 2014 plan was reorganized by theme, the committee agreed that some content, such as a state profile and a summary of the Michigan Hazard Analysis, was appropriate to retain within the core document because of its useful functions to orient and engage readers before considering the set of hazard mitigation goals, objectives, and implementation measures, which constitute about one-quarter of the core document.

The agreed-upon format came to consist of a core document with 10 chapters, followed by a set of 16 appendices that could be referenced as needed, when more detail is sought by a reader. The core document's 10 chapters were emphasized by MCCERCC, while its hazard mitigation committee and MSP/EMHSD planning staff worked through the extensive details within the appendices. Since several of the key MSP/EMHSD planning personnel on the core writing/editing team have also been involved in the production and review of Michigan's many local hazard mitigation plans, a knowledge of these local plans was able to be integrated into both the hazard analysis and the 2019 MHMP. Details of section-by-section changes in the plan will soon be described.

In general, this multi-hazard, state-level hazard mitigation plan is designed to promote and achieve better coordination among agencies, be grounded in an evidence-based assessment and prioritization of hazard mitigation actions at all levels, and to build and sustain awareness and education about hazard risks and vulnerabilities among all stakeholders and residents in Michigan. This plan has in many ways sought a unified approach to emergency management, although for the sake of greater coherence between state and local hazard mitigation plans, standards, and projects, this edition places an emphasis upon hazard mitigation as defined by FEMA, and less priority upon concepts and strategies that are usually classified as "preparedness" (except where such activities are already ongoing).

In the past several years, there has been an effort to encourage hazard mitigation planning processes at the state and local levels to result in additional federal grant applications for hazard mitigation projects. However, as described earlier in this Appendix, Michigan has had to deal with a huge increase in the number of response activities needed to deal with actual disasters and emergencies. Thus, although hoping to encourage hazard mitigation activities that have resulted in loss-reduction, this plan still recognizes the value of preparedness activities that more abstractly help to protect lives and property, as Michigan struggles to recover from its recent disaster and emergency events. The additional standards of the Emergency Management Accreditation Program have also been kept in mind, as a result of Michigan's re-accreditation in 2016 and the potential for that status to be renewed in 2020 or 2021. It is widely recognized that all "mission areas," phases of emergency management, emergency support functions, core capabilities, etc. are valuable and should be integrated as well as possible into a coherent overarching system that involves the whole community, including public and private agencies, both for-profit and not-for-profit. Just as many of these missions, phases, functions, and agencies are covered by an array of specialized plans, this document must emphasize its own most distinctive subject matter—hazard mitigation— even while endeavoring to be part of an integrated whole that crosses over and integrates diverse types of efforts and organizations.

The following sections provide detail about precisely how (and why) each section of the 2014 plan was reorganized and revised, along with a detailed chronology of the activities that, starting just after the completion of the 2014 plan, led toward the improvement and completion of this 2019 plan. Although this chronology should not be so detailed as to list all the daily emails and phone calls handled by planning staff and their partners on behalf of this update, it has been made detailed enough to document the extensive work that has been invested in this process, and thereby the plan's compliance with current standards. Research, outreach, coordination, brainstorming, review, feedback, and editing processes were all undertaken by MSP/EMHSD, MCCERCC, and its partnering agencies that are represented by this plan. Requests for input from numerous agencies were explicitly made at numerous times across the update period, although the bulk of the work fell into its final year (at first focusing upon the updated analysis of hazards, and then specifically upon reorganizing, shortening, clarifying, and updating this plan. A great number of valuable suggestions and new information were obtained, some of which could not be given the full treatment that was originally intended. Portions of this plan were enhanced by increased consideration of academic, theoretical, and technical perspectives and forms of analysis. Every section of the plan was thoroughly reviewed, revised, and some were partially or completely rewritten or supplemented by additional material. Great efforts were made to allow the plan to be compatible with the current scholarship, knowledge, and efforts of academic, specialist, human service, and military agencies. The greater availability of digital online resources also proved to be enormously helpful as a source of factual information throughout the process.

Section by Section Summary of Changes Made during the 2019 Plan Update

The following descriptions explain how the content of the 2014 plan was assessed, reorganized, and revised to form the new 2019 plan. The sections are described in terms of their organization in the 2014 edition, then the superiority of the current 2019 format will be briefly summarized.

1. Background Information Section: This introductory section had stretched on for page after page, going into details about hazard mitigation principles, and did not provide readers with any clear sense of the organization of the plan. The 2019 edition revised and retained only a single page from this section, plus two pages from the following section, and relocated the lengthy descriptions into other sections of the document where they felt most relevant. Information about the roles of different levels of government, including information about MCCERCC, was edited, updated, and moved to Chapter 3 of the 2019 plan. Information about hazard mitigation principles (except for a brief paragraph at the start of the new document) was moved to Chapter 6 of the 2019 plan. Information about the "role of the citizen" was also moved to Chapter 3.

2. Section on Planning Preliminaries, Preparation, Participation, and Process: This section was similarly considered to be too long and rambling to be of interest to most readers. Its 20 dense pages were reviewed for clarity, accuracy, tone, and relevance. Two pages were placed into Chapter 1 of the 2019 plan, some descriptions of an integrated planning process were moved to Chapter 10 of the 2019 plan, and the rest of the content was moved to Appendix 5, considered too detailed for the general plan and more oriented toward documenting to FEMA that the planning process complies with regulatory standards. The material that was moved elsewhere was thoroughly reviewed and updated—especially the description of the planning process in this Appendix.

3. Risk and Vulnerability Assessments Section: The detailed descriptions of update processes were moved to Appendix 5, and the general descriptions of hazard analysis format were shifted to Chapter 4 in the 2019 plan. Even though the hazard analysis is formatted as a separate volume again, it is a vital portion of this plan and therefore the descriptions of its update process have been retained within this plan, thus keeping the Michigan Hazard Analysis itself focused solely upon the assessment of hazards. The lists of hazard mitigation strategies have been moved to the first part of Appendix 13, in the 2019 plan. The special EMAP-oriented section that assesses hazard impacts upon public confidence in Michigan governance was moved to become Appendix 9. The glossary of hazard mitigation definitions was moved to Appendix 1 in the 2019 plan. Finally, the introduction to the hazard analysis was moved into that attached document. After being moved in these ways, all of this content was thoroughly reviewed and revised to fit in with their new locations within the updated 2019 documents.

4. The Hazard Analysis Section: More than 400 pages have been removed from the main document of the plan into an attached volume referred to as the Michigan Hazard Analysis. The document only includes updated natural hazards as required by FEMA to correspond with the completion of this MHMP, but all of the content for those natural hazards has been thoroughly reviewed and improved. The update of those chapters for technological and human-related hazards will resume after the deadline for updating the MHMP has passed. A summary of the key findings from the hazard analysis is presented in Chapter 5 of the 2019 plan's main section, and some of the analysis has been expanded upon in within Chapter 5 and Appendices 2, 7, 8, and 13. This includes the assessment of state facilities, although some of those details needed to be withheld from the public version of this plan. The update of the hazard analysis has already been described within this Appendix, but in short, many new descriptions of historic hazard events were added, new chapters were added (or formed from previously combined chapters), extensively updated data has been analyzed and presented in tables and maps, and all chapters were distributed to available subject matter experts or agencies for review and feedback.

5. The Sections on Local Vulnerabilities, Development Trends, and Loss Estimates: The local vulnerabilities section was moved to Appendix 7 and updated by perusing all county plans that had been updated since 2014. Additional information has been added about local hazard mitigation strategies, based upon the new analysis provided within the second part of Appendix 13. The pages that had offered a critical assessment of available hazard mitigation resources and programs were moved to Appendix 4 and completely updated in coordination with the MCCERCC Hazard Mitigation Committee. The section on development pressures and trends was moved to Appendix 2, reviewed and revised, and supplemented with additional information based upon new census population estimates. The explanation of "Local Hazard Loss Estimation Tables" was moved to Chapter 5, with details appearing within Appendices 7, 8, and 13, as well as the county impact tables appearing throughout the Michigan Hazard Analysis (and summarized in Chapter 5). The assessment of state facility vulnerabilities and losses was moved to Appendix 8, which also includes some county assessment tables for extreme temperatures that hadn't felt like a good fit anywhere else in this document.

6. Hazard Mitigation Strategy Section: The lengthy descriptions of general types of mitigation tools and measures were moved to Appendix 10 in the 2019 plan, with extensive review and revisions made by grants personnel from state departments. Information specifically about grant-funded projects has been shifted to Chapter 7 and Appendix 11, although general information about locating and applying for grant resources is a part of Appendix 10. The hazard mitigation strategy proper has its introductory and explanatory content summarized in Chapters 8 and 9. Chapter 9 presents the lengthy descriptions of each objective and implementation method, which have all been reviewed and re-assessed by the MCCERCC Hazard Mitigation Committee. The full MCCERCC received these revisions and passed a motion of support for the revised plan in March 2019. A new section was added in the form of Appendix 12, to retain and explain previous MHMP objectives, the current status of the objectives described in the 2014 plan, and the process and changes made for the 2019 update. The detailed comparison of changes made in the state mitigation strategy between 2014 and 2019 is found in **Appendix 12**. All of the tables that in 2014 had included extremely small font sizes have been removed and replaced with standard text and normal formatting that should be much easier for readers to use. Extensive updates have been provided to explain the 2019 changes and status for every objective appearing within previous plans. A great deal of old text that had been quoted from all previous plans has been replaced in this 2019 edition with more concise summaries.

7. Coordination Between State and Local Plans: Referenced within Chapter 4 of the 2019 plan, the updated description of state support for local hazard mitigation planning now appears as Appendix 3. References to this coordination appear in multiple places throughout the document. A new chronology of specific activities, meetings, etc. has replaced the earlier chronology, and covers the 5 years between 2014 and 2019. Each element of text was scrutinized and has been revised to reflect this recent history and the current situation.

8. Plan Monitoring and Update: This material was moved to Chapter 10 in the new plan, and was reviewed and revised as needed to reflect the content and status of the 2019 update. In this new location, it joins other future-oriented information that had been pulled from other parts of the 2014 plan.

9. Attachments: The 2014 plan had included seven lengthy sections labeled as "attachments," a formatting decision dating back to the initial FEMA-approved plan from 2004-2005, in which multiple planning requirements had been addressed by including various MSP/EMHSD publications (such as the hazard analysis, a document on funding sources, and a compilation of post-disaster hazard mitigation strategies). That initial submission to FEMA had amounted to more than 1,000 pages of material. Although the plan soon became more of a consolidated and self-contained document (in 2008), one of its organizational features that had remained in place was its ongoing use of "Attachments" for what had in fact become a set of appendices. The 2019 update has retained many of these sections, and added and expanded some new ones to result in a set of 16 appendices, but in order to keep the overall page count manageable, Attachment F in particular was edited down to focus upon the essential strategies elements of the accumulated post-disaster hazard mitigation strategies, rather than continuing to include the entire documents in perpetuity, as they continue to be generated with each disaster.
   - Attachment A (Loss Estimates, Critical Facility Vulnerabilities, and Support Materials): Most of the content was judged as having gradually gone obsolete because of the expansion of the Michigan Hazard Analysis to include comprehensive tables of hazard impacts by county, for all the natural hazards for which this information was readily available. A FEMA consultation agreed that these materials could be removed from the plan, in light of what had become available in the hazard analysis. Only some extreme temperature records had been retained and now appear in Appendix 8 just before the main content involving the assessment of state facilities' vulnerabilities and loss estimates. The detailed loss estimate data was completely updated, using methods described in Appendix 8, although the public versions of this plan do not include a long multi-page table that contains details about all of Michigan's important facilities. Additional assessments for wildfires and freeze damage were included in the 2019 analysis.
   - Attachment B (Disaster Declarations in Michigan): Updated tables now appear within Appendix 6, as well as at the end of the April 2019 edition of the Michigan Hazard Analysis document.
   - Attachment C (Hazard Mitigation Funding Sources and Projects): EMHSD grant experts completely reviewed and updated this information about grant-funded hazard mitigation projects, and it now appears as Appendix 11 with the addition of new information about some funding mechanisms that hadn't previously been detailed within this plan.
   - Attachment D (MCCERCC information): All council information has been updated and now appears within Chapter 3 of the 2019 plan.
   - Attachment E (State Flood Hazard Mitigation Plan): This was relabeled as Appendix 15, and referenced within the flood mitigation and "repetitive loss" elements of this plan. As mere documentation of a state government policy, no update was necessary within this 4-page section.
   - Attachment F (Hazard Mitigation Strategies for Federally Declared Disasters): Four additional strategy documents had been produced since the 2014 plan, but since this part of the plan was already growing beyond 150 pages in length as a result of so many documents dating back to 1986, the full documents have now been replaced with key excerpts that quote just their salient strategic elements. These strategies are referenced within Chapter 9 and Appendix 12. The abbreviated compiled materials now appear as Appendix 14 within the 2019 plan, and although they still take up dozens of pages, this was considered to be far preferable to the full length that this content had previously added to the length of the plan.
   - Attachment G (Review Sheets for State and Local Hazard Mitigation Plans): The current versions of the FEMA's state plan review form, the MSP/EMHSD local plan review form, and EMAP accreditation standards (newly added to this edition) have been provided as Appendix 16 within the 2019 plan.

As a result of these changes, the clarity, quality, and brevity of the 2019 plan have all been markedly improved. The entire document is less than one-half the size of the previous edition, and yet the substantive content contained within its pages has been expanded. The distinct formatting of the Michigan Hazard Analysis as an attached

volume is the largest change that made this possible, but not the only one. Still, additional content has been added where considered helpful for readers, such as the shortened version of the "State Profile" in Chapter 2, which had originally appeared hundreds of pages into the 2014 plan, but that in revised form now provides a starting point for both the Michigan Hazard Analysis and the main MHMP document. The new material appearing in Appendix 13 (summarizing project ideas from local plans) was considered very important to improve coordination between local and state plans, and between planning and grant application processes.

Contact and communication between MSP/EMHSD staff and the involved stakeholders occurred through many means—meetings, office visits, e-mail, phone conversations, hardcopy correspondence, and conference activities. Many details of such stakeholder input are provided in this appendix—agencies, personnel, dates, and processes/content that were discussed for the 2019 Michigan Hazard Analysis and the 2019 Michigan Hazard Mitigation Plan. The level of detail used in the following list of stakeholder input has been considered appropriate for compliance with federal DMA 2000 planning requirements without being excessively cumbersome. In some cases, many contacts occurred at multiple times on a particular day (e.g., multiple phone calls or e-mail messages), or scattered across weeks or even months, but where possible, these have been summarized by month in order to generally describe the character of the activities and contacts, while avoiding the redundancy of repetitive listings. For the sake of simplicity and accurate documentation, information is provided in the form of a general chronology. The details include descriptions that relate to opportunities for public involvement.

The following multi-page listing provides an overview of the outreach activities, and the known agencies that were most directly involved in these activities. It focuses upon those activities that were most directly related to the maintenance, development, and update of this 2019 MHMP (and its associated hazard analysis) since 2014. In many cases, the very same MSP/EMHSD personnel were involved in both the organizing and providing of outreach and the research/editing process for the 2019 MHMP update, thus ensuring that input was considered in the plan.

2014-2019 MHA/MHMP Outreach, Input, and Coordination Activities

NOTE: References to "districts" refer to MSP/EMHSD 8 districts unless otherwise specified, while references to "regions" refer to 14 Michigan's regional planning organizations. A shorthand abbreviation has been used as follows: D for district and R for region, followed immediately by the number of that district or region (e.g. D2N means MSP District 2N, but R2 means planning region 2).

- April 2014: Contact with Department of Environmental Quality (MDEQ) about river assessments. Arrangements pursued for climate change and space weather speakers to provide presentations to MCCERCC later in 2014. A written summary of MHMP changes was provided to Lieutenant-Colonel Gorski. MSP and governor's signatures authorize the 2014 MHMP. SEOC activation for 8-county state-declared flood disaster.
- April 17, 2014: Presentation at MSP District 1 meeting (D1), includes references to the new 2014 plan.
- April 21, 2014: MCCERCC meeting.
- April 22, 2014: Official FEMA approval date for the 2014 MHMP (to expire in exactly 5 years).
- May 2014: Arrangements for web-posting of newly approved 2014 MHMP, replacing the previous final review draft edition. Posting includes an open invitation for review and feedback, along with EMHSD contact information for the plan's main editor. Contact was made with the Michigan Climate Coalition (MCC), and climate information was read by MHMP planning staff, including the Michigan Climate Action Plan. Arrangements were made with State Climatologist Jeff Andresen to give a presentation on climate change to the MCCERCC in June. MHMP staff communication with MDEQ and MSHDA. National Weather Service (NWS) survey response provided. SEOC activation continues for 8-county state-declared flood disaster.
- May 9, 2014: Presentation at D3 meeting, including MHMP references.
- May 15, 2014: MHMP staff participate in an MDOT meeting on climate change assessments.
- May 22, 2014: MHMP staff participated in the Silver Jackets meeting at the USGS Lansing office, including reporting on MHMP.
- May 27, 2014: Presentation at D5 meeting, including MHMP references.

- June 2014: Coordination with State Climatologist for MCCERCC presentation, and discussion of MHMP climate change information. Arrangements for MHMP agenda items on various MSP district coordinator meetings. Contact with MDEQ regarding USACE dam inventory access.
- June 10, 2014: Presentation at D2 meeting, including MHMP references.
- June 16, 2014: MCCERCC meeting (see the MCCERCC meeting minute excerpts in the next section of this appendix).
- June 17, 2014: THIRA/SPR conference call.
- June 23, 2014: Presentation at D6 meeting, including MHMP references.
- June 24 to 26, 2014: MHMP staff attends University of Michigan conference on climate change adaptation.
- June 25, 2014: MHMP staff logs into EMAP training webinar on HIRA and mitigation.
- July 2014: Internal discussion of GLISA grant information. Discussion of CDBG-DR with Michigan State Housing Development Authority (MSHDA). Continued arrangements for MHMP web posting. Contact with MCCERCC HMC chair, and review of MCCERCC Annual Plan.
- July 8, 2014: Conference call with MSHDA to discuss CDBG-DR application prospects.
- July 10, 2014: Presentation at D8 meeting, including MHMP references.
- July 14, 2014: RiskMAP conference call and discussion of Michigan LiDAR activities.
- July 16, 2014: MHMP staff participates in MCC meeting, including MHMP references.
- July 23, 2014: MHMP staff attends USACE workshop on nonstructural flood mitigation.
- August 2014: Internal discussions to explore the feasibility an logistics of a state-funded hazard mitigation grant program. Feedback provided on draft MCCERCC Annual Plan. SEOC activation for widespread metropolitan flooding that results in FEMA disaster #4195. MHMP staff communication with MDOT, American Planning Association (APA), Department of Military and Veterans Affairs/National Guard (MDMVA/MING), and perusing MING/Department of Defense (DOD) information. Received information on APA's hazard mitigation policy, plus emails on THIRA and Silver Jackets.
- August 5, 2014: FEMA THIRA training is provided to MSP staff.
- September 2014: MHMP staff communications with Department of Community Health (MDCH, later MDHHS). SEOC activation for disaster 4195 continues through the end of the month. Declared State of Emergency in Wayne County due to Detroit bridge collapse.
- September 9, 2014: MHMP staff attends RiskMAP meetings in St. Clair Shores and Detroit.
- September 16, 2014: MHMP staff attends MING meeting at their Lansing headquarters (DOD coordination and presentation for climate resilience in defense facilities).
- September 22, 2014: FEMA proposes changes to their state plan review standards, which MHMP staff begins to assess for FEMA's requested feedback.
- September 24, 2014: HUD guidance on the CDBG-DR National Disaster Resilience Competition was printed for study, and the Notification of Funds Availability was discussed with MSHDA.
- October 2014: MHMP staff communications with RiskMAP (including Stantec FEMA consultants), MDEQ, FEMA, MCCERCC HMC chair, MSHDA, HUD, MING. Shared APA information on STARS sustainability criteria. Perused the DOD climate change road map, Silver Jackets materials, and the proposed FEMA state plan review guide revisions. MSP participation in JFO activities continues for disaster 4195.
- October 17, 2014: MHMP staff participates in Silver Jackets meeting.
- October 20, 2014: MCCERCC meeting.
- November 2014: MHMP staff communication with MSHDA, HUD, USACE. MSP work on annual THIRA/SPR.
- November 3, 2014: MCCERCC meeting.
- November 5, 2014: Meeting at MEDC regarding CDBG-DR NDRC.
- December 2014: Reading MDCH report summary. Review of MCCERCC Annual Plan. GIS coordination on population density maps (feeding into risk assessment and CDBG-DR location possibilities). Read HUD info. Contact with RiskMAP consultants and obtain Monroe County information. Contact with USACE, MIARNG, GLISA, MDEQ (about National Inventory of Dams access, and about scrap tire piles, program, and risks). HUD studies and CDBG-DR NDRC preparatory training. MHA article on lightning trends and other research.

- December 10, 2014: THIRA/SPR conference call.
- December 11, 2014: THIRA/SPR meeting and follow-up.
- December 18, 2014: Conference call with MEDC on CDBG-DR prospects and application.
- January 2015: Distribute information on Great Lakes Planning Grant (U-M Graham Sustainability Institute) and answer follow-up questions. Coordination with MEDC and their consultant Capitol Access (CAI) on CDBG-DR training and application preparation (includes USACE contact). Communication with MDEQ and FEMA RiskMAP consultants (STARR). Contact with MCC. Coordination with GIS to map low-moderate income areas with unmet disaster needs, for CDBG-DR application consideration.
- January 14, 2015: EMAP meeting and discussion.
- January 15, 2015: RiskMAP meeting in Three Rivers, for the St. Joseph River watershed area.
- January 16, 2015: Fort Custer climate adaptation meeting in Battle Creek.
- January 22, 2015: Conference call on CDBG-DR NDRC and its associated "Resilience Academy" sessions in Chicago.
- January 27, 2015: MEDC conference call on CDBG-DR and NDRC selection process.
- January 29, 2015: Chicago "Midwest Resilience Academy" sessions and meetings with MEDC and HUD.
- February 2015: Coordination with MEDC on CDBG-DR NDRC application, including follow-up with potentially eligible areas in Kent, Ottawa, Ionia, Newaygo, and Houghton Counties, and sharing and developing information for the competitive grant application, including a consideration of the Norton Mounds within the application. Arranging for MCCERCC agenda item on NDRC with MEDC and CAI as presenters. Contact with Consumers Energy re: lightning info for MHA, MIARNG, MDMVA, MCC. Obtain information on structural bridge collapse for MHA. Examine MDEQ/RiskMAP data for St. Joseph watershed and receive information on dams. Respond to public inquiry on our analysis and plan coverage for the "supervolcano" hazard. Work on EMAP standards 4.3.1 and 4.3.2.
- February 3, 2015: Conference call with MEDC and CAI.
- February 5, 2015: Conference call with CAI.
- February 11, 2015: Attend meeting of the Michigan Climate Action Network (MCAN), but it's less appropriate for government agency involvement than MCC.
- February 23, 2015: MCCERCC meeting, including CDBG-DR NDRC presentation, motion of support approved. (Please see MCCERCC minutes excerpts in a later section of this appendix.)
- March 2016: Coordination with MEDC and CAI on CDBG-DR NDRC application, including contact with GLISA. Fort Custer resilience coordination with LIAA, Calhoun County, and MDMVA. Coordinate with Captain Kelenske on climate elements within his NEMA presentation.
- March 4, 2015: EMPG meeting includes reporting tool for hazard mitigation (and follow-up discussion of changes to it on March 10, 2015).
- March 11, 2015: EMAP meeting and work on standard 4.3.2. The newly received FEMA state plan review guide is printed out (to become effective in March 2016).
- March 16, 2015: Silver Jackets meeting.
- March 24, 2015: Participation in Fort Custer resilience meeting in Battle Creek.
- March 25, 2015: EMAP meeting.
- March 31, 2015: MHMP staff training with Flood Resilience webinar.
- April 1-2, 2015: MHMP staff attends 2nd MSU climate conference.
- April 14, 2015: EMPG work group meeting.
- April 15, 2015: Participation in RiskMAP conference calls for Branch County (St. Joseph watershed).
- April 16, 2015: MHMP staff attends afternoon HMGP workshop sessions in Lansing.
- April 17, 2015: Participation in RiskMAP conference call for Hillsdale County (St. Joseph watershed).
- April 20, 2015: EMAP status meeting.
- April 22, 2015: Participation in RiskMAP conference call for Branch County (St. Joseph watershed).
- April 29, 2015: Meeting on MI-CEMKR training revisions.
- May 12, 2015: Participate in RiskMAP meeting in St. Joseph County.
- May 20, 2015: MHMP staff participation in MCC meeting.
- May 26, 2015: Silver Jackets conference call and webinar.
- June 9, 2015: EMAP plan review meeting, for MHMP component of week-long EMAP assessment.

- June 11, 2015: FEMA conference call on new state plan review guidance.
- June 15, 2015: MCCERCC meeting.
- July 15, 2015: MHMP staff participation in MCC meeting, then NDRC briefing at SEMC meeting.
- July 30, 2015: MHMP staff training from APA webinar on climate change adaptation and resilience.
- August 12, 2015: Coordination meeting with LIAA, MDMVA, DOD for military facility resilience.
- September 16, 2015: MHMP staff participation in MCC meeting.
- October 1, 2015: Meeting re: revision of MI-CEMKR training materials.
- October 13, 2015: Silver Jackets meeting at USGS Lansing.
- October 19, 2015: MCCERCC meeting and CDBG-DR NDRC presentation with MEDC.
- October 26, 2015: MHMP staff training from GSI webinar on climate risk reduction.
- November 18, 2015: MHMP staff participation in MCC meeting.
- November 24, 2015: SPR meeting.
- December 2015: MSP/EMHSD staff packing materials for move to new facility. SEOC activation for Flint water contamination.
- December 16, 2015: MHMP staff training in FEMA course, "Winter Weather Science and Preparedness" at MSU.
- January 2016: State of Emergency declaration for Flint water contamination, and continued SEOC activities. MSP/EMHSD move to its new facility occurs throughout this month.
- January 14, 2016: MHMP staff training from NEMA webinar on cyber-attack.
- January 20, 2016: MHMP staff participation at MCC meeting.
- January 21, 2016: MHMP staff participation in Allegan County RiskMAP conference call.
- January 29, 2016: MHMP staff participation in Silver Jackets meeting at USGS Lansing office.
- February 2016: SEOC activities for the Flint water contamination emergency continue at new MSP headquarters facility. Unpacking and organizing of MSP/EMHSD materials occurs during this month.
- February 12, 2016: MHMP staff participation in Wayne State University planning conference, as a hazard mitigation planning mentor for graduate students in a "roundtable" workshop session (organized by the Michigan Association of Planning).
- February 22, 2016: MCCERCC meeting involving hazard mitigation and guest speaker presentation by a professor from the University of Michigan, on space weather hazards.
- March 2016: SEOC activation continues for the Flint water contamination emergency. Monthly MSP/EMHSD emergency management webinars have begun, providing an additional means of regular outreach with questions and feedback from Michigan's emergency management network.
- March 10, 2016: MHMP staff participation in RiskMAP conference call for Allegan County.
- March 16, 2016: MHMP staff participation in MCC meeting.
- March 30, 2016: MHMP staff participation in RiskMAP conference call for Allegan County.
- April 2016: SEOC activation continues for the Flint water contamination emergency.
- April 6-7, 2016: MHMP staff attends 3rd MSU climate conference.
- April 18, 2016: MCCERCC meeting with CDBG-DR NDRC update.
- April 27, 2016: MHMP staff participation in RiskMAP conference call for Allegan County.
- April 28, 2016: MHMP staff attendance at PBB conference at Alma College ("Intergenerational Risk from Environmental Contamination").
- May 2016: SEOC activation continues for the Flint water contamination emergency.
- May 18, 2016: MHMP staff attendance at MCC meeting.
- June 2016: SEOC "hot wash" for Flint water contamination emergency.
- June 2, 2106: MHMP staff training in LIAA workshop "Climate Health Adaptation Planning."
- June 15, 2016: MHMP staff participation in RiskMAP conference call for Allegan County.
- July 7, 2016: MHMP staff training in webinar "Combining Climate Health Adaptation and Hazard Mitigation Plans."
- July 20, 2016: MHMP staff participation in MCC meeting.
- July 28, 2016: Silver Jackets meeting hosted by MSP/EMHSD at MSP HQ facility.
- August 15, 2016: MCCERCC meeting.

- September 21, 2016: MHMP staff participation in MCC meeting.
- September 22, 2016: FEMA consultation meeting at MSP/EMHSD. MHMP staff training from APA webinar: "State Resiliency Initiatives."
- October 2016: Data processing activities for the Flint water contamination emergency continued many months after the SEOC had been deactivated.
- October 5-7, 2016: MHMP staff training at the Great Lakes Adaptation Forum, University of Michigan Ann Arbor campus.
- October 21, 2016: THIRA/SPR meeting.
- October 25, 2016: Participation in Fort Custer planning meeting, Battle Creek.
- November 7, 2016: MCCERCC meeting.
- November 10, 2016: Meeting with Dr. Kassens-Noor of MSU, and guest presentation on hazard mitigation planning in her UP 488/888 class.
- December 2016: Wrapping up of MHMP planning staff data processing activities for the Flint water contamination emergency.
- January 11, 2017: MHMP staff training from SSF webinar, "The Business of Risk: Climate and Resilience."
- January 26, 2017: MHMP staff participation in Silver Jackets meeting, USGS Lansing office.
- January 27, 2017: MHMP staff participation in MCC meeting.
- February 3, 2017: MHMP staff presentation on Silver Jackets, during monthly EMHSD webinar.
- February 27, 2017: MHMP staff training from MSU ESPP lecture on climate hydrology.
- March 1, 2017: MHMP staff participation in the 4th National Climate Assessment satellite workshop, in Ann Arbor.
- March 9, 2017: Contact with EPA re: non-point-source runoff and flood/water quality risks.
- March 15, 2017: EMHSD Planning Unit conference call re: international cross-border emergency notification.
- March 20, 2017: EMHSD coordination with FEMA re: upcoming course delivery.
- March 22, 2017: MHMP staff presentation within FEMA's Disaster Recovery course, at EMHSTC.
- April 12-13, 2017: MHMP staff attends 4th MSU climate conference.
- April 21, 2017: MHMP staff guest presentation at SEMC quarterly meeting.
- May 15, 2017: MCCERCC meeting, includes MHMP presentation.
- May 23, 2017: Meeting to assess potential for state-funded hazard mitigation grant program.
- May 30, 2017: MHMP staff participation in Silver Jackets meeting, USGS Lansing office.
- June 2017: SEOC activation for central Michigan flood disaster.
- June 1, 2017: MHMP staff training from webinar on systems thinking and climate literacy.
- June 12, 2017: MHMP staff participation in USACE conference call, follow-up from Silver Jackets meeting (FPMS project selection and multiagency support).
- July 12, 2017: MHMP staff participation in Silver Jackets meeting, USGS Lansing office.
- July 25, 2017: MHMP staff participation in MCC meeting.
- August 10, 2017: FEMA webinar and consultation meeting.
- August 15, 2017: Participate in "Game of Floods" resilience tabletop exercise in Ann Arbor, and provide feedback.
- August 23, 2017: MHMP staff training from EPA webinar on stormwater calculator.
- September 13, 2017: MHMP staff participation in Silver Jackets meeting at USGS Lansing office.
- September 26, 2017: MHMP staff participation in MCC meeting.
- October 2, 2017: MHMP staff participation in RiskMAP conference call for Muskegon watershed.
- October 6, 2017: presentation in monthly EMHSD webinar.
- October 11, 2017: SPR information meeting.
- October 16, 2017: MHMP staff participation in RiskMAP conference call for Muskegon watershed.
- October 24, 2017: MHMP staff training from FEMA/RiskMAP webinar: "Utilizing Nature-Based Solutions to Enhance Flood Resilience and Recovery."
- November 2, 2017: Guest presentation on hazard mitigation in MSU urban sociology course.

- November 3, 2017: MHMP staff presentation on ice storm risks, in monthly EMHSD webinar.
- November 6, 2017: MCCERCC meeting.
- November 14, 2017: MHMP staff participation in Silver Jackets meeting at USGS Lansing office.
- November 16, 2017: MHMP staff training from CTP webinar on flood frequency calculations.
- November 28, 2017: MHMP staff participation in MCC meeting.
- January 5, 2018: MHMP staff presentation on pandemic illness, in monthly EMHSD webinar.
- January 16, 2018: MHMP staff participation in Silver Jackets meeting at Lansing USGS office.
- January 31, 2018: MHMP staff training from APA PIE, FEMA, ASFPM webinar, "Hazard Mitigation in Historic Districts."
- February 2018: SEOC activation for Lower Peninsula flood disaster.
- February 12, 2018: MCCERCC meeting.
- February 20, 2018: MHMP staff meeting with MDEQ and USACE on Michigan levee inventory.
- February 27, 2018: Planning call with Dickinson County re: subsidence risks (for local and state analysis).
- November 2016 to February 2018: Perusal of local hazard mitigation plans to compile information on local hazard priorities and hazard mitigation projects (see **Appendix 7** and **Appendix 13**).
- March 12, 2018: MHMP staff training from FEMA "prep talk" video.
- March 13, 2018: MHMP staff participation in Silver Jackets meeting at Lansing USGS office.
- March 20, 2018: MHMP staff participation in MCC meeting.
- April 5, 2018: MHMP staff participation in D8 meeting to collect subsidence risk and contact information from the Upper Peninsula's historic mining counties.
- April 6, 2018: MHMP staff presentation on subsidence research, in monthly EMHSD webinar.
- April 9, 2018: Conference call with Michigan Association of Planning, re: conference presentation.
- April 17, 2018: THIRA meeting.
- April 20, 2018: Discussion with MDNR about Great Lakes shoreline hazards.
- April 26, 2018: MHMP staff delivers a conference presentation at the Michigan Association of Planning's Resilience Summit in downtown Lansing.
- April 2018: Research on programs and initiatives for the MHA hail chapter.
- May 3, 2018: Discussion on Great Lakes shoreline hazards with MTU researchers Guy Meadows and Amanda Grimm (Great Lakes Research Center), followed by information-sharing.
- May 8, 2018: MHMP staff participates in Silver Jackets meeting at Lansing USGS office, including coordination on Great Lakes shoreline hazards, research, and information-sharing.
- May 22, 2018: MHMP participation in MCC meeting, including extensive discussion of MHA climate trends chapter.
- June 2018: SEOC activation for Upper Peninsula flood disaster.
- June 22, 2018: Coordination with MSU Extension (Saginaw region) for webinar presentation.
- June 27, 2018: MHMP staff gives initial webinar presentation on extreme storm hazards (later captioned and posted online for anyone to view thereafter), in coordination with the Saginaw region of MSU Extension.
- July 2018: SEOC activation for Upper Peninsula flood/mudslide disaster.
- July 10, 2018: MHMP staff participation in Silver Jackets meeting at Lansing USGS office.
- July 11-12, 2018: MHMP staff training in FEMA cyber-security workshops at Jackson College.
- July 24, 2018: MHMP staff participation in MCC meeting, including "Game of Floods" discussion and follow-up alternative demonstration involving serious games, plus additional feedback request on MHA climate trends chapter.
- August 2018: SEOC activities continue from Upper Peninsula flood/mudslide disaster, including After-Action Report work and meeting on August 27. PFAS water contamination coordination and research is also being worked on by state agencies.
- August 13, 2018: MCCERCC meeting.
- August 15, 2018: MHMP staff gives presentation on natural hazards at a "Resilience Summit" in Frankenmuth, organized by the Saginaw region of MSU Extension.
- August 16, 2018: FEMA consultation meeting occurs at MSP/EMHSD.

- May, July, and August 2018: Completing the research on county plans' top-priority hazards (**Appendix 7**).
- September 2018: Research on recent events involving structural fires, hazardous materials (fixed site and transportation), oil/gas pipeline and well incidents, infrastructure failures, transportation accidents, civil disturbances, public health events, and scrap tire fires for the MHA. (Note: these are not natural hazards, so they were not incorporated into the April 2019 MHA edition designed to accompany this plan.) Verify or replace the technological hazards online links for later MHA inclusion.
- September 5, 2018: EMHSD meeting with Consumers Energy, presentation, and follow-up inquiries sent.
- September 11, 2018: MHMP staff participation in Silver Jackets meeting at USGS Lansing office.
- September 18, 2018: MHMP staff participation in MCC meeting.
- September 19, 2018: Follow-up planning call with FEMA.
- September 25-26, 2018: MHMP staff training and partner coordination at the Great Lakes Adaptation Forum (University of Michigan, Ann Arbor).
- October 2018: Researching dam failures from online sources.
- October 5, 2018: MHMP staff update on MHA/MHMP during monthly EMHSD webinar.
- October 11, 2018: Conference call with USACE re: MHA/MHMP feedback on flood, shoreline hazards, and dams/levees.
- October 17, 2018: MHMP staff presentation at quarterly SEMC meeting.
- October 23, 2018: MHMP staff training from Silver Jackets/HUD webinar on "U.S. Department of Housing and Urban Development, Disaster Support."
- October 26, 2018: Meeting with MDOT and Michigan Municipal League re: hazards, mitigation, and insurance.
- October 30, 2018: MHMP staff participation in Silver Jackets meeting at USGS Lansing office.
- November 2, 2018: MHMP staff presentation in monthly EMHSD webinar.
- November 5, 2018: MCCERCC Hazard Mitigation Committee meeting. MCCERCC meeting.
- November 20, 2018: MHMP staff participation in MCC meeting.
- December 5, 2018: MHMP staff training from FEMA webinar. Meeting of MCCERCC Hazard Mitigation Committee.
- January 2019: SEOC activations for winter weather emergencies, and governor's declaration. State government offices are closed for most of the day on January 28, and all day on January 30 and 31, including governor-requested thermostat reductions across Southern Michigan.
- January 4, 2019: MHMP staff presentation during monthly EMHSD webinar.
- January 11, 2019: Conference call with FEMA.
- January 16, 2019: MCCERCC Hazard Mitigation Committee meeting. FEMA conference call.
- October 2018 to January 2019: Compiling information on technological hazard incidents from email newsfeeds. Descriptions of these were written in preparation for updating MHA technological hazard chapters. Writing text descriptions for new programs for the MHA. MHA wildfires and subsidence research.
- February 2019: SEOC activation, governor's declarations for Grand Rapids winter emergency and Ionia County flooding. Compilation of MHA mitigation strategies for MHMP **Appendix 13**.
- February 8, 2019: MHMP staff presentation during monthly EMHSD webinar.
- February 14, 2019: MHMP staff presentation in quarterly SEMC meeting.
- February 26, 2019: MCCERCC meeting (rescheduled from January 28).
- February 28, 2019: Conference call with FEMA.
- March 2019: Governor's declaration for Newaygo County flooding. Compilation, editing, reformatting disaster strategy information for **Appendix 14**.
- March 1, 2019: MHMP staff participation in Silver Jackets meeting at USGS Lansing office (with FEMA).
- March 14, 2019: MCCERCC Hazard Mitigation Committee meeting.
- March 25, 2019: MCCERCC meeting and official motion of support for the MHMP.
- July 2018 to March 2019: Tracking MHA chapter distribution and feedback from agencies and SMEs.
- February to March 2019: Work to update **Appendix 7** information from local plans.
- April 2, 2019: Final MHMP files to FEMA for review.

- April 3, 2019: Full draft in single document to FEMA.
- April 4, 2019: Confidential section in Appendix 8 to FEMA for review.
- April 5, 2019: MHMP staff presentation during monthly EMHSD webinar.
- April 17, 2019: MHMP staff attendance at quarterly SEMC meeting.
- March to April 2019: Compiling historical outreach, activities, and process information from personnel records, to update these chronologies in **Appendix 3** and **Appendix 5**.

NOTE: The preceding list does not attempt to provide a complete list of those who attended presentations, conferences, workshops, meetings, etc. through which MSP/EMHSD distributed materials and sought feedback about local/regional hazard vulnerabilities, mitigation project status, and other topics relevant to this plan. Rather, this chronology focuses upon activities that have specifically been part of MSP/EMHSD's planning staff outreach efforts to promote and accomplish state hazard mitigation planning during the past 5 years. It should also be noted that today, an agency's web sites often provide a form of official outreach and information from that agency, without any direct agency contact (i.e. interpersonal) needing to take place. A few of these circumstances have been included in the preceding list, especially when they involve agencies not otherwise credited within this updated 2019 MHMP. For example, in the past, an agency might have been contacted in order to formally request information or guidance, but now the same materials might be freely available to obtain through online sources without official contact to request them. Wherever specific research and outreach activities were pursued on behalf of state planning, they have generally been noted here by month. Specific meetings or events have been marked by date.

The same MSP/EMHSD personnel that have trained, overseen, reviewed, coordinated, facilitated, promoted, and otherwise been involved in the production and review of local mitigation plans have also been involved in the core research/editing team involved in the production of this 2014 MHMP update, thus providing a clear and convenient link between the various levels and types of planning, and the partnering agencies of all types that have been involved in these processes. **Some of these state planning activities necessarily overlap with those described in Appendix 3, where local and state planning activities were synergistically reinforcing and informing each other**.

MCCERCC Processes

In addition to the activities already described, important planning input was obtained from over a dozen key partnering agencies through the use of a questionnaire at MCCERCC and Silver Jackets meetings just before the Hazard Mitigation Committee met to update and re-prioritize the plan's hazard mitigation strategy. The following synopses summarize the ideas that were generated from this questionnaire. Responses were either received in person during meetings from February 26 to March 1, or were submitted subsequently, in writing. The questionnaire provided a list of Michigan's major hazards, with spaces near each of them for responding to instructions which read:

"For each of the hazards listed below, please provide suggestions or information about programs and activities that your agency oversees (or would like to), or that you have seen some partnering agency implementing, to reduce the impacts of these threats upon life, property, the economy, environment, or infrastructure. Feel free to add additional pages or to provide information in any format or method you choose. (Returning this form may be one convenient way to respond, but any available feedback may also be sent to sobocinskim@michigan.gov.)"

Washtenaw County (LEPC) – Marc Breckenridge (Amended re: 3-5-19 email)

For severe weather: Skywarn program and warning systems (IPAWS, sirens, local alerting systems), StormReady accreditation, ongoing annual awareness programs (social media, Facebook, Twitter, Nixle, etc.). Tornado shelter information and awareness-building for high-risk populations. Winter weather: 4WD team, HAM radio EMCommunications training (NWS). Dam/levee flood plan maintenance by local EOC. Multi-modal, multi-path communications circuits (RACES, AuxCOMM), 800MHz/MPSCS for solar storm alternatives? MABAS and mutual aid plans for major industrial explosions/fires. Haz mat team, LEPC, Chemical Awareness Week for hazardous materials incidents. Annual exercises by pipeline awareness group (Paradigm). Mutual aid agreements

between LUGs and Road Commission (which operates gas and diesel pumps with backup power capability) for energy emergencies.

MDARD – Elizabeth Weier, for Brad Deacon (received by email, 3-4-2019)
[Specific to MHMP draft] Application of 2017 agricultural census data when available. Objective 1.1. Prep4AgThreats.com multi-state partnership for security in agriculture document; Emergency Preparedness for the Farm document with MSU X, Emergency Action Plans for retail food establishments document. Objective 1.2. Ongoing emergency preparedness efforts with local health departments for public health emergencies, planning, and communications (exercises, workshops). Preparedness efforts with local EMCs. Objective 2.1. MDARD Right to Farm program includes site selection for agricultural facilities to minimize hazard vulnerability. MDARD Bulk Chemical storage program protects environment and groundwater as well as the stored products, facilities, and personnel. Objective 2.3. MDARD GIS and data management efforts are ongoing; agreement between data set formats, geo-coding license locations for GIS use. Objective 2.6. FIREWISE workshops are hosted by Conservation Districts, aimed toward private forest property owners. Objective 2.8. FIREWISE workshops hosted by Conservation Districts. Objective 2.9. Rural Development grants have been awarded to local jurisdictions to upgrade roads, and to local jurisdictions and private organizations to upgrade water infrastructure. Examples of grants from the rural development fund include Marquette County wastewater pump replacements and conversion of a road to year-round use, Negaunee city sewer main replacement, feasibility study for the Village of Central Lake (Antrim County) wastewater treatment facility, a study for improving the Coldwater Water Resource Recovery Facility, City of Hillsdale storm sewer and road improvements, and coordination to modify the Michigamme River Basin's Republic Dam to a fixed spillway dam.
[Specific to MCCERCC survey] Weather hazards are addressed by federal USDA programs. MDARD flood programs include the Right to Farm program (livestock facility siting), Bulk Chemical Storage Siting (also relevant for hazardous materials and industrial accident hazards), Emergency Action Plans for food establishments, Conservation Districts (which also offer Forestry Stewardship pertinent to wildfires), and Conservation Reserve Enhancement Program. Shoreline hazard programs include the Western Lake Erie Basin efforts (MI CLEAR), MI Agricultural Environmental Assurance Program (MAEAP, also for subsidence, drought, and climate change), and Qualified Forest Program (also relevant for wildfires). The Intercounty Drains Program is relevant to dam and levee failures, drought, and mudslides/subsidence. MDARD has many programs relevant to agricultural diseases and invasive species, including programs for cervid and small ruminants, bovine tuberculosis, biosecurity, poultry and animal disease traceability, swine and livestock markets, aquaculture, animal shelters, import/export requirements, and related legislation for companion and exotic animals, etc. Additional MDARD programs relevant for hazardous materials include pesticide labeling, pesticide container disposal, the Clean Sweep Program, and Private/Commercial Pesticide Applicator Licensing. For energy emergencies, MDARD has the Motor Fuel Quality Program and the Weights & Measures Program. For public health hazards, MDARD has ongoing education efforts on food safety and food security topics.

EGLE – Jay Eickholt
MDNR is the lead agency on invasive species, assisted by EGLE. EGLE will now include a Michigan "Office on Climate and Energy" in 2019. EGLE deals with heat and drought events impacting water quality and shortages (low pressure in system, aquifer shortages). EGLE deals with Great Lakes shoreline erosion (sand dune, shoreline management), water quality (including harmful algal blooms as a cause), and the floors of the Great Lakes. Non-FERC dams are regulated by EGLE. EGLE handles any impacts from oil/mineral extraction (e.g. subsidence), impacts on waste and drinking water systems (e.g. freezes, contaminants, system failures). EGLE is the primary agency handling municipal drinking water and wastewater systems. Releases with environmental impacts are regulated by EGLE, EPA, US Coast Guard, with clean-up under EGLE. Pipelines are regulated by MPSC and PHMSA in Michigan. LARA's MAE is the lead on energy emergencies, with MDARD handling gas station supply and distribution. EGLE houses Michigan's nuclear/radiological laboratory and radiological protection section. LARA and MDHHS regulate human-related impacts; EGLE handles environmental contamination investigations and sampling.

Calhoun County BOC, Lifecare Ambulance – Steven Frisbie
Coordination of resources, responses to emergency-affected areas (while continuing operations in non-affected areas). Directing citizens to warming/cooling/shelter areas. Coordination of snowplows with EMS responses.

Monitoring firefighter health, and rehabilitation services for affected fire/wildfire/industrial/haz mat responders. Patient care and decontamination after exposure to hazardous materials, pipeline contents, etc. Prepare backup sources to plan for infrastructure failures, to maintain operations. Provide medical evaluation of incoming evacuees in the event of national emergencies or catastrophes in other areas. Reporting signs/symptoms of dangerous communicable diseases and incidence trends. Coordination of response to terrorism and similar criminal activities.

Michigan Community Service Commission (MCSC) – Virginia Holmes (MDHHS)
In general, can support any issue involving volunteers or donations management, which is usually preparedness and response. Promote awareness and use of 2-1-1 in emergency events. CERT HAM radio operators could be available during energy emergencies or other major crises. Coordination with CDC during pandemics. The 2-1-1 security program pertains to cyber-attacks as well.

City of Mason Fire Department – Chief Kerry Minshall
Severe weather awareness: public education including preparedness kits and supplies for power outages, safety around downed power lines, safety in use of generators (carbon monoxide). Use of shelters for mobile home communities. Opening fire station and city hall for cooling centers during extreme temperatures, with water distribution. Severe winter weather: working with public works department to provide accessibility, plow driver assigned with fire department during winter response. Wildfires: Public education re: burning restrictions, permits under high-risk conditions, plan review for prescribed burns, with appropriate resources on-scene. Major fires and industrial incidents: pre-planning, inspection, code enforcement, mutual aid agreements in place, MABAS. Planning, education, and early incident reporting for hazardous materials and pipeline incidents, emergency contacts in place for pipelines and operators. Infrastructure backup plans and emergency contact lists, mutual aid agreements.

MDOT – Eileen Phifer and Connie Vallier (received by email, 2-27-2019)
Programs and activities apply to most hazards, including maintenance activities such as debris removal (after thunderstorms, floods, wildfires, and wind/tornado events) and snow/ice removal. Flood repairs to bridges, culverts, roads, and adjacent rights-of-way after washouts. Access control is provided during emergencies. Climate resiliency is coordinated with other agencies. The agency has continuity of operations and business continuity plans. Infrastructure construction projects can involve hazard mitigation.

MSU – Phil Schertzing
Increase university involvement, involving themed conferences, consortia, research grants, faculty expertise, and educational activities.

MDHHS – Jennifer Lixey-Terrill, for Linda Scott (amended re: MCCERCC meeting feedback, 3-25-2019)
Medical surge and mass care planning activities for all weather hazards. Triage procedures across agencies and first responders, responder safety and health during collapse and industrial events. There is a need for toxic substance response plans (not just chemical response plans). Maintaining the most critical health care during infrastructure failure situations, and similarly prioritizing fuel for hospitals during energy emergencies. Assist with mental and behavioral health assessment and improvement during national emergencies or catastrophes. Improving pediatric, burn, and psychological surge capacities during public health emergencies. Crime victim advocacy training and certification, relevant to the aftermath of terrorism and similar criminal activities.

MDLARA State Fire Marshal – Kevin Sehlmeyer
Work with DTE to educate on downed power lines and electrical safety for severe weather hazards. MI Task Force 1 available for tornado and severe wind disasters, and large-scale national emergencies—task force "concepts" involve the typing of resources statewide (all fire resources, equipment and personnel), with standing contracts for task force and strike team deployment. Fire department responses to winter accidents. Flood response includes water rescue teams. Drought response can involve local fire departments moving water by tenders. Wildfire hazards – support to local fire departments, MABAS system operation. Trench rescue and Federal urban search and rescue teams available for subsidence, structural collapse, the worst earthquake events, and hazardous materials.

City of Dearborn – Capt. Brad Smith
Public notification for weather hazards. Pre-planning and training for technological hazards, including SARA Title III site exercises and walk-throughs, annual training for pipeline incidents, working with DTE on power failures, being proactive before storms. Exercises every 1 to 3 years for major transportation incidents. Proactive with law enforcement on civil disturbances. Region 2 South members coordinate on public health emergencies. Active shooter response training for law enforcement personnel (terrorist-related).

MDMVA – Col. Sean Southworth
Providing aviation and engineering support, site security, communications support, logistics support, crowd control, urban search and rescue, Common Operating Picture, spill containment, Civil Support Team response, hazardous materials handling, decontamination, firefighting, National Guard Response Force (NGRF), non-lethal weapons, crowd control (if appropriate, as part of a graduated civil disturbance response strategy), traffic control points, PODs, transportation convoys, debris removal, emergency management, CBRNE response in most kinds of disasters or emergencies. For the nuclear attack and terrorism hazards, the 46 MP Command CRE-B, Domestic Operations mobilization, and Civil Support Teams are available. For cyber-attack risks, Cyber Protection Team and Cyber Operations Squadron, penetration testing, network mapping, and network defense activities are available, and have been included in the current Cyber Disruption Plan.

Oakland County – Sara Stoddard
For severe weather, 24/7 on-call staff coordinated with NWS to provide information and activate warnings, with all outdoor warning systems owned and operated by the county. Coordinating with cities, villages, and townships to promote warming/cooling centers, and healthy ways to work and live during extreme temperatures. Increases in urban flooding are occurring, due to infrastructure limitations and aging equipment, requiring more resources or new ways to address the problem. [Action item to promote and install green infrastructure?] Aging infrastructure leads to a great risk of sinkhole and water main break problems. Need assistance to assess and prioritize areas at risk and in need of grant-funded work. Haz mat response plans are in place but probably require additional testing to ensure a coordinated response to very large incidents. Similar concerns regarding widespread power failures. There is a widespread need to better understand energy supply systems. Oakland County has OakTac, a law-enforcement training consortium working to plan and train teams for coordinated response to civil disturbances or other major incidents. The county health department creates and tests plans for public health events such as influenza and Hepatitis A.

City of Lansing Police Department – Chief Mike Yankowski
Vegetation control for severe weather mitigation (summer and winter). Flood mitigation plan and flood assessments; portable retention walls. Sewer separation project for flood mitigation. Removal of lead pipes throughout city (took 20 years). Provide more mental health facilities—would gun violence tie in with public health hazards?

U.S.G.S. Lansing Office – Cynthia Rachol (amended re: 3-8-2019 email)
During extreme cold, USGS can measure and inform (upon request) about ice jams on rivers. For floods, USGS collects high-water marks and flow measurements, develops flow statistics, and produces flood inundation models and maps as flood warning and analysis tools. A beach warning model was developed for Lake Erie (available online), predicting high algal bloom potential, and its development for other Great Lakes is being evaluated. USGS can participate in post-event analysis of dam and levee failures. USGS operates a groundwater monitoring network for use in drought assessments. USGS has researchers identifying the likelihood and locations of Asian Carp invasive species habitat areas, and has done some measurements and analysis of the Chicago River barrier. USGS staff are involved in climate assessments, earthquake monitoring and reporting systems. USGS has been developing response models and maps for pipeline break scenarios, and would like to receive funding to conduct asset surveys. For public health protection, USGS microbiologists work to identify contaminants that may cause water contamination.

FEMA – Frank Shockey
Help local governments promote flood insurance through outreach and public information. Provide detailed information on Great Lakes coastal flood hazards and associated floodplain management. Obtain ASFPM and

states' support for further study and guidance regarding ice and ice jam Impacts, to encourage support from FEMA headquarters' Building Science Group.

NOAA/NWS – Brandon Hoving
Advance provision of state-level severe weather risk graphics and customized flood warnings to local and state partners, including the expected timing of specific threats and specific locations expected to be vulnerable. Wireless Emergency Alerts (WEA) for tornadoes and flash floods are geographically targeted to mobile device users in the impacted areas. Outdoor weather siren best practice document: http://skywatch.org/ows.pdf. Currently developing "Warn on Forecast" technology https://www.nssl.noaa.gov/news/factsheets/WoF_2015.pdf with the goal of expanding average advance warning from the current 15 minutes to up to an hour of lead time for severe weather mobilization activities. Tailored and detailed severe winter weather forecasts are being provided directly to county Road Commissions. Coordination with MDOT's internal incident dashboard for system travel speeds and road conditions, etc., to fine-tune forecast and warning information with Intelligent Transportation Systems (ITS). NOAA uses river-level forecasts and specialized flood inundation maps to inform locals of actions warranted to protect facilities and other property (e.g. sandbagging at the Grand Rapids wastewater treatment plant). Progress is occurring on the National Water Model https://water.noaa.gov/map, which will inform decision-makers of current streamflow information and projections at and between USGS stream gauge sites (https://water.noaa.gov/documents/wrn-national-water-model.pdf). NOAA/NWS maintains a comprehensive site on Michigan's beach hazards https://www.weather.gov/greatlakes/beachhazards, including dangerous current and wave conditions, plus an array of shoreline-related coordination and educational services.

The various conferences, training courses, and coordination meetings in which MSP/EMHSD has participated have included attendees from an enormous variety of professions and organizational types. Other sections of this plan have referred to the coordination with Native American organizations, the urban/regional planning profession, emergency management and response organizations, and governmental entities at all levels. In addition, there exist many connections with non-profit, corporate, and non-governmental agencies—often through attendance at meetings, conferences, training courses, emergency management exercises, and other means of outreach and coordination. The Volunteer Area Liaison positions in MSP/EMHSD have strengthened enormously since 2014, and are staffed within the same planning unit that has primary responsibility for the state plans and hazard analyses (the State and Local Planning Unit). The agencies contacted have included representatives from hospitals and health agencies, the insurance industry, radio operators (R.A.C.E.S./ARES), businesses (often risk-management personnel or other key persons concerned with safety and hazard mitigation), schools and private colleges, the American Red Cross, and even large corporations such as Michigan's major automotive manufacturers and retail suppliers. Outreach to subject matter experts in academia has also been maintained, and subject matter experts consulted where appropriate for their knowledge, regardless of current employment. For example, university scholars gave presentations to the MCCERCC about emerging hazards and climate conditions. Hazard mitigation plans for the adjacent states of Ohio, Indiana, Wisconsin, and Canada were perused when developing this MHMP update. The January 2019 edition of the Michigan Emergency Management Plan (MEMP) was also perused for consistency with this document and its associated hazard analysis. The MEMP response plan document is also maintained by the same unit that oversees the hazard mitigation plan. Many of the conferences, meetings, training courses, and outreach activities also included members of the general public, who were provided with contact information to reach MSP/EMHSD planning personnel and ask questions or provide comment/feedback about planning processes and documents, including the MHMP.

The MSP/EMHSD was required by MCCERCC provisions (Michigan Executive Order 2007-18) to operate using certain protocols with regard to the development and revision of the MHMP. As a result, MSP/EMHSD staff activities related to the MHMP were necessarily funneled through the multi-agency MCCERCC framework. Since the creation of the MCCERCC, the MHMP has been included as an agenda item at numerous meetings. (The use of formal agenda items in this way helps to direct specific attention to the MHMP as part of the announcement and open meeting provisions under which the MCCERCC operates within a public government framework). The following is a list of dates and MCCERCC minute excerpts during the current 2014-2019 MHMP update period, describing plan-related activities at full MCCERCC meetings that were open to public attendance and comment:

- June 16, 2014 – Dr. Schertzing, Chair of the Hazard Mitigation Committee, reported that the State Hazard Mitigation Plan was submitted and approved.

Presentation on Climate Change Impacts on Michigan – Dr. Jeff Andresen, Associate Professor of Geography at Michigan State University, presented a PowerPoint program on climate change impacts on Michigan. He is an AgBioResearch scientist and serves as the state climatologist. There were questions and comments throughout his presentation. [Note: State planning staff had arranged for this presentation, to tie in with the addition of climate change considerations to the MHMP.]

- February 23, 2015 – Mr. Mike Sobocinski reported on Michigan's application for Community Development Block Grant Disaster Recovery (CBDG-DR) funds. He distributed a one-page handout highlighting information regarding the grant, and a multi-page handout regarding the U.S. Department of Housing and Urban Development, National Disaster Resilience Competition for Michigan.

  Mr. Sobocinski explained that as a result of Hurricane Sandy and flooding that occurred on the East Coast, the U.S. Department of Housing and Urban Development (HUD) has made disaster recovery funds available nationwide through a competitive process entitled the National Disaster Resilience Competition (NDRC). The funds are potentially available for areas that had federally declared disasters which occurred between 2001 and 2013. Michigan's 2013 flood event is a qualifying disaster, making 16 counties potentially eligible for funding. Mr. Sobocinski explained there are two phases to the HUD application process, and the guidelines they provided are complicated. Phase I, which is due next month, will demonstrate that Michigan is a qualifying state. Phase II will lay out the details of how Michigan intends to use the funds. The Michigan Economic Development Corporation (MEDC) is the lead agency in this endeavor, and Ms. Deborah Stuart is the lead point of contact. Mr. Sobocinski explained that multi-agency, coordinated efforts are important to HUD; therefore, he requested to present information at today's meeting in order to seek input and review of Michigan's application.

  Mr. Sobocinski clarified that they are seeking a motion of general support for Michigan to apply for these funds. The qualifying target area would be in or near Grand Rapids, Michigan. Timelines are being discussed at this point, and specific details will be presented at a later MCCERCC meeting.
- October 19, 2015 – Mr. Mike Sobocinski confirmed that the next state hazard mitigation plan update will be in 2019.

  Mr. Sobocinski recognized Ms. Deborah Stuart from the Michigan Economic Development Corporation (MEDC) to report on the status of Michigan's application for Community Development Block Grant Disaster Recovery (CDBG-DR) funds.
- February 22, 2016 – Mr. Sobocinski introduced himself and explained that he is the primary editor of the Michigan Hazard Mitigation Plan. His role as a planner includes trying to predict the different types of hazards that could occur. Although the section of the state mitigation plan on celestial impacts had examined the risk of meteorites, such as the one that had damaged Chelyabinsk, Russia, it also identified a much more likely threat to the United States—that being the topic of geomagnetic storms, or space weather. Mr. Sobocinski introduced Dr. Daniel Welling from the University of Michigan and also welcomed Mr. Dale Zorn, a Legislative member from southeastern Michigan. [Note: Dr. Welling gave a presentation to MCCERCC on the geomagnetic storm hazard, as arranged by planning staff in conjunction with work to update that chapter in the Michigan Hazard Analysis.]
- April 18, 2016 – Mr. Mike Sobocinski distributed a report that summarizes the National Disaster Resilience Competition (NDRC) projects selected by the U.S. Department of Housing and Urban Development (HUD), which included 13 final-selected recipients. He pointed out the focus of the program was to emphasize resilience—our particular interest being in disaster resilience. He stated there has been no announcement to continue the program as it was likely designed to be a one-time follow-up to disperse the remaining funds available from a superstorm Sandy allocation.
- May 15, 2017 – Mr. Mike Sobocinski provided an overview of the state of Michigan Hazard Mitigation Plan that is to be updated by 2019.
- November 5, 2018 – Mr. Sobocinski distributed two handouts: 1) a proposed process and timeline for the Michigan Hazard Mitigation Plan, and 2) a summary of Michigan's estimated top hazards. He provided an extensive explanation of the plan, which needs to be updated every five years. The plan is a large document (approximately 950 pages), which presents some issues for logistics updating and review. As a result, there will be a separate document for the Michigan Hazard Analysis, which provides the framework for the plan. Mr. Sobocinski stated that the MCCERCC will be called upon to support the plan. The plan

must be approved by FEMA, but first requires the Governor's signature. He noted that hazard mitigation grants also require the plan to be in place.

- February 26, 2019 – Dr. Schertzing reported that the Hazard Mitigation (HM) Committee convened on January 16 to discuss the Michigan Hazard Mitigation Plan and Pre-Disaster Mitigation (PDM) application selections. He recognized Mr. Mike Sobocinski to report on the Hazard Mitigation Plan.
  Mr. Sobocinski distributed a two-page questionnaire and indicated it is his last opportunity to have direct contact with Council members prior to the Plan being submitted for FEMA review. Following input received at today's meeting, there will be a conference call on Thursday with the FEMA reviewer. There will also be a Silver Jackets meeting on Friday, which is a means of partnering with federal agencies, as well as some state agencies that will be represented. Another HM Committee meeting will be held at the end of March; therefore, they would like to have assurances and a completed FEMA review that would enable MCCERCC members to pass a motion that accepts the finalized version of the Plan. Mr. Sobocinski indicated that the two-page questionnaire is composed of numbered items for each of the major hazards viewed as potentially causing issues in Michigan. He allowed time for Council members to provide suggestions and information regarding the programs and activities their agency oversees or have seen partnering agencies implement. He indicated that Ms. Roos did send Council members an email containing a digital copy of the questionnaire, so any additional information can be sent to her after today's meeting. [Note: this meeting had originally been scheduled for January 28, but state offices were closed that day during a winter emergency event.]

March 25, 2019 – Dr. Schertzing recognized Mr. Mike Sobocinski to report on the Michigan Hazard Mitigation Plan. Mr. Sobocinski briefly summarized activities since the previous meeting, including the consolidation of questionnaire information into summaries that had been considered by the Hazard Mitigation Committee. At a committee meeting on March 14, the hazard mitigation strategies in Chapter 9 had been revised and re-prioritized. The results were distributed to MCCERCC members in an emailed MHMP document. Dr. Schertzing made a motion for MCCERCC to grant its official support to the plan as developed, with the understanding that changes will still be made to meet FEMA review standards. The motion passed. [Note: Official minutes were not yet available for the March 25 meeting at the time of writing, so this brief synopsis is provided as a substitute.]

All of these meetings were open to the public and were advertised in accordance with the Council bylaws and the Michigan Open Meetings Act, thus providing various opportunities for citizens and stakeholders to personally attend meetings and offer comment on any topic related to the MHMP, in addition to the ordinary ongoing means available to contact MSP/EMHSD staff by phone, fax, or e-mail regarding the MHMP and related topics. In addition, interested individuals and organizations could submit written comments at any time to the Council and/or the MSP/EMHSD planning staff, using regular U.S. mail or through the MCCERCC web page on the MSP/EMHSD web site (or as also presented on the general michigan.gov web site). These web addresses are
https://www.michigan.gov/msp/0,4643,7-123-72297_60152_69727-198426--,00.html and
https://www.michigan.gov/msp/0,4643,7-123-72297_60152_69727_73631---,00.html,
and they display clearly identified means for citizens to contact the appropriate staff to provide feedback, as well as to read meeting minutes, agendas, and MCCERCC meeting schedules. The meeting minutes document that public comment opportunities were provided at Council meetings. (Other means of feedback to MSP/EMHSD staff and MCCERCC committee members, such as by phone, wouldn't necessarily include and relay to staff the means by which the contact information had been obtained, for documentation and analysis of the effectiveness of the feedback opportunities.)

The text of each edition of the MHMP (and its associated MHA) has included a standing invitation for comment (with no expiration date), and provided readers with contact information to reach the leading staff member. Any readers of this plan can contact Mike Sobocinski of the MSP/EMHSD, with questions, comments, or recommendations concerning the Michigan Hazard Mitigation Plan. Mike's primary means of being contacted is by telephone at (517) 284-3947 and by e-mail at sobocinskim@michigan.gov. Each edition of the MHMP has been posted online continuously since 2011, with this invitation for feedback and suitable contact information for providing comment.

The MHMP is also distributed through professional networks (such as those of emergency managers and planners), and to those other citizens who have specifically requested a copy. Copies are widely distributed to those personnel and their associated agencies, along with the numerous MSP/EMHSD planning partners who have been involved in the plan's production and update. Editions of the MHMP that include information about Michigan's critical facilities can be made available to authorized personnel only, with the agreement that such information must remain confidential. Document distribution has also included registered participants in MSP/EMHSD training courses. General public access includes an internet posting and pdf download option, or a printed or digital pdf copy available upon request from MSP/EMHSD's State and Local Planning Unit (Tom Weber, Manager).

The opportunity for public input is also required for local planning activities, with their own associated update cycles (every 5 years) that are ongoing in Michigan's counties and major municipalities, and whose results have been analyzed for inclusion in this 2019 plan (see **Appendix 3** and **Appendix 13**). As already noted, dozens of plan development meetings, training sessions, and coordinating meetings were held across the state since the last MHMP update was federally approved in 2014. Pertinent comments and ideas from those local planning meetings were noted for consideration during the 2019 update process, and the ideas from updated state documents are used as a basis for local hazard mitigation plan updates in a continuing cycle of shared information and improving research methods.

In accordance with Michigan law, the MSP/EMHSD has also provided hard copies and CDs of its planning documents to the Library of Michigan for public review at that facility and for distribution to the state's 64 depository libraries. This has allowed for public review of the Michigan Hazard Mitigation Plan at any of those depository libraries. After the governor's authorization of the final, FEMA-approved edition of this plan, the required distribution process will again be followed.

HHPD Planning Process

From June 2020 to September 2020, staff from the MSP/EMHSD and EGLE Dam Safety Program coordinated to update the MHMP and its associated hazard analysis to include enhanced content involving dam risks within Michigan. Information was exchanged, discussed, added in draft form, reviewed, revised, and submitted to FEMA. Formal comments from that submission were provided by FEMA in August 2021 that requested additional information. A new revision process with MSP/EMHSD and EGLE then took place, with a revised submission sent to FEMA in November 2021. Continued planning addressed broader dam safety goals, including an update in PAR methodology options and the objective to digitize inundation maps for all high hazard dams within the state (beyond those that were HHPD eligible). After consultation with FEMA, new language was tentatively finalized in February 2022 so that it could be internally approved by EMHSD, MCCERCC, and the Office of the Governor before FEMA's official approval.

Appendix 6: Federal and State Disaster and Emergency Declarations in Michigan

Presidential Declarations in Michigan: 1953-2020*

Date of Incident	Type of Incident	Affected Area	Type of Declaration / Federal ID Number**
05/16/20-5/22/20	Flooding/ Dam breach	5 counties: Arenac, Gladwin, Iosco, Midland, Saginaw	Major Disaster (4547)
05/16/20-5/22/20	Flooding/ Dam breach	2 counties: Gladwin, Midland	Emergency (3525)
01/20/20- ongoing	Pandemic	Statewide	Major Disaster (4494)
01/20/20- ongoing	Pandemic	Statewide	Emergency (3455)
6/16/18-6/18/18	Severe storms, flooding, landslides, mudslides	3 counties: Gogebic, Houghton, Menominee	Major Disaster (4381)
6/22/17-6/27/17	Flooding	4 counties: Bay, Gladwin, Isabella, and Midland	Major Disaster (4326)
8/11-13/14	Urban flooding	3 counties: Macomb, Oakland, and Wayne Co.	Major Disaster (4195)
4/25/14	Contaminated water	City of Flint (Genesee Co.)	Emergency (3375)
4/16/13-5/14/13	Flooding	16 counties: Allegan, Baraga, Barry, Gogebic, Houghton, Ionia, Kent, Keweenaw, Marquette, Midland, Muskegon, Newaygo, Ontonagon, Osceola, Ottawa, and Saginaw Co.	Major Disaster (4121)
7/14/08	Thunderstorms, flooding	12 counties: Allegan, Barry, Eaton, Ingham, Lake, Manistee, Mason, Missaukee, Osceola, Ottawa, Saginaw, and Wexford Co.	Major Disaster (1777)
9/07/05	Hurricane evacuation	All 83 counties	Emergency (3225)
5/20/04-6/8/04	Thunderstorms, flooding	23 counties: Barry, Berrien, Cass, Eaton, Genesee, Gladwin, Ingham, Ionia, Jackson, Kent, Livingston, Macomb, Mecosta, Muskegon, Oakland, Ottawa, Saginaw, Sanilac, Shiawassee, St. Clair, St. Joseph, Washtenaw, and Wayne Co.	Major Disaster (1527)
8/14-17/03	Electric power failure	14 counties: Calhoun, Eaton, Genesee, Hillsdale, Ingham, Kalamazoo, Lapeer, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Co.	Emergency (3189)
4/10/02-5/9/02	Flooding	6 counties: Baraga, Gogebic, Houghton, Iron, Marquette, and Ontonagon Co.; plus the Keweenaw Bay Indian Community	Major Disaster (1413)
12/11-31/00	Blizzard, snowstorm	39 counties: Allegan, Barry, Bay, Berrien, Branch, Calhoun, Cass, Clare, Clinton, Eaton, Genesee, Gladwin, Gratiot, Hillsdale, Huron, Ingham, Ionia, Isabella, Jackson, Kalamazoo, Kent, Lapeer, Livingston, Macomb, Mecosta, Midland, Montcalm, Muskegon, Oakland, Osceola, Ottawa, Saginaw, St. Clair, St. Joseph, Sanilac, Shiawassee, Tuscola, Van Buren, and Washtenaw Co.	Emergency (3160)
9/10-11/00	Urban flooding	2 counties: Oakland and Wayne Co.	Major Disaster (1346)
5/2-10/99	Wildfire	2 counties: Marquette and Mackinac Co.; (Grant Recipient: Michigan Dept. of Natural Resources)	Fire Suppression
1/2-15/99	Blizzard, snowstorm	31 counties: Alcona, Allegan, Arenac, Barry, Berrien, Cass, Crawford, Ionia, Iosco, Jackson, Kalamazoo, Kent, Lenawee, Macomb, Marquette, Mecosta, Monroe, Montmorency, Muskegon, Newaygo, Oakland, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Ottawa, St. Joseph, Van Buren, Washtenaw, and Wayne Co.	Emergency (3137)
7/21/98	Thunderstorms, severe winds	2 counties: Macomb and Wayne Co.	Major Disaster (1237)
5/31/98	Thunderstorms, severe winds	13 counties: Bay, Clinton, Gratiot, Ionia, Kent, Mason, Montcalm, Muskegon, Newaygo, Oceana, Ottawa, Saginaw, and Shiawassee Co.	Major Disaster (1226)
7/2/97	Tornadoes, flooding	5 counties: Genesee, Macomb, Oakland, Saginaw, and Wayne Co.	Major Disaster (1181)
6/21-7/1/96	Rainstorms, flooding, tornado	7 counties: Bay, Lapeer, Midland, Saginaw, Sanilac, St. Clair, and Tuscola Co.	Major Disaster (1128)
12/93-5/94	Underground freeze	10 counties: Charlevoix, Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	Major Disaster (1028)
9/10-19/86	Flooding	30 counties: Allegan, Arenac, Bay, Clare, Clinton, Genesee, Gladwin, Gratiot, Huron, Ionia, Isabella, Kent, Lake, Lapeer, Macomb, Manistee, Mason, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa, Saginaw, Sanilac, Shiawassee, Tuscola, and Van Buren Co.	Major Disaster (774)
9/5-6/85	Flooding	6 counties: Alcona, Genesee, Iosco, Lapeer, Saginaw and Shiawassee Co.	Major Disaster (744)
3/12-20/82	Flooding	2 counties: Berrien and Monroe Co.	Major Disaster (654)
7/15-20/80	Severe winds	10 counties: Allegan, Berrien, Calhoun, Cass, Jackson, Ottawa, St. Joseph, Van Buren, Washtenaw, and Wayne Co.	Major Disaster (631)
5/13/80	Tornado	2 counties: Kalamazoo and Van Buren Co.	Major Disaster (621)
1/26-27/78	Blizzard, snowstorm	Statewide	Emergency (3057)

Presidential Declarations in Michigan: 1953-2020* (cont.)

Date of Incident	Type of Incident	Affected Area	Type of Declaration / Federal ID Number**
3/2/77	Drought	44 counties: Alcona, Alger, Alpena, Antrim, Arenac, Baraga, Benzie, Charlevoix, Cheboygan, Chippewa, Clare, Crawford, Delta, Dickinson, Emmet, Gladwin, Gogebic, Grand Traverse, Houghton, Iosco, Iron, Isabella, Kalkaska, Lake, Leelanau, Luce, Mackinac, Manistee, Marquette, Mason, Mecosta, Menominee, Missaukee, Montmorency, Oceana, Ogemaw, Ontonagon, Osceola, Oscoda, Otsego, Presque Isle, Roscommon, Schoolcraft, and Wexford Co.	Emergency (3035)
1/26-31/77	Blizzard, snowstorm	15 counties: Allegan, Barry, Berrien, Cass, Chippewa, Hillsdale, Kalamazoo, Kent, Monroe, Muskegon, Newaygo, Oceana, Ottawa, St. Joseph, and Van Buren Co.	Emergency (3030)
3/20/76, 3/2-7/76	Ice storm, tornadoes	29 counties: Allegan, Bay, Clare, Clinton, Genesee, Gladwin, Gratiot, Ionia, Isabella, Jackson, Kent, Lapeer, Macomb, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oakland, Oceana, Osceola, Ottawa, Roscommon, Saginaw, St. Clair, Sanilac, Shiawassee, Tuscola, and Wayne Co.	Major Disaster (495)
8/20/75-9/6/75	Rainstorms, severe winds, flooding	16 counties: Allegan, Clare, Genesee, Gratiot, Ingham, Isabella, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa, Saginaw, and Shiawassee Co.	Major Disaster (486)
4/18-30/75	Flooding, rain, tornadoes	21 counties: Allegan, Barry, Berrien, Calhoun, Clinton, Crawford, Eaton, Genesee, Ingham, Ionia, Kalamazoo, Kent, Lapeer, Livingston, Macomb, Oakland, Ottawa, Saginaw, St. Clair, Shiawassee, and Van Buren Co.	Major Disaster (465)
4/3/74	Tornado	1 county: Hillsdale Co.	Major Disaster (429)
4/12/73	Severe storms, flooding	14 counties: Arenac, Bay, Berrien, Huron, Iosco, Macomb, Menominee, Monroe, Saginaw, Sanilac, St. Clair, Tuscola, Van Buren, and Wayne Co.	Major Disaster (371)
12/1/72	Severe storms, flooding	9 counties: Arenac, Bay, Berrien, Iosco, Macomb, Monroe, St. Clair, Tuscola, and Wayne Co.	Major Disaster (363)
4/5/72	Snowstorm, freezing rain	9 counties: Allegan, Barry, Calhoun, Clinton, Eaton, Ingham, Ionia, Jackson, and Kalamazoo Co.	Major Disaster (330)
4/11/65	Tornadoes, severe storms	16 counties: Allegan, Barry, Bay, Branch, Clinton, Eaton, Gratiot, Hillsdale, Kalamazoo, Kent, Lenawee, Monroe, Montcalm, Ottawa, Shiawassee, and Washtenaw Co.	Major Disaster (190)
4/5/56	Tornado	4 counties: Benzie, Leelanau, Manistee, and Ottawa Co.	Major Disaster (53)
6/8/53	Tornado	3 counties: Genesee, Iosco, and Monroe Co.	Major Disaster (6)
5/21/53	Tornado	1 county: St. Clair Co.	Major Disaster (4)
Totals for 1953-2020:	**42 Incidents**		**30 Major Disasters; 10 Emergencies; 1 Fire Suppression**

Notes

*Does not include separate Secretary of Agriculture or Small Business Administration (SBA) disaster declarations, which are issued under other authorities. Declarations after 1974 were issued under PL 93-288 (Disaster Relief Act), as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (1988) and the Disaster Mitigation Act (2000).

**Indicates federal declaration number assigned by FEMA or its predecessor agencies.

Governor's Declarations in Michigan: 1977-2020

Date of Incident	Type of Incident	Affected Area	Type of Declaration**
5/19/2020	Flooding, Dam Failure	Arenac, Gladwin, Iosco, Midland, and Saginaw Counties	Emergency
3/10/2020	Pandemic	All 83 counties	Emergency
7/20/2019	Flooding	Lake County	Emergency
5/25/2019	Flooding	Tuscola County	Emergency
4/30/2019	Flooding	Wayne County	Emergency
3/14/19	Flooding	Newaygo County	Emergency
2/7/2019	Severe Winter Weather	City of Grand Rapids	Emergency
2/7/2019	Flooding	Ionia County	Emergency
1/29/2019	Extreme Cold	All 83 counties	Emergency
7/26/2018	Drinking Water Contamination	Kalamazoo County	Disaster
7/25/2018	Flooding	Houghton County	Disaster
7/12/2018	Flooding	Houghton County	Disaster
6/16/2018	Flooding	Gogebic, Houghton, and Menominee Co.	Disaster
2/19/2018	Flooding	City of Grand Rapids and City of Lansing; Allegan, Arenac, Barry, Berrien, Cass, Clare, Eaton, Ingham, Ionia, Kalamazoo, Kent, Newaygo, Mecosta, Ogemaw, Oscoda, Ottawa, and St. Joseph Co.	Disaster
6/22/17	Flooding	Bay, Gladwin, Isabella and Midland Counties	Disaster
12/24/16	Sewer Collapse/Sinkhole	City of Fraser; Macomb County	Emergency
10/16/16	Flooding	Chocolay, Skandia, and West Branch Townships; Marquette County	Disaster
7/12/16	Severe weather	City of Wakefield (Gogebic Co.), Township of Bessemer (Gogebic Co.), Township of Erwin (Gogebic Co.); Gogebic Co.	Disaster
8/2/15	Thunderstorms	City of Traverse City (Grand Traverse Co.), Township of Acme (Grand Traverse Co.), Township of East Bay (Grand Traverse Co.), Township of Garfield (Grand Traverse Co.), Township of Long Lake (Grand Traverse Co.), Township of Peninsula (Grand Traverse Co.), and Township of Whitewater (Grand Traverse Co.); Grand Traverse, and Leelanau Co.	Disaster
6/22/15	Tornado	City of Portland, Orange Township, and Portland Township (Ionia Co.)	Disaster
9/26/14	Bridge collapse	City of Detroit (Wayne Co.)	Emergency
8/11/14	Urban flooding	Macomb, Oakland, and Wayne Co.	Disaster
4/25/14	Contaminated water	City of Flint (Genesee Co.)	Emergency
4/12/14	Flooding	Isabella, Mecosta, Missaukee, Muskegon, Newaygo, Osceola, Roscommon, and Wexford Co.	Disaster
2/13/14	Deep frost	Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Gogebic, Luce, Mackinac, and Marquette Co.	Emergency
6/18/13 5/7/13	Flooding	Allegan, Baraga, Barry, Benzie, Genesee, Gogebic, Gratiot, Houghton, Ionia, Iron, Kent, Keweenaw, Marquette, Mecosta, Midland, Muskegon, Newaygo, Ontonagon, Osceola, Ottawa and Saginaw Co.; City of Grand Rapids (Kent Co.); City of Ionia (Ionia Co.)	Disaster
5/25/12	Wildfire	Luce and Schoolcraft Co.	Disaster
5/11/12	Flooding	Genesee County	Emergency
5/31/11	Thunderstorms	City of Battle Creek (Calhoun Co.); Calhoun Co.	Emergency
7/27/10	Oil pipeline spill	Calhoun Co.	Disaster
6/9/10	Thunderstorms, tornadoes	Monroe Co.	Emergency
7/21/09	Tanker truck explosion, fire	Oakland Co.	Emergency
6/19/08	Thunderstorms	Lake, Manistee, Osceola, Ottawa, and Wexford Co.	Emergency*
6/13/08	Thunderstorms	City of Saginaw and City of Lansing (Ingham Co.); Allegan, Eaton, and Mason Co.	Emergency*
8/27/07	Tornado	City of Fenton (Genesee Co.)	Emergency
8/9-10/07	Wildfire	Luce Co.	Emergency
7/28/06	Thunderstorms, heavy rain	Oscoda Co.	Emergency
2/27/06	Severe winds, ice storm	Montcalm Co.	Emergency
9/4/05	Hurricane evacuation	All 83 counties	Disaster
6/3/04	Thunderstorms, flooding	Arenac, Barry, Berrien, Cass, Genesee, Gladwin, Ingham, Ionia, Jackson, Kent, Livingston, Macomb, Mecosta, Newaygo, Oakland, Ottawa, Saginaw, St. Clair, St. Joseph, Sanilac, Shiawassee, Van Buren and Wayne Co.	Disaster

Governor's Declarations in Michigan: 1977-2020 (cont.)

Date of Incident	Type of Incident	Affected Area	Type of Declaration**
4/30/04	Insect infestation (Emerald Ash Borer)	Genesee, Ingham, Jackson, Lapeer, Livingston, Macomb, Monroe, Oakland, Washtenaw and Wayne Co.; Cities of Fraser, Sterling Heights, and Warren (Macomb Co.); Cities of Birmingham, Lathrup Village, and Southfield (Oakland Co.); City of Ann Arbor (Washtenaw Co.); Cities of Allen Park, Dearborn, Dearborn Heights, Detroit, Livonia, River Rouge, Romulus, Trenton, and Wayne (Wayne Co.); Bloomfield Township (Oakland Co.); Canton and Plymouth Townships (Wayne Co.)	Emergency
8/15/03	Power failure	Macomb, Monroe, Oakland, Washtenaw, and Wayne Co.	Emergency
5/15/03	Flooding	City of Marquette, Marquette Township, and Negaunee Township (Marquette Co.)	Emergency
5/10/02 4/30/02 4/16/02	Flooding	Baraga, Houghton, Iron, Marquette, and Ontonagon Co.; City of Ironwood (Gogebic Co.)	Disaster
12/29/01	Heavy snow	Emmet Co.	Emergency
10/26/01	Severe winds	Kalamazoo Co.	Disaster
3/9/01	Flooding	Genesee Co.	Disaster
9/20/00	Urban flooding	Wayne Co.	Disaster
6/7/00	Gasoline pipeline rupture	Blackman Twp. (Jackson Co.)	Emergency
8/5/99	Subsidence (mine shaft cave-in)	Dickinson Co.	Emergency
7/5/99	Tornado	Oscoda Co.	Disaster
1/15/99	Blizzard, snowstorm	City of Detroit (Wayne Co.)	Emergency
9/27/98	Severe winds	Otsego Co.	Emergency
9/1/98	Thunderstorms, severe winds	City of Niles (Berrien Co.)	Emergency
7/24/98 7/23/98	Thunderstorms, severe winds	Wayne Co.; City of Dearborn (Wayne Co.); City of Warren (Macomb Co.)	Disaster
6/5/98 6/4/98 6/3/98	Thunderstorms, severe winds	Bay, Clinton, Gratiot, Ionia, Kent, Mason, Mecosta, Montcalm, Muskegon, Newaygo, Oceana, Ottawa, Saginaw, and Shiawassee Co.; Village of Armada (Macomb Co.)	Disaster
4/1/98	Flooding	Alpena Co.	Emergency
7/6/97 7/3/97	Tornadoes, flooding	Genesee, Macomb, Oakland and Wayne Co.; City of Detroit (Wayne Co.); Village of Chesaning (Saginaw Co.)	Disaster
6/27/97	Rainstorms, flooding	Allegan and Ottawa Co.	Disaster
6/26/96 6/21/96	Rainstorms, flooding, tornado	Bay, Lapeer, Saginaw, Sanilac, St. Clair, and Tuscola Co.; City of Midland (Midland Co.)	Disaster
5/22/96	Flooding	Berrien Co.	Disaster
12/13/95	Snowstorm	City of Sault St. Marie (Chippewa Co.)	Emergency
7/8/94	Flooding	Lapeer, Tuscola and Sanilac Co.	Disaster
3/10/94 3/4/94 2/23/94, 2/25/94	Underground freeze	Charlevoix, Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	Emergency
4/20/93	Flash flood	Shiawassee Co.	Disaster
7/16/92	Heavy rain	Gogebic Co.	Disaster
7/14/92	Tornado	Cass Co.	Disaster
10/6/90	Tornado	Genesee Co.	Disaster
9/16/90	Ship explosion, fire	Bay Co.	Emergency
5/9/90	Wildfire	Crawford Co.	Emergency
6/8/89	Flooding, severe winds	Branch, Kalamazoo and St. Joseph Co.; Village of Manchester (Washtenaw Co.)	Disaster
6/9/88	Fire	City of Corunna (Shiawassee Co.)	Disaster
8/18/87	Airline crash	City of Romulus (Wayne Co.)	Disaster
10/28/86 9/15/86 9/12/86	Flooding, heavy rain	Allegan, Arenac, Bay, Clare, Clinton, Genesee, Gladwin, Gratiot, Huron, Ionia, Isabella, Kent, Lake, Lapeer, Macomb, Manistee, Mason, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa, Saginaw, Shiawassee, Tuscola, and Van Buren Co.	Disaster
2/21/86	Great Lakes flooding, wave action	Allegan, Arenac, Bay, Berrien, Grand Traverse, Iosco, Macomb, Marquette, Menominee, Monroe, Muskegon, Ottawa, Saginaw, St. Clair, Tuscola, Van Buren, and Wayne Co.	Disaster
9/13/85	Heavy rain, flash flood	Alcona Co.	Disaster
9/10/85	Heavy rain, flooding	Genesee, Lapeer, and Saginaw Co.	Disaster

Governor's Declarations in Michigan: 1977-2020 (cont.)

Date of Incident	Type of Incident	Affected Area	Type of Declaration**
4/13/85	Great Lakes flooding, wave action	Arenac, Bay, Macomb, Monroe, Saginaw, St. Clair, Tuscola, and Wayne Co.	Disaster
1/15/85	Ice storm	Allegan, Barry, Berrien, Calhoun, Eaton, Genesee, Ingham, Jackson, Kalamazoo, Lapeer, Livingston, Oakland, and Van Buren Co.	Disaster***
7/15/83	Wildfire	Schoolcraft Co.	Disaster
3/19/82	Flooding	Berrien and Monroe Co.	Disaster
7/21/80	Thunderstorms, severe winds	Allegan, Berrien, Calhoun, Cass, Jackson, St. Joseph, Van Buren, Washtenaw, and Wayne Co.; City of Grand Haven and Village of Spring Lake (Ottawa Co.)	Disaster
5/13/80	Tornado	Kalamazoo and Van Buren Co.	Disaster
8/9/78	Sewer main break	Macomb Co.	Disaster
6/30/78	Thunderstorms, severe winds, hail, rain	Berrien Co.	Disaster
6/28/78	Thunderstorms	Allegan Co.	Disaster
1/26/78	Blizzard, snowstorm	Statewide	Disaster
12/10/77	Snowstorm	City of Hamtramck (Wayne Co.)	Disaster
4/6/77	Tornado, severe winds	Clinton, Eaton, Kalamazoo, and Livingston Co.	Disaster
1/28/77	Blizzard	Allegan, Barry, Berrien, Cass, Chippewa, Eaton, Hillsdale, Ionia, Muskegon, Newaygo, Oceana, Ottawa, Sanilac, Shiawassee, and Van Buren Co.	Disaster
Totals for 1977-2020	**88 Incidents**		**52 Disaster Declarations; 36 Emergency Declarations**

Notes

*Some incidents have resulted in multiple declarations for the same incident (each jurisdiction declared separately). These are counted as one declaration only for the purposes of this list.

**Declarations since 1977 were issued under 1976 PA 390, as amended (Michigan Emergency Management Act).

***A "State of Emergency" was also declared for this incident under 1945 PA 302 (Emergency Powers of Governor Act).

Appendix 7: Locally Identified Hazard Vulnerabilities

Local Vulnerabilities as Determined from Local Plans/Documents

This section provides the most relevant information about specific vulnerabilities identified by local jurisdictions in their hazard mitigation plans or related documents. It may eventually provide a potential method for a preliminary prioritization of statewide risks, although is not yet recommended for this purpose because of differences between the standards for local plans and state purposes. For example, although this state plan includes all hazards, federal review standards only require natural hazards to be assessed. This causes plans to more heavily emphasize natural hazards. In addition, local agencies tend to give highest priority to the protection of human life, while federal hazard mitigation standards are most clearly defined when describing the mitigation of property damage. Nevertheless, this section provides an important source of information that was considered when assessing the extent of risks that are faced by Michigan communities, and that have more severe impacts within some areas and jurisdictions than they do in others.

Please refer to Chapter 4 for a description of the process used to analyze this information obtained from local plans and assessments. Please refer as well to Appendix 2, describing development pressures. Some of the descriptions of local development trends and pressures used in this "Local Vulnerabilities" section will only make full sense to those familiar with the phrases and standards used to identify areas of local development pressure. Appendix 13 provides detail about local hazard mitigation strategies as compiled from local hazard mitigation plans. These and other sections of the MHMP are meant to complement each other and supplement the many state and federal sources of information with additional local sources of information and input. In some cases, relevant aspects of both development trends and local vulnerabilities have been presented in the Michigan Hazard Analysis document that provides a factual assessment of hazards addressed by this plan.

In this current section of the MHMP, an overview and analysis (along with some tentative prioritizations, where warranted and feasible) is given for each of Michigan's counties for which relevant information about various hazards was available within local plans. As described in the "process" section, there were many counties for which information about hazard prioritization was not available in sufficient quality to support further analysis of that comparative type. Nevertheless, some attempts have been made in this section to evaluate and compare local vulnerabilities, despite the fact that the effective comparison of risks more properly requires an elaborate method by which different types of impacts and probabilities can be validly estimated and weighed against each other in conjunction with a consideration of mitigation capabilities and established program priorities on multiple levels of government (multiple local levels, state, and federal). To the extent that has indeed been achieved for natural hazards within Michigan, it can best be perceived in the NCEI hazard information, presented on a county and regional basis, that appears within the Michigan Hazard Analysis, and whose results have been partially described later in this chapter.

The bulk of the following text descriptions summarize local plan information that is more jurisdictionally specific than that which was included in the state-level hazard analysis subsections, although care has been taken to expand and refine the Michigan Hazard Analysis so that local emergency management jurisdictions are identified in the description of previous hazard events (i.e. searchable by county). All counties that were covered by plans have been considered in this section, in terms of their top hazards and any areas of significant development pressures, plus vulnerabilities as suggested by selected hazard mitigation project ideas from those local plans. The following information focuses upon local hazard aspects that weren't already covered in the state's hazard subsections. All counties are included in the list below, although there are still a few counties that have not completed a local hazard mitigation plan. (See also Chapter 4: the "Coordination with Local Hazard Mitigation Planning" section.) Although county and local references have already been included within the Michigan Hazard Analysis, this appendix renders more clearly some of the most significant and interesting information about local hazard priorities, vulnerabilities, mitigation project ideas, and development trends and pressures, as identified in Michigan's local plans themselves.

The information included here emphasizes (within the limits suggested by the sensitivity and confidentiality issues of some of the subjects, and within the limits of summarizing information from thousands of pages of local

planning documents in just a few selected pages of the state plan) some key locations, vulnerabilities, assessed risks, and potential losses that have been identified in local plans. Although it would still be premature on the basis of current information to try to definitively prioritize all jurisdictions with regard to each other, on each or all known hazards, federal planning requirements insist that a prioritization effort must be made. The information in this section can therefore be taken as representing important enough concerns from the local hazard mitigation plans that it indicates (county) jurisdictions within the state that are perceived at this time to have greater overall or specific vulnerabilities of the sort that could be appropriate for State assistance and attention to be warranted. With respect to State hazard mitigation goals and objectives, priority tends to be given to those project applicants whose applications have merits that outweigh other applications in terms of required FEMA criteria (passing a benefit-cost analysis review, other project feasibility, consideration for potential environmental impacts, possible effects on endangered species, unique cultural resources such as Native American Burial Grounds, etc.) Rather than prioritizing communities in general, the focus here and in Appendix 13 has been upon the selection of projects that are most likely to pass federal criteria for project application review standards. There are very few submitted applications that appear equivalent in merit to other submissions. Variations in the quality and quantity of documentation, the types and effectiveness of proposed mitigation actions, and the extent of alleviated damages, together tend to allow the prioritization of applications during those periods in which they are sought. This basis for prioritizing community grant applications is given a full description within Appendix 11 in this plan.

Overview of Significant Local Vulnerabilities, Conditions, and Proposals

As a step toward the federal goal that each state's plan describes and compares jurisdictions' vulnerabilities, as a potential basis for the prioritization of hazard mitigation projects, this appendix first presents the following information about the most heavily impacted counties from all of the natural hazards included within the NCEI online database (detailed information is included in the Michigan Hazard Analysis document, an attachment to this plan). Although no precise formula has yet been agreed upon for a further comparison and prioritization process, this starting point, combined with Appendix 13, identifies hazards that accounted for at least $5 million in damages according to NCEI records (counting each associated death as the equivalent of $2 million) and is presented here, with total value estimates rounded off, for each natural hazard type. It should be noted, however, that this information still comes from less than 30 years of data, and that nearby counties probably have similar risks which would emerge in a larger sample of events, taken from a longer historical time period (going back before 1996), but which could not be validly captured in the available statistics. Therefore, the following list provides an interesting set of indicators, but is then followed by local hazard priorities that suggest additional areas for prioritization, based upon local priorities, needs, desires, and capabilities. Any state prioritization cannot yet take into full account the dynamics and nuances of local political processes that may often cause differences in the results of locally prioritized hazard mitigation project selections. However, these are Michigan counties that have been prioritized by each natural hazard type, according to the impacts logged in the NCEI database (with each hazard listed in the same order that was used within the Michigan Hazard Analysis).

Hail: Kalamazoo ($130M), Marquette ($65M), Van Buren ($51M), Ogemaw ($33M), Oakland ($25M), Bay ($20M), Kent ($15M), Midland ($10M).
Lightning: Wayne ($1M, 3 deaths). Washtenaw ($2M, 2 deaths).
Tornadoes: Wayne ($91M), Monroe ($60M), Eaton ($51M, 1 death), Macomb ($31M), Ingham ($21M, 2 deaths), Genesee ($19M, 1 death), Washtenaw ($13M), Livingston ($10M), Oakland ($7M, 1 death), Dickinson ($7M), Saginaw ($7M), Cass ($6M), Kent ($6M), Allegan ($5M).
Severe Winds: Wayne ($100M, 8 deaths), Kent ($99M, 3 deaths), Ottawa ($63M, 4 deaths), Oakland ($65M, 2 deaths), Macomb ($62M), Muskegon ($50M, 1 death), Washtenaw ($45M, 1 death), Calhoun ($42M, 1 death), Genesee ($36M), Livingston ($32M), Saginaw ($32M), St. Clair ($32M), Montcalm ($25M), Leelanau ($24M), Lenawee ($23M), Monroe ($22M), Kalamazoo ($21M), Newaygo ($13M, 2 deaths), Bay ($13M, 1 death), Lapeer ($15M), Ingham ($15M), Eaton ($15M), Oceana ($15M), Clinton ($12M, 2 deaths), Van Buren ($12M, 1 death), Allegan ($14M), Huron ($11M, 1 death), Grand Traverse ($13M), Shiawassee ($12M), Barry ($12M), Isabella ($12M), Ionia ($12M), Gratiot ($11M), Jackson ($11M), Tuscola ($11M), Mecosta ($11M), Midland ($11M), Sanilac ($11M), Clare ($6M, 2 deaths), Marquette ($3M, 2 deaths), Mason ($7M), Lake ($7M), Osceola ($6M), Delta ($5M).
Extreme Heat: Oakland (5 deaths), Wayne (3 deaths).

Extreme Cold: Wayne (9 deaths), Benzie ($15M), Grand Traverse ($15M), Manistee ($10M), Antrim ($10M), Oakland ($1M, 4 deaths), Berrien ($8M), Charlevoix ($8M), Macomb ($1M, 3 deaths), Bay ($1M, 2 deaths), Emmet ($5M), Cheboygan ($5M), Presque Isle ($5M).
Ice/Sleet: Oakland ($107M, 2 deaths), Macomb ($57M), St. Clair ($12M), Wayne ($5M, 1 death), Washtenaw ($3M, 1 death), Ingham ($5M), Eaton ($5M), Livingston (5M), Barry ($5M), Monroe ($5M).
Snowstorm: Leelanau ($14M), Grand Traverse ($6M).
Flooding: Wayne ($1,124M), Oakland ($403M, 1 death), Macomb ($402M), Ottawa ($50M, 2 deaths), Allegan ($23M, 2 deaths), Gogebic ($24M), Kalamazoo ($18M), Marquette ($15M), Ingham ($12M), Lapeer ($11M), Newaygo ($11M), Mecosta ($11M), Monroe ($4M, 3 deaths), Ionia ($9M), Isabella ($9M), Osceola ($9M), Barry ($8M), Tuscola ($8M), Muskegon ($8M), Genesee ($8M), Mason ($8M), Berrien ($7M), Calhoun ($7M), Clinton ($7M), Eaton ($7M), Lake ($7M), Bay ($3M, 1 death), Van Buren ($5M), Kent ($5M), Jackson ($5M), Montcalm ($5M), Gratiot ($5M), Oceana ($5M), Clare ($5M).
Shoreline Hazards: Berrien (16 deaths), Marquette (5 deaths).
Drought: Wayne ($150M).
Wildfires: Luce ($12M), Marquette ($5M).

Individual county vulnerabilities, as expressed by them in their most recent local plans, are summarized below. Note: those counties that have updated their plan since the spring of 2014 have had some additional adjustments made in this descriptive text, which otherwise has mostly been retained from that provided in the 2014 edition of the MHMP (and therefore still reflects the most current plan that is on file).

ALCONA COUNTY – Their plan was last approved in October 2014. The wildfire hazard was still identified in their updated local plan as the most significant facing the county. The Alcona plan notes that between 1981 and 1999, 206 significant wildfires occurred in the county. The county contains part of the Huron National Forest, which has had over 2,700 fires between 1970 and 1996. Such a large part of the county is forested that a small number of specific areas of wildfire vulnerability would not be appropriate to identify. Wildfire is a hazard that has the potential to affect practically the entire county. The county's local plan has also pinpointed a few selected areas as vulnerable to shoreline and riverine flooding, but the amount of risk there is relatively limited. Potential mitigation strategies include establishing community wide hazard warning systems, repairing or replacing damaged or degraded infrastructure, purchasing power generators for critical infrastructure, construction of elevated or alternative roads, making roads more flood resistant, floodproofing structures within known flood areas, structural projects to increase drainage or absorption capacities, and requiring mobile home parks to establish shelters.

ALGER COUNTY – Their plan was updated in August 2015. Weather-related hazards were identified as posing the largest concerns, especially winter weather hazards such as snow, ice and sleet storms; extreme temperatures, and the infrastructure failures that can be associated in many cases with these hazards. This county receives an annual average snowfall of about 200 inches per year, which is also significant in its potential impact on major transportation routes for the Upper Peninsula (Highways 28, 67, 94, and US-41 pass through this county). In addition to winter weather conditions, the county identified wildfires, structural fires, lightning, and thunderstorms as additional as hazards. Flooding has been an issue, specifically the Au Train River in Au Train Township, which has flooded due to sand shoaling from northwest winds and ice dams. Several mitigation strategies have been identified, such as improving warning systems and hazard signage, installing safety rails at dangerous curves, purchasing generators for emergency power, dredging of portions of the Au Train River affected by sand shoaling, constructing snow fences at transportation routes, and reconstructing a break wall at the Grand Marais Harbor.

ALLEGAN COUNTY – Their plan was updated in March 2015. Allegan has significant flooding problems as well as severe weather risks of both the summer and winter variety. Severe weather hazards include tornadoes and severe winds, thunderstorms, severe cold, and droughts. The county is also faced with severe winter storms due to significant amounts of lake-effect snow from Lake Michigan. There are several jurisdictions within the county that face significant development pressures due to their growth. Allegan County has 7 dams that have significant downstream developments to protect. Infrastructure failure has also been identified as a hazard, and there is a significant risk of hazardous materials incidents, particularly along I-196 and US-31 and US-131. Mitigation strategies that have been identified include maintenance, strengthening, modification or removal of dams, enhancement of county-wide warning systems, elevation of existing roads or construction of alternative roads,

improvement of drainage for roads, purchasing backup power generators for critical facilities, hardening and rebuilding of the water plant and waste water treatment plant in the City of Allegan to raise them above 500-year floodplain elevation, removal of existing structures from flood-prone areas, the construction of flood walls, and the replacement of culverts. Within the county, a plan for the Pokagon Band of Potawatomi was FEMA-approved in July 2012.

ALPENA COUNTY – Their plan was updated in October 2014. The plan gives top priority to flooding and dam failure hazards. There are two dams with significant downstream developments that must remain protected. The county also experiences notable winter weather impacts. A specific location of flooding was identified at the Washington Bridge on U.S.-23 where it crosses the Thunder Bay River. Potential mitigation actions include the extension of sewer and water infrastructure in anticipation of the future expansion of the system into Alpena Township, the potential construction of a multi-jurisdictional sewer system, expansion of county-wide warning systems, repairs and replacements of critical infrastructure and facilities, and the purchase of generators to provide back-up power for community infrastructure during outages. Studies have been recommended to determine if the removal of old bridge waste and/or repairs to the bridge would improve the water flow of the Thunder Bay River at the George Washington Bridge on US-23.

ANTRIM COUNTY – Their plan was updated in November 2015. Weather events dominate the local planning concerns of the county, including drought, thunderstorms, wind, hail, and tornado problems, and snow and ice impacts causing damage over recent decades. Severe thunderstorms and high winds have a particularly strong potential for adverse impacts during the summer, when they could affect a higher seasonal population and associated area festivals. Specific locations of vulnerability include structures and roadways along Torch Lake, along US-31 through Elk Rapids, the Shanty Creek Resort area (with water and communication towers), and various shoreline erosion sites. Identified mitigation actions include the creation of storm shelters and safe rooms, specifically in the Village of Bellaire area, and the development of a multi-hazard warning plan. Examples of past mitigation projects include the replacement of a culvert with a bridge, installation of storm-water relief drains, acquisition of floodway properties, creation of retention basins, construction of a dike, expansion of the storm sewer network for a subdivision, removal of abandoned dams, construction of a mobile home park storm shelter, the installation of and upgrades to warning sirens, and the relocation of sewer mains. The county plan officially covers the Grand Traverse Reservation area, as well.

ARENAC COUNTY – In their May 2008 plan, thunderstorm and wildfire hazards were identified as particularly significant. Numerous damages were reported from past tornado, hail, and wind events. The county also considered itself to have significant development pressures, with a 15.6 percent population increase between 1990 and 2000 (Michigan grew by seven percent during that time), but only one specific community (Lincoln Township) was identified by the criteria in this state plan as being unusual in this regard, with a growth rate of 57 percent over that decade. The new census data for 2010 suggests that the growth pressures had dissipated a decade ago. Mitigation actions that have been identified include the installation of warning sirens, repair, replacement and hardening of critical infrastructure and facilities, acquiring back-up generators for critical facilities, construction of safe rooms and shelters, arson prevention activities (including reduction of blight), separation, expansion or rerouting of sewer systems, structural projects to channel away water from properties or to increase drainage and absorption capacities, acquisition of structures within the floodplain, and construction of elevated or alternative roads.

BARAGA COUNTY – This plan was updated and approved by FEMA in September 2013. The county's most significant hazards were identified as flooding (both riverine and shoreline), snowstorms, and subsidence. Millions of dollars of damages were caused by three floods between 1994 and 2003, and the county also contains high-risk shoreline erosion areas along Lake Superior. By comparison, impacts from subsidence were considered slight. The local hazard mitigation plan included specific mitigation strategies concerning flooding and erosion. These included the replacement of inadequate culverts along Park Road, Indian Road (by Gomache Creek), Beaufort Lake (by Spurr River), and eight other locations. Also noted was a project for the stabilization of banks along areas of the Sturgeon River to reduce ongoing erosion problems, and which would include the associated reconstruction of nearby Tahtinen and Myllya Roads. These extensive project needs should be assessed locally for their likelihood to meet FEMA-required benefit-cost review and other project funding criteria.

BARRY COUNTY – In their March 2006 plan, top concerns included winter weather and extreme temperatures. The county wished to expand its warning siren system and had also taken steps toward the coordination of hazard mitigation planning with local comprehensive planning (it has a county planning office that covers a substantial portion of the local land area). This state plan has identified two local jurisdictions with significant development pressures. The local plan also refers to addresses with repetitive flood losses, but a huge cost that makes an acquisition project unfeasible.

BAY COUNTY – In their March 2011 plan, the top hazards included flooding, winter storms, severe thunderstorms, drought, tornadoes, and wildfires. The county plan lists numerous repetitive-loss properties and describes 21 major flood events since 1947, resulting in more than $100 million in damages. Winter storm damages have resulted in nearly $40 million in damages since 1967.

BENZIE COUNTY – Their plan was updated in April 2015. Top hazards included flooding, erosion, wildfires, severe winter weather (including heavy snow, extreme temperatures, and ice damages), and high winds. The Platte, Betsie, and Herring River Basins are particularly prone to flooding, while the Lake Michigan coast is prone to erosion issues. The Lake Ann area and Sleeping Bear Dunes National Lakeshore are vulnerable to wildfires. The county experiences great seasonal population changes (up to 50 percent difference at one point in the year). The county plan officially covers the Grand Traverse Reservation area, as well.

BERRIEN COUNTY – This plan was updated and approved by FEMA in May 2013. The top county hazards include winter weather, extreme temperatures, tornadoes, and severe winds, and their plan has included infrastructure failures and nuclear power plant incidents as high priorities. From 1950 to 2004, 49 significant snow and ice events were documented. Annual average snowfall is 71 inches. About 5.7 severe wind events occur each year. Several disaster declarations have included a 1975 flooding and tornado event, a 1980 severe wind event, and thunderstorm/wind events. From 1950 to 2002, 27 tornado events were also reported, including 5 particularly notable events that caused 15 injuries, one death, and various property damages. The county proposed the use of generators for various critical facilities, the replacement of undersized culverts (at numerous specified locations), the relocation of the Berrien Springs Wastewater Treatment Plant, and the removal of 2 dams from along the Paw Paw River. Their plan also notes several proposed developments, including some that are in hazard-prone floodplain areas, and the County includes 9 communities identified in this state plan as being under significant development pressures. Within the county, a plan for the Pokagon Band of Potawatomi was FEMA-approved in July 2012.

BRANCH COUNTY – High winds, lightning, and winter weather were listed as the most significant hazards in their draft plan's hazard analysis. Mitigation actions proposed in the local plan include retrofitting and protective measures for critical facilities, and a drainage project. Many townships don't have zoning ordinances, although the Coldwater area has experienced significant growth so far during the 21st Century.

CALHOUN COUNTY – Their plan was updated in September 2017. Top hazards include earthquakes, flooding, hail, hazardous materials incidents, thunderstorms, severe winds, tornadoes, and severe winter weather. Fourteen flood events were reported between 1996 and March 2017, along with some flash flooding, with about $7 million in resulting damages. Severe weather events caused other injuries and millions of dollars in property damages. The county's growth rate has slowed, and then reversed in the 21st Century, potentially relieving some development pressures while creating a new form of development need within a couple of the faster-shrinking communities.

CASS COUNTY – The county's top hazards include thunderstorms, winter weather hazards, structural fires, transportation accidents, and extreme temperatures. A nuclear plant in neighboring Berrien County also requires coordination and planning activities to occur. The county contains two communities identified within this plan as experiencing significant development pressures. Their plan was previously updated in 2012, and the county has since updated it again. It has passed FEMA review and will receive approval soon (as of early 2019). Within the county, a plan for the Pokagon Band of Potawatomi was FEMA-approved in July 2012.

CHARLEVOIX COUNTY – Charlevoix County is covered by the Charlevoix, Cheboygan, and Emmet County Regional Hazard Mitigation Plan, which was updated in October 2016. For Charlevoix County, the plan identified flooding, extreme cold and wind chill events, hail, snow and ice, thunderstorms, and high winds (including concerns regarding utility outages) as the top hazards. Areas of particular concern are the area around the US-31 bridge in the City of Charlevoix regarding thunderstorms and high winds, the Boyne River and East Jordan area for flooding, the eastern portion of the county for potential wildfires and tornadoes, and wildfires in the rural areas of the county. Also, festivals frequently occur in seasonal population centers throughout the county. The county plan officially covers the Grand Traverse Reservation area, as well.

CHEBOYGAN COUNTY – Cheboygan County is covered by the Charlevoix, Cheboygan, and Emmet County Regional Hazard Mitigation Plan, which was updated in October 2016. Their top hazard is severe winter weather, including ice, sleet, and snowstorms. Additional hazards include fixed site and transportation-related hazardous materials incidents, extreme temperatures, and transportation accidents. It is normal for the county to experience several heavy snow or ice events per year.

CHIPPEWA COUNTY – Their plan was updated in November 2014. Their top hazards included severe winter weather and associated infrastructure failures. The plan refers to other local planning mechanisms and the intention to coordinate them with hazard mitigation considerations. Mitigation actions that include locational references involve river warning sensors, snow fences for roads, lightning protection devices, backflow prevention valves, a stormwater detention basin, culvert replacements, facility retrofitting, the acquisition of flood-prone properties, insulation of municipal water lines, and construction of safe rooms for critical facilities.

CLARE COUNTY – Their plan was updated in September 2016. The top hazards in Clare County included severe weather, flooding, earthquakes, wildfires, and subsidence. In addition to these hazards, hazardous materials incidents, dam failures, and transportation accidents are hazards in Surrey Township. Oil and gas well accidents and pipeline ruptures are additional hazards in Winterfield Township. Several injuries, plus hundreds of thousands of dollars in damages, have been caused by weather events in the county over the previous ten years. In 1977, 1400 acres were burned in a Summerville Township wildfire event. Clare also deals with substantial seasonal population increases (the 2010 census reported that 37 percent of their housing units were seasonal/recreational).

CLINTON COUNTY – Top hazards include flooding and ice/sleet storms (with associated power failures). Some coordination with other forms of planning has been evidenced, through a partnership with the Tri-County Regional Planning Commission, a consulting firm, and use of MSU expertise during their local plan's development and update processes. Their plan was updated in July 2015. Proposed mitigation actions include the identification and acquisition of vulnerable flood-prone properties, and the floodproofing of basements. County planning for land use and capital improvements will reportedly be directed to incorporate hazard mitigation strategies into their plan updates.

CRAWFORD COUNTY – Their plan was updated in November 2014. Top hazards include wildfires, hazardous materials fixed site and transportation incidents, severe winds, and infrastructure failures. In 1990, a wildfire burned 5,900 acres, including 76 homes and 125 other structures, with property losses of $5.5 million. Damages from wildfires between 1996 and March 2017 exceeded $1.5 million.

DELTA COUNTY – Their plan was updated in August 2015. Top hazards included hazardous materials transportation and fixed-site incidents, ice/sleet, snowstorms, severe winds, lightning and thunderstorms, and school and workplace violence. Four ice/sleet events were reported between 1996 and March 2017. Particular areas of concern include Ensign Township regarding wildland fires on the Stonington Peninsula, Ford River Township regarding ice jams on rivers, and Garden Township regarding flooding and ensuring that floodwaters are diverted into Lake Michigan.

DICKINSON COUNTY – Their plan was updated in July 2018. Top hazards included tornadoes, public health emergencies, hazardous materials transportation incidents, transportation accidents, and earthquakes, the latter being combined with the effects of subsidence related to underground mining. Between 1996 and April 2017, 8 tornadic events occurred, with property and crop damage exceeding $7 million.

EATON COUNTY – Their plan was updated in August 2015. Their top hazards include flooding and tornadoes. Proposed mitigation actions include dam replacements, the identification of repetitively damaged structures, acquisition or relocation of repetitive-loss properties, and expanded identification of urban flood-prone areas. Recommendations are in-place for hazard mitigation considerations to inform comprehensive planning process in the county (which has a county planning office). Their regional plan also includes Delta Township, which has its own distinct emergency management program.

EMMET COUNTY – Emmet County is covered by the Charlevoix, Cheboygan, and Emmet County Regional Hazard Mitigation Plan, which was updated in October 2016. Top hazards include fires (structural and wildfires), severe winter weather, severe thunderstorms, high winds and tornadoes, flooding (particularly in Harbor Springs, Boyer Creek, Tannery Creek, at the Alanson Locks and on the Bear and Maple Rivers), and shoreline and steep slope erosion (particularly on Lake Michigan and Little Traverse Bay).

GENESEE COUNTY – Their plan was updated in January 2015. Top county hazards involve inclement weather (both summer and winter), structure fires, riverine flooding, extreme temperatures, hazardous materials transportation incidents, and public health emergencies. The county appears to be prone to tornado occurrences and impacts, including its experience of the most destructive tornado in Michigan history (in 1953). Other wind, storm, and snow damages have also been very substantial, each going into millions of dollars of impacts. Redevelopment pressures exist in jurisdictions throughout the county, with many municipalities experiencing significant population growth or decline. For example, the City of Flint lost 18 percent of its population between 2000 and 2010 and had 21 percent of housing units vacant, according to the 2010 census. The county reports many identified repetitive-loss properties. A separate plan for the University of Michigan (Flint campus) was also completed in December 2012.

GLADWIN COUNTY – This plan was last updated in September 2016. Their top hazards were identified as severe winter weather, major population changes, severe summer weather, infrastructure failure, and riverine flooding. Dam failures, with 6 dams located upstream from developed parcels, were identified as a concern, particularly in Sherman Township. Severe weather is of concern in Clement Township, Gladwin Township, Hay Township, Secord Township, and Sherman Township. Infrastructure failures is an area of concern for Grout Township and Sage Township. The most significant hazards in Secord Township are structural fires and changes in its population. Although the Gladwin County plan expired in September 2021, concerns were greatly elevated by a dam failure disaster in 2020, and after some discussions about achieving compliance with the new HHPD program, FEMA provided a courtesy review of the existing plan on September 1, 2021, finding that one HHPD requirement had already been met but that three others would require additional work during the next plan update, to gain eligibility under that program. During 2022, a planning grant was lined up for the county, and discussions took place about having the updated plan comply with HHPD elements.

GOGEBIC COUNTY – This plan was updated in October 2013. Top hazards include extreme temperatures, wildfires, snowstorms, flooding, drought, and oil/gas accidents. A 1994 event with record cold temperatures caused frozen pipes that resulted in $2 million in estimated damages. An average of more than 3 wildfires occur each year as well as an average of nearly 7 significant snowstorm events. Some examples of the snowfall associated with these storms include 16 inches on January 18, 1996, 23 inches on January 9, 1997, and 10 inches on October 6, 2000. Eighty percent of the county encompasses the Ottawa National Forest, with residential and commercial developments along a corridor between Wakefield and Ironwood. Residential development also occurs alongside numerous lakes, including Lake Superior. The City of Wakefield had produced a flood mitigation plan of its own (now expired), which had required improvements with a floodgate at an identified Sunday Lake problem area. Other county mitigation actions include drainage improvements and underground pipe retrofitting. Provisions for incorporating hazard mitigation into upcoming comprehensive plan updates should be in place.

GRAND TRAVERSE COUNTY – Their plan was updated in July 2015. Hazards facing the county include severe storms, flooding, tornadoes, winter weather, high/straight line winds, wildfires, shoreline erosion, and ice damage. These hazards impact the entire county. Hazards threaten public infrastructure including culverts, dams, and bridges concentrated throughout the Broadman River communities (Blair, East Bay, Garfield, Paradise, and Union

Townships, and Traverse City). Forty-five high wind events between 1996 and April 2017 caused over $13 million in damages in the county. The county plan officially covers the Grand Traverse Reservation area, as well.

GRATIOT COUNTY – Their plan was updated in January 2012. Their top hazards included winter weather hazards, tornadoes, severe winds, major structural fires, thunderstorm hazards, and flooding. There is an average of 3.25 significant weather events each year in the counts, plus an annual average of 3.1 severe wind events. The county's primary goals are to minimize the harmful effects of severe weather hazards, improve the efficiency of all local emergency responders, and reduce the frequency of utility breakdowns. The county has incorporated hazard mitigation considerations into its master planning process.

HILLSDALE COUNTY – A plan was completed and then approved by FEMA in September 2012. Their top hazards included energy emergencies, snowstorms, ice storms, tornadoes, structural fires, wildfires, oil/gas well accidents, and public health emergencies. Local development trends focus new developments (of all kinds) around existing cities, villages, selected unincorporated settlements along major roadways, and around ponds and lakes.

HOUGHTON COUNTY – Their plan was updated in October 2013. The top hazards include subsidence from large and deep copper mines, infrastructure failure, terrorism, and structural fires. In April 2001, a 3-foot sinkhole appeared near the corner of Red Jackal Road and US-41 in Calumet. The mining inspector reports that numerous ground subsidence events occur each year. Less than half of the county's jurisdictions are zoned, but a consideration of hazard mitigation in future planning is encouraged in the local hazard mitigation plan. Mitigation actions include bank stabilization along Sturgeon River Road, sewer and storm drainage upgrades for 40 culverts (susceptible to flooding every 3 to 4 years), securing the Redridge Dam, promoting mine shaft safety, and updating their flood maps and stormwater management plans.

HURON COUNTY – Their plan was updated in August 2013. Top hazards include severe winter storms, thunderstorms, structural fires, transportation accidents, public health emergencies, and nuclear attack. Between 1950 and 2005, 11 notable tornado events occurred within the county, including an F3 event in 1984 that caused about $2.5 million in property damage. Thunderstorm and winter storm events have caused more than ten times as much damage during that same time period. New developments tend to occur near existing cities and villages, and along the coastline of Saginaw Bay and Lake Huron, where future condominium developments are anticipated. The incorporation of hazard mitigation considerations into other plans is noted in the county hazard mitigation plan. Mitigation actions include heating and cooling centers, generators for public facilities, expanded warning systems, and the burial of power lines.

INGHAM COUNTY – Their plan was updated in August 2015. Top hazards include flooding and tornadoes. In 1975, a severe flood event occurred that inundated 250 homes and businesses. In 2003 and 2007, damaging tornadoes occurred in the county, caused a death, and destroyed structures and vehicles. Mitigation actions include the updating of flood maps, relocation or acquisition of repeatedly flood-damaged structures, and encouragement of safe room construction. Within the county, Michigan State University has also developed its own hazard mitigation plan, approved in 2016, and achieved EMAP accreditation. The City of Lansing recently completed its own plan update in January 2019.

IONIA COUNTY – Although their unfinished draft plan did not rank hazards, their identified issues included flooding, winter weather, thunderstorms, and hail. The Grand River, other rivers, streams, and inland lakes have had floods associated with them. Electrical and phone services have been interrupted by summer storms and associated winds and hail. From 1950 to 2004, 172 significant weather events affected the county, resulting in 3 deaths, 17 injuries, and about $20 million in property damage. Mitigation actions include warning system improvements, strengthening infrastructure against power failures, acquiring portable generators, and removing the Lyons Dam.

IOSCO COUNTY – Their plan was updated in September 2016. Identified hazards include severe weather, geological threats, fires, flooding, drought, hazardous materials incidents, infrastructure problems, public health emergencies, transportation incidents, seasonal population shifts, civil unrest, and war. The shoreline area may be the most vulnerable part of the county, and has had greater interest from developers.

IRON COUNTY – This plan was updated and approved by FEMA in November 2013. Top hazards still include wildfires and dam failures. Between 1981 and 2000, 1,362 acres were burned in the county. There are areas of the county that contain no zoning, but a consideration of hazard mitigation is encouraged for future master planning activities. Mitigation actions include the promotion of mine-shaft safety, the retrofitting of underground pipes, and increased use of NOAA weather radios.

ISABELLA COUNTY – Their plan was updated in September 2016. Top hazards include severe weather (both summer and winter) and associated infrastructure failures. Areas of the county have notable development pressures, such as the city Mt. Pleasant and the area around Soaring Eagle Casino. Mitigation actions emphasize the improvement of warning systems. Local communities in the county are encouraged by its hazard mitigation plan to incorporate hazard mitigation into their comprehensive planning activities.

JACKSON COUNTY – A plan was completed and then approved by FEMA in December 2011. The top hazards in the county include energy emergencies, public health emergencies, ice storms, snowstorms, structural fires, and tornadoes. The final edition of the plan also identified civil disturbances as an additional high priority. Numerous snow events are documented in their local hazard analysis. Ice and sleet storms were accompanied in most cases by widespread power failures. Structural fires total about $4.4 million in damages per year within the county. Mitigation strategies include the use of back-up generators for critical facilities, the establishment of a community forestry program, and the bolstering of immunization programs for public health. Various communities have significant development pressures within the county (6 identified within this state plan).

KALAMAZOO COUNTY – This plan was updated and approved by FEMA in January 2013. Top hazards include severe weather of all types (winter and summer), with the documentation of dozens of major weather events between 1950 and 2003, resulting in millions of dollars of damages. The plan has flooding and tornadoes as additional high priorities. There are numerous areas of strong development pressures within the county (9 identified within this state plan), and the incorporation of hazard mitigation considerations into master planning has been promoted, with multiple local participants agreeing in principle to so in their plan updates.

KALKASKA COUNTY – Their plan was updated in December 2016. Top hazards include severe storms, flooding, tornadoes, winter weather and high/straight-line winds. Between 1996 and April 2017, four tornado incidents impacted Kalkaska County and caused over $1 million in property damage.

KENT COUNTY – This plan was updated and approved by FEMA in June 2017. Top hazards include winter weather, power failures, tornadoes, flooding, communication/cyber failure, and thunderstorms (hail and severe winds). About 100 events were noted in their hazard mitigation plan within these categories, resulting in millions of dollars of property damage and dozens of injuries and deaths (especially from a 1956 tornado event that destroyed 700 homes). Most of the county is under strong development pressure. A list of repetitive loss properties was included in the local hazard mitigation plan. Mitigation actions include the acquisition of flood-prone properties (especially in Plainfield Township, which had its own flood mitigation plan), measures to retrofit existing structures against flooding, an Ada Township acquisition project, improvements to the New York Creek Watershed drainage system, installing generators, and the expansion of warning systems (especially in Grand Rapids).

KEWEENAW COUNTY – This plan was updated and approved by FEMA in October 2013. Top hazards include winds, shoreline erosion, and snowstorms, along with associated power failures (2 per year on average), but the new edition of their plan has also identified infrastructure failures as a high priority. Several wind and snow events were documented in their local hazard mitigation plan, along with associated damages (thousands of dollars). Various high-risk shoreline erosion areas were identified in the plan (no associated flood problems were known). Mitigation projects include the stabilization of Gay-Lac-La Belle Road at 7 locations, a flood mitigation project at Eliza Lake, the upgrade of storm sewers and culverts, the promotion of mine-shaft safety, improving public notification with community warning systems, and NOAA weather radio use. Although this is the least populated county in the State of Michigan, notable residential growth trends were evident. These have since calmed, according to census data.

LAKE COUNTY – Their plan was updated in July 2015. Top hazards include winter weather, associated infrastructure failures, extreme temperatures, wildfires, and severe winds. Numerous damaging winter storms were documented during the 1990s, and an April 2003 ice storm event caused massive amounts of property damage and widespread loss of power. Documented wind events have been similarly damaging. Wildfires burned 769 acres between 1981 and 2000, with an average of 8 fires per year and 38.5 acres burned. In 1994, the "county line fire" burned 900 acres of land. The county had various areas of significant development pressures, with residential developments concentrating near the villages of Baldwin and Luther, and around various lakes in the county. The plan notes the presence of two repetitive-loss properties. Mitigation actions include the creation of firebreaks, use of generators, construction of concrete storm and tornado safe rooms, raising or relocating buildings above the base flood level, the acquisition of properties in floodplain areas, structural projects to channel water away from people and property or to improve drainage capabilities, the encouragement of hazard mitigation considerations in master planning, and the review of code requirements for mobile home wind resistance.

LAPEER COUNTY – Their plan was updated in May 2015. Top hazards include extreme temperatures, structural fires, snow, ice, hail, lightning, and winds. Many past events were documented in the county hazard mitigation plan, including millions of dollars of damages from various weather events. The county had patterns of significant growth and associated development pressures, including the appearance of 10 mobile home parks within several years. All participating local jurisdictions (27 of them) agreed to consider hazard mitigation concerns within their other planning activities. An estimated 615 structures were located within floodplains. Mitigation actions include the use of generators, enhanced warning systems, storm shelters, repairing critical infrastructure, repairing critical dams, culvert improvements, and NOAA weather radios. A restoration project of the Bell River in Imlay City was reportedly ongoing.

LEELANAU COUNTY – Their plan was updated in August 2015. Top hazards include severe weather of all kinds (winter and summer), Lake Michigan shoreline erosion, and localized flooding and dam failure risks. Numerous types of weather events over the last 15 years were documented in the county's plan. The southern half of the county's coastline is considered a high-risk erosion area. Mitigation actions focus on gathering more detailed information about flood and erosion risk areas, the use of warning systems, and snow-load design standards. The county plan officially covers the Grand Traverse Reservation area, as well.

LENAWEE COUNTY – A plan was completed and then approved by FEMA in June 2012. Top hazards included extreme temperatures, snowstorms, infrastructure failures, ice and sleet storms, lightning, and hail. Numerous weather events were documented in the county's hazard analysis. Hazard mitigation actions included the development of an outreach program for vulnerable populations during periods of extreme temperatures, increasing warning siren coverage, the installation of emergency generators, and the construction of concrete safe rooms. Significant development pressures exist in some areas of the county.

LIVINGSTON COUNTY – Their plan was updated in April 2017. Top hazards include severe winter weather, severe thunderstorms, and tornadoes, with numerous such events documented in the county's hazard mitigation plan. The county is one of the most rapidly growing in the state, with numerous areas of strong development pressures throughout it. The county is very proactive in promoting the inclusion of hazard mitigation considerations within master planning, having identified the potential for development to cause increased risks from flooding. Mitigation actions include the installation of public warning sirens in county communities, making major safety and operational improvements to the I-96/US-23 interchange in Brighton Township, purchasing generators, dam repairs or replacements, the removal of invasive weeds that contribute to the flooding of Ore Lake and the Huron River (in Green Oak and Hamburg Townships), and promoting the acquisition of many flood-prone properties in the lowlands surrounding a lake in Green Oak Township. MDOT also constructed the $32 million Latson Road Interchange which opened in 2013, retrofitting the transportation infrastructure there.

LUCE COUNTY – Their plan was updated in November 2014. Top hazards include wildfires, infrastructure failures, flooding, winter storms, and thunderstorms (hail, lightning, and severe winds). The county is mostly rural, forested land, with various locations of development (of different types) noted in the local hazard mitigation plan. Mitigation actions include infrastructure improvements (especially in the Village of Newberry), the installation of

natural ("living") snow fences, relocation of a lighthouse at risk from shoreline erosion, relocation of the Muskallonge Park Headquarters Building out of the critical shoreline area, construction of percolation ponds, construction of flood barriers such as levees, construction of safe houses around campgrounds and trailer courts, the purchase of generators, upgrading the culverts for the Sault Tribe of Chippewa Indians, and improving the county's warning systems. Encouragement is provided for the consideration of hazard mitigation topics within the county master plan. (The county has its own planning office.)

MACKINAC COUNTY – Their plan was updated in November 2014. Their main top hazard is severe summer weather, which includes thunderstorms, lightning, tornadoes, severe winds, and hail. The other top hazards include infrastructure failure, drought, flooding, severe winter weather, wildfires, and extreme temperatures. Numerous historic major weather incidents were documented in the county's hazard mitigation plan, with many thousands of dollars of associated damages. Identified mitigation actions include warning system enhancements, infrastructure reinforcement, snow fences, lightning protection, purchasing generators, construction of percolation ponds, construction of flood barriers such as levees, construction of safe houses around campgrounds and trailer courts, acquisition of flood-prone properties, additional communication towers for cell phone and internet service in Moran Township, the construction of an additional road crossing/bridge over the Manistique River in Portage Township, upgrading culverts for the Sault Tribe of Chippewa Indians, and an increased capacity for the water detention basin in the city of St. Ignace. The integration of hazard mitigation into local comprehensive planning is encouraged.

MACOMB COUNTY – This plan was successfully updated before the 5-year schedule established by federal regulations, in May 2015, and each update has usually been completed in advance of the plan's expiration date. Top hazards are identified as tornadoes, severe winds, winter weather (extreme cold and ice/sleet/snow storms), transportation hazardous materials incidents, and flooding. Numerous historic occurrences of all these weather events were documented in the county's local hazard mitigation plan, which places a great emphasis on flood mitigation. The county is under very strong development pressures, especially in its northern, less-developed half. Mitigation actions include the construction of safe rooms, the upgrade of pumping stations, installation of emergency warning sirens, installation of generators, and flood mitigation projects addressing dozens of at-risk structures (including repetitive-loss properties), with hundreds of other flood-prone properties identified within the plan. The City of Mount Clemens has a water treatment facility improvement project. Washington Township has an Emergency Operations Center project and was also re-engineering an existing sewer systems project. Encouragement of hazard mitigation considerations in comprehensive planning is given within the plan, and although most major projects still require supplementary grant funding in order to be accomplished, the county nevertheless did accomplish a few of its original hazard mitigation objectives and updated its lists of projects—in some cases with different priorities having been assigned by its participating local communities.

MANISTEE COUNTY – Their plan was updated in July 2015. Top hazards include wildfires, tornadoes, winter weather, dam failures, flooding, thunderstorms, and coastal erosion. Numerous historic events have been documented in the plan for each of these hazards (except dam failures). Mitigation actions include property acquisitions in flood-prone areas, the protection of sand dunes, and the incorporation of hazard mitigation into local comprehensive plans.

MARQUETTE COUNTY – Their plan was updated in August 2015. Top hazards include severe winter weather, public health emergencies, wildfires, infrastructure failures, extreme temperatures, violent weather events (hail and severe winds), rip currents, and flooding. Numerous historical hazard events were documented in the county's hazard mitigation plan. This county's local jurisdictions experience some development pressures, with a few areas seeing significant new development. Developments in the Chocolay and Carp River drainage basins are increasing the amount and rate of run-off, exacerbating problems for older developments downstream. Hazard mitigation considerations are recommended in local comprehensive planning activities. Flood damages were noted for 475 parcels, with 10 parcels experiencing multiple damages. Mitigation actions include storm sewer separation in the City of Ishpeming, drainage system developments in Forsythe Township, flood mitigation along the Chocolay and Carp Rivers in Chocolay Township, the elevation of homes along Compeau Creek in Marquette Township, removal of the carp intake dam in Sands Township, elevation of Bayou Road (along with some structures) in Chocolay Township, the elevation of structures in Republic Township, the replacement of old/failing water supply and delivery infrastructure with sustainable new infrastructure in the Cities of Ishpeming and Negaunee, protection of

the Hawley Street lift station from flooding in the City of Marquette, providing shoreline restoration and road relocation on Lakeshore Boulevard in the City of Marquette, raising the bridge over the East Branch Escanaba River on Southgate Drive in Forsythe Township, protection of the township transfer station on Depot Road from flooding in Forsythe Township, raising the Wolf Lake Road of the Escanaba River in Humboldt Township, installing more break-walls along the shore of Lake Michigamme to protect adjacent properties in Michigamme Township, raising of the Carp River Bridge on Heritage Drive in Negaunee Township, relocating structures in the flood zone near the Dead River Storage Basin, raising the level of River Road in Republic Township, improving the bridge over Ely Creek on County Road PCC in Tilden Township, and removing the Carp Intake Dam #158 in Sands Township. Originally developed to satisfy both FMAP and HMGP standards, the county's hazard mitigation plan includes a flood mitigation emphasis within it. Other mitigation actions include the addition of public notification system(s) for weather events, the installation of generators, and various culvert replacement projects throughout the county.

MASON COUNTY – Their plan was updated in August 2015. Top hazards include winter weather, extreme temperatures, severe winds, wildfires, and associated infrastructure failures. Numerous historic events have been documented in the county's hazard mitigation plan for these hazards, which also requests that hazard mitigation considerations be incorporated into local comprehensive plans. Other mitigation actions include increasing the use of NOAA radios, installation of back-up generators at critical facilities, construction of concrete storm/tornado safe rooms, relocation of buildings above the 100-year flood level, acquiring properties in flood areas for demolition and re-use of the land as open space, the use of "living" snow fences, and identifying structural projects to channel water away from people and property or to improving drainage capabilities.

MECOSTA COUNTY – Top hazards within their draft plan appeared to include flooding, snow, ice, severe winds, and tornadoes. Various documentation of past weather events appears in the county's hazard mitigation plan, and mitigation actions included the expansion of warning systems and emergency shelters.

MENOMINEE COUNTY – Their plan was updated in August 2015. Top hazards include severe winter weather (ice and sleet storms, snowstorms), infrastructure failures, thunderstorms (severe wind and lightning), transportation accidents, and extreme temperatures. Various weather events are documented in the county's hazard mitigation plan, which also identified 80 structures within Spalding Township as being at risk for potential flooding. High-risk shoreline erosion areas were also noted along the Green Bay shoreline. Various areas of development were noted in the plan but were not necessarily indicative of exceptional development pressures. Mitigation actions include the use of lightning protection devices, snow fences, construction of escape and entry routes in areas with high wildfire risk, NOAA radios and new warning systems, generators at critical facilities and shelters, and improved flood maps. The Village of Carney has concerns about poor visibility on certain roads. Meyer Township has a concern about a blind exit at CR388 and the condition of other side roads. Stephenson Township has concerns about poor road conditions. Spalding Township wants to install larger culverts and enhance ditch maintenance.

MIDLAND COUNTY – This plan was updated and approved by FEMA in January 2019. The county's top hazards include severe winds, winter weather, riverine flooding, dam failures, tornadoes, and public health emergencies. Numerous past events were noted in the county's hazard mitigation plan and an inundation map for dam failure was included that was a good indication of what actually occurred in the May 2020 flood disaster there. That map was used for quick reference during the initial response activities in the State Emergency Operations Center. Their plan's hazard mitigation actions include increased NFIP enrollment, expanded use of river gauges, the expansion of warning systems and weather radios, more use of "Firewise" strategies, and the encouragement of hazard mitigation within local comprehensive plans. In 2022, an inquiry was made with FEMA about evaluating the current plan for HHPD compliance.

MISSAUKEE COUNTY – Their plan was updated in July 2015. Top hazards include severe weather events (summer and winter), flooding, dam failures, and wildfires. The plan documented numerous past weather events, plus 14 wildfires that had burned more than 10 acres each. Most of the county is either forest or wetlands, and development pressures appear very limited. Mitigation actions include the consideration of new shelters, the

development of public warning systems, and the inclusion of hazard mitigation considerations within local comprehensive plans.

MONROE COUNTY – Their plan was updated in July 2017. Top hazards include severe weather (including winter events, hail, drought, and tornadoes), floods and flash flooding, hazardous materials incidents, aircraft accidents, Fermi II Nuclear Power Plant issues, and terrorism. The county's hazard analysis provided documentation of past weather events. The county contains numerous areas with strong development pressures. Mitigation actions include providing public early warning systems and networks; the construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas; flood mitigation measures and projects; storm sewer system mitigation measures and projects; back-up generators for critical facilities; the replacement or renovation of aging structures and equipment; and the acquisition, relocation, or condemnation of structures within floodplain or floodway areas. The Village of Dundee wants to acquire two light towers. The Village of Estral Beach wants to re-route a pipeline away from the canal in the dike system that surrounds the village. They also want to mitigate dike failures and retrofit alternative road access points. There is a seawall restoration project in Frenchtown Township. The City of Milan is constructing a truck route/business spur along US 23. The City of Monroe has a footing drain disconnection program, and is replacing all existing lead water service lines in the drinking water system. Monroe Township's central water system is being expanded and updated, and they are expanding their area's wastewater treatment plant. Raisinville Township is removing dams and improving the design of its current truck routes. Within the county, the City of Estral Beach has its own distinct hazard mitigation plan, which had been approved in June 2015.

MONTCALM COUNTY – According to a draft plan, the county's top hazards appear to include tornadoes and severe winds, winter storms, flooding, and extreme temperatures. The county hazard mitigation plan provided descriptions of numerous past events of these types, and described numerous township areas experiencing significant development pressures. Hazard mitigation actions include the enhancement of warning systems, use of NOAA radios and emergency power generators.

MONTMORENCY COUNTY – Their plan was updated in January 2015. Top hazards include severe winter weather and extreme temperatures. Various past events were described in the county hazard mitigation plan, along with associated damages. Mitigation actions include the consideration of hazards within comprehensive plans, the expansion of warning systems in the county, increased use of NOAA radios and backup generators, the placement of snow fences or planting of "living" snow fences, and the study of potential enhancements in sewer and drainage systems.

MUSKEGON COUNTY – Their plan was updated in October 2015. Top hazards include winter weather, severe winds, structural fires, infrastructure failures, and extreme temperatures. Numerous past events were documented in the county's hazard mitigation plan, totaling many millions of dollars of damage over recent decades, including disaster declarations. The existing county plan recommends "smart growth" to direct new developments, and reported that numerous parts of the county experienced strong development pressures. Mitigation actions include the consideration of hazard mitigation in comprehensive plans, assessing the capacity of current urban storm sewer systems, the use of backup generators at critical facilities, the construction or designation of storm/tornado shelters; the relocation of buildings or their elevation above the base flood level, the acquisition of properties in flood and high-risk erosion areas for demolition and re-use of the land as open space, and the use of snow fences along roadways.

NEWAYGO COUNTY – Their plan was updated in August 2015. Top hazards include flooding, dam failures, infrastructure failures, wildfire, thunderstorms, and tornado. Numerous past events of these types were documented in the county's hazard mitigation plan, along with two repetitive flood-loss properties. Mitigation actions include the incorporation of hazard mitigation considerations into comprehensive planning and zoning; increasing the use of NOAA radios, backup generators, the construction or designation of storm/tornado shelters, the relocation of buildings or their elevation above the base flood level, the acquisition of properties in flood and high-risk erosion areas for demolition and re-use of the land as open space, the identification of structural projects to channel water away from people and property (or to improve drainage capabilities), and the use of snow fences.

OAKLAND COUNTY – This plan was updated and approved by FEMA in September 2018. The top natural hazards include winter storms and blizzards, riverine flooding, urban flooding, strong winds, and hail. The top technological and human-related hazards include structural fires, highway transportation accidents, hazardous materials transportation and fixed facility incidents, and petroleum and natural gas pipeline accidents. Numerous past events were documented in the county's hazard mitigation plan, including a major pump station that experiences a harmful failure about once every 20 to 25 years (most recently in November 1998). Huge costs were associated with tornado events, including more than a dozen deaths, 78 injuries, and millions of dollars of property damage as a result of 30 events since 1950. This is the second most populated county in Michigan, and most of its communities experience significant development pressures. Land use changes have the potential to exacerbate flooding, and already there were several thousand structures identified as at-risk in floodplain locations within the county. Mitigation actions include the installation of new warning sirens, provide heating/cooling shelters for vulnerable populations, adding security cameras to schools, and generators for critical facilities and schools. Beverly Hills, Bingham Farms, and Birmingham have identified specific projects. Clawson is planning water and sewer line improvements. Hazel Park has two structures that should be removed. Holly Township has inadequate culverts. Keego Harbor has flood projects. Novi Township needs road repairs and replacement. In Oxford Township, an energy pipeline has required repairs at several locations. Rose Township has aging and inadequate culverts. West Bloomfield Township needs to widen Maple Road, and storm water management infrastructure improvements are needed. Commerce Township wants to widen Union Lake and Haggerty Roads to five lanes for improved public safety and emergency vehicle access. Holly Township wants to raise and improve sections of township roads that are susceptible to flooding, pave Falk and Rood Roads, and improve Grange Hall Road, Holly Road, and other roads. Milford Township wants to redesign culverts in areas of frequent flooding along the Huron River. Novi Township needs to repair roads. The City of Oak Park started construction of a new public safety and city hall building, and the city's community center is due for renovation. Rose Township wants to pave Rose Center Road and improve local/primary road intersections. The consideration of hazard mitigation issues is being incorporated into the municipal plan review process of some jurisdictions, as well as the county's Department of Planning and Economic Development Services. Within the county, an additional plan for Bloomfield Township was updated and approved by FEMA in September 2017. There was also a new plan created for the City of Royal Oak that was approved by FEMA in October 2018.

OCEANA COUNTY – Their plan was updated in April 2015. Top hazards include winter weather, extreme temperatures, severe winds, wildfires, and associated infrastructure failures. A great number of documented events and their associated damages were described in the county's hazard mitigation plan. Several local jurisdictions experienced significant development pressures, and the county's plan included three action items promoting the inclusion of hazard mitigation issues in local comprehensive plans and zoning ordinances. Other mitigation actions include the improvement of warning system coverage, the construction of concrete storm/tornado safe rooms in the community, structural projects to channel water away from people and property or to improve drainage capabilities, and the installation of back-up generators at critical facilities in the county.

OGEMAW COUNTY – Their plan was updated in July 2017. Top hazards include severe summer and winter weather, wildfires, infrastructure failures, hazardous materials transportation accidents, structural fire, oil/gas well accident, dam failures, and transportation accidents. Numerous summer and winter storm events were described in the county's hazard mitigation plan, and areas of development were also noted, with mitigation actions emphasizing improvements in warning systems, construction and use of shelters, safe rooms, and snow fences. Additional mitigation actions include the acquisition of generators, construction of emergency access roads to dams, construction of elevated or alternative roads that may be less affected by flooding, structural projects to help with drainage systems to reduce flooding, the acquisition, relocation, or condemnation of structures within a floodplain or floodway area, heating centers for vulnerable populations, as well as the protection of electrical infrastructure.

ONTONAGON COUNTY – This plan was updated and approved by FEMA in September 2013. Top hazards include infrastructure failures, hazardous material accidents, terrorism, and oil/gas accidents. About two power outages are experienced each year. Mitigation actions include a drainage study for the Village of Ontonagon, dredging of the Ontonagon Harbor, enhancement of mine-shaft safety, the construction of a new bridge on M-28,

the relocation of important village offices from the floodplain, community warning systems, purchasing generators, and upgrading storm sewers, problem roadways, drains, bridges and culverts.

OSCEOLA COUNTY – Their plan was updated in July 2016. Top hazards appear to include winter weather, tornadoes, fires, severe winds, and flooding. Numerous past weather incidents were documented within the plan, along with a map showing various structures within identified floodplain areas. An associated hazard analysis produced by the county's emergency management office identified thunderstorms, wildfires, winter weather, and tornadoes as the top natural hazards in the county. Mitigation actions include the consideration of hazard mitigation concepts within local comprehensive planning, the provision of firebreaks and improved vehicular access roads for wildfire response, the expansion of emergency warning systems, floodplain-related projects to reduce flooding, developing a water storage structure for a reserve during drought events, and the increased use of power generators and NOAA radios.

OSCODA COUNTY – Their plan was updated in August 2014. Top hazards include wildfires, severe winds, winter weather hazards, infrastructure failures, and tornadoes. Development patterns have caused increased vulnerability to wildfires, with a 60 percent increase in rural homes since 1980, and 144 documented wildfires between 1981 and 1999 that affected more than 200 acres each. Approximately 83 percent of the county's land is forested. Mitigation actions include the increased use of NOAA radios, emergency power generators, sheltering areas at campgrounds and other areas of outdoor congregation, heating centers for vulnerable populations, snow fences, improve critical road/steam crossings, and the encouragement of "Fire-wise" practices and program participation.

OTSEGO COUNTY – This plan was updated in August 2014. Top hazards include winter weather, extreme temperatures, wildfires, transportation accidents, and severe winds. Various past events of these types were described in the county's hazard mitigation plan. The county's population has tripled since 1960, and several communities were noted as experiencing significant development pressures, particularly around the City of Gaylord. There is also a substantial number of seasonal housing units that causes the county's population to swell during certain times of the year. Mitigation actions include the increased use of emergency power generators, warning systems, NOAA radios, heating centers and shelters for vulnerable populations, snow fences, and improvements in the design of water and sewer systems.

OTTAWA COUNTY – Their plan was updated and approved by FEMA in June 2017. Top hazards include severe winter weather, infrastructure failures (communication failure, cyber failure, and electrical failure), tornadoes, thunderstorms, and flooding (riverine and urban). The plan includes descriptions of numerous past events associated with these hazardous conditions. The county experiences an average of about 97 inches of snowfall per year (due in great measure to the "lake effect" from Lake Michigan). Tornado damages have been extensive, with 20 events between 1956 and 2004. The county, squeezed between three metropolitan areas (Grand Rapids, Muskegon, and Holland), experiences strong development pressures throughout many of its local jurisdictions. A substantial floodplain area has been identified in the county, and one community, Robinson Township, developed its own FEMA-approved flood mitigation plan and associated project funds to address several areas of its flood-prone structures near the Grand River. Mitigation actions include the acquisition of highly vulnerable flood-prone properties (dozens of vulnerable properties have been identified), the use of building and zoning regulations to limit and protect floodplain developments from harm, a culvert replacement project in the City of Zeeland (at 104th Avenue), a culvert replacement project in Chester Township (at Coolidge Street), a culvert replacement project in Park Township (at Ottawa Beach Road), replacement of a drainage structure and storm sewer in Ottawa County (at Leonard Road), replacement of drainage structures in Holland Township (at 104th Street), a culvert replacement project in Zeeland Township (at 64th Avenue), replacement of the drainage structure under South Shore Drive in the Kelly Lake Intercounty Drain, replacement of the drainage structure under Riley Street in the Number 37 County Drain, a culvert replacement project in Crockery Township (State Street), expansion of warning systems, increased use of portable generators, installation of a sewer system at Crockery Lake, installation of a public water and sewage system along two river roads on Van Lopik and Limberlost Lanes in Robinson Township, and the identification of infrastructure vulnerabilities. In the City of Holland, mitigation actions include relocation of the portion of the storm sewer that is currently located under buildings (north side of West 17th Street between Homestead and Diekema), improvement of the drainage crossing on Azalea at South Shore Drive, improving the

Holland Heights Drain (from approximately East 12th and Cambridge and running westerly to US-31), tying a portion of the Hope Avenue Storm Sewer into the Paw Paw Relief Drain, adding detention capacity in several locations from East 24th Street south to the M-40 Midway Drain, and extending and replacing a force main from the west end (Old Orchard to Myrtle) to alleviate wet-weather issues.

PRESQUE ISLE COUNTY – Their plan was updated in November 2014. Top hazards include severe winds, infrastructure failures, structural fires, winter weather hazards, transportation accidents, and hazardous materials transportation incidents. Various past wind events were identified in the county's hazard mitigation plan. Mitigation actions include improvements to the county's warning systems, the use of backup power generators and NOAA weather radio, the provision of heating centers and shelters, the use of snow fences, construction of safe rooms and storm shelters, and infrastructure enhancements (including water and sewer systems). Improvement projects were also reported at Rogers City County Airport.

ROSCOMMON COUNTY – Their plan was updated in September 2016. Top hazards include floods, tornadoes, severe weather (summer and winter), fires (wildfire and structural), and hazardous materials incidents. Many previous weather events were described in the county's hazard mitigation plan, along with the identification of one dam that has potentially vulnerable downstream development. Several townships in the county were reported as experiencing significant development pressures, with a large emphasis on tourist and resort attractions. The county contains 17 lakes that are more than 100 acres each and attract residential developments. Seasonal or recreational housing accounts for at least 50 percent of the housing units in the county. Mitigation actions include the use of emergency power generators, expansion of public warning systems, use of snow fences and lightning protection devices, establishment of heating centers and shelters, improvements in infrastructure, and dam repairs.

SAGINAW COUNTY – Their plan was updated in September 2017. Top hazards include severe weather (both summer and winter), tornadoes, structural fires, hazardous material transportation incidents, flooding, transportation accidents, and public health emergencies. Heavy detail is provided for the weather and flooding issues. Mitigation proposals include the acquisition of vulnerable parcels, elevation of structures vulnerable to flooding, floodproofing of structures, floodplain mapping, discouraging mobile home parks from occupying floodplain areas, and the consideration of larger-scale flood control measures. Improved warning systems, emergency generators, and aggressive tree trimming were also noted as desirable mitigation actions.

ST. CLAIR COUNTY – Their plan was updated in July 2015. Top hazards include hazardous materials incidents (of both the fixed-site and transportation types), infrastructure failures, winter storms, thunderstorms, pipelines, and terrorism, but the county's hazard mitigation plan also identifies many properties that have suffered repeated damages from flooding. Leaking underground storage tanks are also a problem throughout St Clair County. The plan includes an entire chapter that aims to integrate hazard mitigation into policy and regulatory frameworks. Much of the county's eastern coastline consists of planned communities, and most of the county's jurisdictions experience significant development pressures. Mitigation actions include the enhancement of storm-water management standards, the use of land use regulations and planning to protect floodplain and coastal zone areas, the acquisition or elevation of flood-prone properties, bridge improvement projects, increased culvert capacity, increased use of erosion control structures in the county, the use of backup power systems at critical facilities, storm drain improvements, warning system improvements, the replacement or renovation of aging structures and equipment, and the construction of storm shelters in selected locations. The St. Clair County International Airport (SCCIA) has developed a 10-year Capital Improvement Program that includes construction projects.

SANILAC COUNTY – Their plan dates from August 2007. Top hazards include wildfires, infrastructure failures, and terrorism. Wildfires are an annual occurrence in the county. Mitigation actions include the increased use of NOAA radios and warning systems. The local hazard mitigation plan identifies new residential development as concentrating around existing cities, villages, and the lakeshore. An update to this plan is currently being funded through a FEMA grant.

SCHOOLCRAFT COUNTY – Their plan was updated in August 2015. Top hazards include hazardous materials incidents (transportation), winter weather hazards (ice, sleet, and snowstorms), thunderstorms (severe winds and lightning), structural fires, and transportation accidents. The northern part of the county averages about 120 to 130

inches of snow per year, and the southern part averages about 60 to 70 inches per year. The southern part of the county includes the important transportation route of US-2, whose uses (along with nearby railroad tracks) include the transportation of hazardous materials. In the northern part of the county is Michigan highway 28, and another important railroad line that lies nearby. Two-thirds of the county's population lives within a mile of a trunk-line or railroad. Waterfront properties have experienced a trend in which natural areas are being converted into residential and cottage areas. Development along US-2 is expected to intensify, along with the conversion of seasonal homes along lakes and streams into year-round occupancy. A great many housing units are seasonal or recreational. Mitigation actions include the expansion of warning systems and NOAA radio use, installation of snow fences, improved use of shelters, increased use of generators, infrastructure enhancements, construction of elevated or alternative roads that are less affected by flooding (or making roads more flood resistant), and the consideration of hazard mitigation issues within comprehensive plans. Germfask Township needs road and bridge replacements or upgraded. The City of Manistique needs to develop a local bypass around the US-2 overpass and railroad at Tannery Road.

SHIAWASSEE COUNTY – Their plan was updated in September 2016. Top hazards include snowstorms, flooding, tornadoes, and severe weather (thunderstorms, hail, and lightning). The county's local hazard mitigation plan describes numerous snow, flood, and weather events that have affected the county. Major snowfall events have caused up to 15 inches of snow to fall on the county, and during warmer weather, the county experiences an average of 30 to 40 thunderstorms per year. Lightning events alone caused more than $100,000 in property damage during three events from 1998 to 2002 (plus one injury). Infrastructure failures also occur as a result of weather events. Past flood events have included up to 9 feet of basement flooding, backed-up sewers, closed streets (locations are specified within the local plan), and overwhelmed culverts and bridges. Mitigation actions include consideration of hazards within comprehensive plans, enhanced warning systems, the use of NOAA radios and warming stations, storm shelter provision, flood control, drainage improvements, and water storage enhancement. The county has initiated the removal of the Shia Dam. Owosso Township constructed a new Township/Fire Hall in 2016. Owosso Public Schools sought to construct of a new bus garage.

ST. JOSEPH COUNTY – No plan or draft plan for the county was on file with MSP/EMHSD, but based on input from the county emergency management coordinator, the top hazards for the county were (in order of priority) tornadoes, thunderstorm hazards, flooding, and winter weather (all about equal in priority), petroleum and natural gas pipeline accidents, and hazardous materials incidents (both fixed-site and transportation-related). The county's flood risk includes a concern with the impacts of dam failure. It was reported that at least two pipeline incidents had occurred within this decade.

TUSCOLA COUNTY – Their plan was updated in August 2016. Top hazards include severe winds, snowstorms, thunderstorms, hazardous material transportation accidents, ice/sleet storms, and extreme temperatures (cold). Past events of those types are described in the county's hazard mitigation plan. Mitigation actions include enhanced notification methods, the offering of incentives to businesses and residents to modify existing property for hazard resistance, the construction of retention ponds and flow constrictors, and flood prevention methods at specifically selected locations. The City of Vassar also has a flood mitigation plan on file (approved under older FMA program standards) and has accomplished many improvements over more than a ten-year period, to alleviate the city's flood impacts, such as removing the Vassar Dam and building two diversion pipes with back-flow prevention structures at their outlets in the Cass River at Vassar. Recent upgrades to sewer and water systems have occurred in the City of Caro, Village of Millington, and the Village of Akron. Denmark Township had also received USDA grants and loans to install a sanitary sewer system.

VAN BUREN COUNTY – Their plan was updated in March 2016. Top hazards include winter weather hazards, thunderstorms (wind and lightning), tornadoes, structural fires, hazardous materials (fixed site and transportation), and associated infrastructure failures. The county hazard mitigation plan includes descriptions of various such events that have occurred in the county, with associated damage estimates. Over 1,200 structures were identified as being within flood-prone areas. Some areas in the county have experienced significant development pressures. Mitigation actions to address these concerns include the consideration of hazard mitigation within comprehensive plans, increased use of generators and NOAA radios, construction of a shelter at the county fairgrounds, construction of storm shelters in mobile home parks where needed, installation of stormwater relief drains in the

City of Hartford, the replacement of undersized culverts, flood reduction measures, and the use of snow fences. Within the county, a plan for the Pokagon Band of Potawatomi was FEMA-approved in July 2012.

WASHTENAW COUNTY – Their plan dates from July 2005. Top hazards included severe weather such as severe winds, lightning, tornadoes, and hail. The plan includes descriptions of numerous significant weather events since 1980. Most of the county feels strong development pressures, and the county plan identifies various development trends. Mitigation actions include increases in warning sirens, generators, mobile home anchoring, shelters, warming centers, culvert replacement; dam, bridge, and spillway repairs; and the modification or acquisition of flood-prone structures. Within the county, a separate plan for the City of Ann Arbor was updated and approved by FEMA in November 2017, and a plan for Eastern Michigan University was developed and FEMA-approved in March 2013.

WAYNE COUNTY – Their plan was updated in July 2014. Top hazards include severe weather (lightning, severe winds, tornadoes), infrastructure failures (specifically water systems, electricity, and communications), urban flooding, hazardous materials incidents, and public health emergencies. The county plan documents numerous past events for each of these hazards. (There are also multi-hazard plans developed for some jurisdictions within Wayne County, notably the City of Detroit's update, in April 2015.) Wayne County is the most heavily populated county in Michigan, containing about 18 percent of the state's population, and has a great number of communities that are under strong development pressures. Tornado events have had powerfully destructive effects when they strike areas of such density, with damages running into the millions of dollars and injuries numbering in the dozens. Power failures can be particularly harmful to vulnerable residents in heavily urbanized areas of the county where heat effects tend to be exacerbated. Mitigation actions include the establishment of warming and cooling centers, increased use of back-up generators, development of a comprehensive flood mitigation plan and its associated (more specific) flood mitigation actions, use of backflow preventers, storm-water retention and best management practices, and emergency flood relief pumps.

WEXFORD COUNTY – Their plan was updated in August 2015. Top hazards include severe winter weather (heavy snow and extreme temperatures), wildfires, severe weather (thunderstorms, high winds, and tornadoes), and flooding. The county's hazard mitigation plan provides historical background that describes numerous events of these types that have negatively impacted the county. Snowfall events may involve up to 15 inches of snow that causes road blockage, accidents, and power failures. There is also a potential for ice damage, especially along lakeshores. Between 1987 and 2000, 15 wildfire events occurred that burned 10 acres or more, including one event that burned more than 50 acres. Strong winds are a frequent cause of power failures, and there is a high damage potential affecting the seasonal population influx and festivals held in various towns and villages throughout the county. Flood risks have been identified near Lake Cadillac, Lake Mitchell, Silver Creek, the Manistee River, and Fletcher Lake. Mitigation actions include the incorporation of hazard concerns into the county's master plan, expanded siren coverage, drainage improvements (including larger culverts), and the provision of storm shelters at campgrounds and trailer/modular home parks.

Appendix 8: Additional Assessment of Extreme Temperatures, Infrastructure, and State Facilities

Extreme Cold Temperatures for the State of Michigan: Risk / Probability of Occurrence

COUNTY	Population*	Relative Risk	Date of Record Cold Temperature	Record Cold Temperature °F	Number of Days Annually < 0° F**	Probability of Occurrence (%)
Alcona	10,942	MEDIUM	12/28/1977	-28	13.4	3.7
Alger	9,601	HIGH	7/7/1936	-33	20.7	5.7
Allegan	111,408	LOW	2/10/1912	-29	9.6	2.6
Alpena	29,598	HIGH	2/17/1979	-37	19.6	5.4
Antrim	23,580	HIGH	2/17/1979	-41	19	5.2
Arenac	15,899	MEDIUM	2/1/1994	-28	18.8	5.1
Baraga	8,860	HIGH	2/17/1979	-40	38.4	10.5
Barry	59,173	MEDIUM	1/4/1896	-40	11.7	3.2
Bay	107,771	LOW	1/19/1994	-18	6.7	1.8
Benzie	17,525	LOW	2/11/1889	-32	3.6	1.0
Berrien	156,813	LOW	1/12/1918	-21	4.7	1.3
Branch	45,248	MEDIUM	1/4/1981	-23	10	2.7
Calhoun	136,146	LOW	2/12/1899	-24	8.3	2.3
Cass	52,293	LOW	2/7/1978	-23	8.9	2.4
Charlevoix	25,949	MEDIUM	2/17/1979	-35	18.4	5.0
Cheboygan	26,152	HIGH	2/9/1934	-35	20.9	5.7
Chippewa	38,520	HIGH	2/8/1934	-37	31.7	8.7
Clare	30,926	HIGH	2/20/1929	-39	21.6	5.9
Clinton	75,382	LOW	2/2/1895	-42	9.4	2.6
Crawford	14,074	HIGH	2/17/1979	-42	30.6	8.4
Delta	37,069	HIGH	2/17/1979	-30	22.9	6.3
Dickinson	26,168	HIGH	2/3/1996	-45	37.7	10.3
Eaton	107,759	MEDIUM	2/10/1912	-31	13.5	3.7
Emmet	32,694	MEDIUM	2/9/1934	-35	10.7	2.9
Genesee	425,790	MEDIUM	2/14/1916	-28	10.5	2.9
Gladwin	25,692	MEDIUM	2/20/1929	-39	18.9	5.2
Gogebic	16,427	HIGH	1/17/1982	-41	44.3	12.1
Gd Traverse	86,986	MEDIUM	2/17/1979	-37	11	3.0
Gratiot	42,476	MEDIUM	2/5/1918	-29	10.1	2.8
Hillsdale	46,688	MEDIUM	2/11/1912	-25	12.6	3.4
Houghton	36,628	MEDIUM	2/4/1996	-28	18	4.9
Huron	33,118	LOW	1/30/1951	-23	9.4	2.6
Ingham	280,895	MEDIUM	1/4/1981	-29	13.1	3.6
Ionia	63,905	MEDIUM	1/15/1963	-25	10.4	2.8
Iosco	25,887	MEDIUM	4/7/1904	-34	16.3	4.5
Iron	11,817	HIGH	2/17/1979	-42	55.1	15.1
Isabella	70,311	LOW	2/5/1918	-30	9.9	2.7
Jackson	160,248	LOW	2/10/1912	-21	9.4	2.6
Kalamazoo	250,331	LOW	2/10/1912	-22	5.3	1.5
Kalkaska	17,153	HIGH	2/4/1996	-34	21	5.7
Kent	602,622	LOW	2/13/1899	-24	7.9	2.2
Keweenaw	2,156	MEDIUM	3/6/2003	-23	13.4	3.7
Lake	11,539	HIGH	2/11/1999	-49	21.3	5.8

Extreme Cold Temperatures for the State of Michigan: Risk / Probability of Occurrence – cont.

COUNTY	Population*	Relative Risk	Date of Record Cold Temperature	Record Cold Temperature °F	Number of Days Annually < 0° F**	Probability of Occurrence (%)
Lapeer	88,319	MEDIUM	1/11/1984	-26	11.5	3.1
Leelanau	21,708	LOW	2/17/1979	-24	8.5	2.3
Lenawee	99,892	MEDIUM	1/20/1992	-26	10.2	2.8
Livingston	180,967	MEDIUM	1/19/1994	-23	11.3	3.1
Luce	6,631	HIGH	2/7/1899	-32	24.5	6.7
Mackinac	11,113	MEDIUM	2/16/1987	-29	13.9	3.8
Macomb	840,978	LOW	2/10/1912	-24	3.6	1.0
Manistee	24,733	LOW	2/11/1899	-38	4.6	1.3
Marquette	67,077	HIGH	2/17/1979	-34	35.2	9.6
Mason	28,705	LOW	2/11/1899	-38	5.6	1.5
Mecosta	42,798	MEDIUM	2/11/1899	-36	15.7	4.3
Menominee	24,029	HIGH	2/3/1996	-45	36.3	9.9
Midland	83,629	LOW	1/19/1994	-19	7.6	2.1
Missaukee	14,849	HIGH	1/30/1951	-37	24.5	6.7
Monroe	152,021	LOW	2/5/1918	-21	5	1.4
Montcalm	63,342	MEDIUM	1/19/1994	-26	11.5	3.1
Montmorency	9,765	HIGH	2/9/1934	-46	25.2	6.9
Muskegon	172,188	LOW	2/11/1899	-30	4.1	1.1
Newaygo	48,460	MEDIUM	2/1/1918	-37	13.2	3.6
Oakland	1,202,362	LOW	2/5/1918	-22	6	1.6
Oceana	26,570	LOW	2/11/1899	-35	7.3	2.0
Ogemaw	21,699	HIGH	2/10/1912	-36	23.1	6.3
Ontonagon	6,780	HIGH	2/17/1979	-42	28	7.7
Osceola	23,528	HIGH	1/15/1963	-30	24.2	6.6
Oscoda	8,640	HIGH	2/1/1918	-47	24.8	6.8
Otsego	24,164	MEDIUM	2/9/1934	-51	19.7	5.4
Ottawa	263,801	LOW	2/22/1936	-18	2.3	0.6
Presque Isle	13,376	MEDIUM	2/18/1979	-37	15.4	4.2
Roscommon	24,449	HIGH	3/3/1943	-43	20.8	5.7
Saginaw	200,169	LOW	2/5/1918	-23	7.6	2.1
Sanilac	163,040	LOW	1/23/1949	-21	8.9	2.4
Schoolcraft	61,295	HIGH	1/20/1994	-23	25.4	7.0
Shiawassee	43,114	MEDIUM	2/23/1925	-31	11.6	3.2
St. Clair	8,485	LOW	2/4/1970	-33	5.3	1.5
St. Joseph	70,648	LOW	2/5/1918	-26	8.7	2.4
Tuscola	55,729	MEDIUM	2/9/1934	-30	12.8	3.5
Van Buren	76,258	LOW	2/11/1899	-22	2.6	0.7
Washtenaw	344,791	LOW	2/5/1918	-25	5.9	1.6
Wayne	1,820,584	LOW	2/20/1929	-24	2.3	0.6
Wexford	32,735	HIGH	1/30/1951	-43	22.9	6.3
AVERAGE:				**-31.6**	**15.7**	**4.2**

Notes: *2010 Census; **Days recorded from 1971-2001.

Extreme Hot Temperatures for the State of Michigan: Risk/Probability of Occurrence

COUNTY	Population*	Relative Risk	Date of Record Hot Temperature	Record Hot Temperature °F	Number of Days Annually > 90° F**	Probability of Occurrence (%)
Alcona	10,942	LOW	8/13/1918	107	3.8	1.0
Alger	9,601	LOW	7/7/1936	103	3.1	0.8
Allegan	111,408	HIGH	7/29/1916	106	9.6	2.6
Alpena	29,598	MEDIUM	7/13/1936	106	6.2	1.7
Antrim	23,580	MEDIUM	7/13/1936	103	6.3	1.7
Arenac	15,899	MEDIUM	6/20/1995	100	6.9	1.9
Baraga	8,860	LOW	6/27/1971	96	1.6	0.4
Barry	59,173	HIGH	7/14/1936	109	10.0	2.7
Bay	107,771	MEDIUM	6/20/1995	101	8.6	2.4
Benzie	17,525	LOW	8/19/1955	95	0.9	0.2
Berrien	156,813	HIGH	6/1/1934	104	11.9	3.3
Branch	45,248	MEDIUM	7/24/1934	108	8.5	2.3
Calhoun	136,146	HIGH	7/14/1936	104	9.2	2.5
Cass	52,293	HIGH	6/20/1953	103	12.7	3.5
Charlevoix	25,949	MEDIUM	8/18/1955	102	8.9	2.4
Cheboygan	26,152	LOW	8/6/1947	104	2.7	0.7
Chippewa	38,520	LOW	8/5/1947	98	1.3	0.4
Clare	30,926	HIGH	7/13/1936	105	10.9	3.0
Clinton	75,382	HIGH	8/6/1947	102	11.3	3.1
Crawford	14,074	MEDIUM	7/11/1936	104	6.6	1.8
Delta	37,069	LOW	8/21/1955	100	0.6	0.2
Dickinson	26,168	LOW	7/13/1936	104	1.9	0.5
Eaton	107,759	MEDIUM	7/14/1936	106	7.5	2.1
Emmet	32,694	LOW	8/21/1955	99	2.0	0.5
Genesee	425,790	MEDIUM	7/8/1936	108	7.3	2.0
Gladwin	25,692	HIGH	7/13/1936	105	10.9	3.0
Gogebic	16,427	LOW	7/13/1936	103	5.7	1.6
Gd Traverse	86,986	MEDIUM	7/7/1936	105	8.8	2.4
Gratiot	42,476	HIGH	7/14/1936	108	12.0	3.3
Hillsdale	46,688	MEDIUM	7/14/1936	107	7.4	2.0
Houghton	36,628	LOW	7/7/1988	102	2.3	0.6
Huron	33,118	MEDIUM	7/8/1936	103	7.0	1.9
Ingham	280,895	HIGH	7/6/1988	100	9.1	2.5
Ionia	63,905	HIGH	7/6/1988	103	12.8	3.5
Iosco	25,887	LOW	7/8/1936	106	4.3	1.2
Iron	11,817	LOW	6/30/1963	99	4.4	1.2
Isabella	70,311	MEDIUM	8/6/1918	108	8.8	2.4
Jackson	160,248	HIGH	7/14/1936	105	10.3	2.8
Kalamazoo	250,331	HIGH	7/13/1936	109	16.3	4.5
Kalkaska	17,153	LOW	7/15/1995	96	2.3	0.6
Kent	602,622	HIGH	6/20/1953	102	9.6	2.6
Keweenaw	2,156	LOW	7/7/1988	99	1.4	0.4
Lake	11,539	MEDIUM	7/13/1936	111	7.2	2.0

Extreme Hot Temperatures for the State of Michigan: Risk/Probability of Occurrence – cont.

COUNTY	Population*	Relative Risk	Date of Record Hot Temperature	Record Hot Temperature °F	Number of Days Annually > 90° F**	Probability of Occurrence (%)
Lapeer	88,319	MEDIUM	6/26/1988	100	8.8	2.4
Leelanau	21,708	MEDIUM	7/14/1995	102	7.2	2.0
Lenawee	99,892	HIGH	7/24/1934	108	11.7	3.2
Livingston	180,967	MEDIUM	7/24/1934	104	6.3	1.7
Luce	6,631	LOW	7/13/1936	103	1.2	0.3
Mackinac	11,113	LOW	8/4/1985	93	0.1	0.0
Macomb	840,978	MEDIUM	7/5/1911	106	8.6	2.4
Manistee	24,733	LOW	8/5/1947	100	3.3	0.9
Marquette	67,077	LOW	7/19/1977	104	3.8	1.0
Mason	28,705	LOW	8/2/1988	99	3.7	1.0
Mecosta	42,798	MEDIUM	7/30/1916	103	7.6	2.1
Menominee	24,029	LOW	7/26/1955	101	5.3	1.5
Midland	83,629	HIGH	7/5/1911	107	12.6	3.4
Missaukee	14,849	LOW	7/11/1936	106	4.1	1.1
Monroe	152,021	HIGH	6/26/1988	106	19.4	5.3
Montcalm	63,342	HIGH	7/13/1936	108	11.1	3.0
Montmorency	9,765	MEDIUM	7/13/1936	104	6.4	1.8
Muskegon	172,188	LOW	7/30/1913	99	2.1	0.6
Newaygo	48,460	MEDIUM	7/13/1936	111	5.2	1.4
Oakland	1,202,362	HIGH	7/5/1911	104	10.6	2.9
Oceana	26,570	LOW	7/4/1911	104	2.9	0.8
Ogemaw	21,699	MEDIUM	7/13/1936	107	6.5	1.8
Ontonagon	6,780	LOW	7/7/1988	101	4.5	1.2
Osceola	23,528	MEDIUM	8/21/1955	100	6.5	1.8
Oscoda	8,640	MEDIUM	7/13/1936	112	7.9	2.2
Otsego	24,164	LOW	7/1/2001	101	4.6	1.3
Ottawa	263,801	LOW	6/20/1953	100	1.9	0.5
Presque Isle	13,376	LOW	7/8/1988	100	4.2	1.1
Roscommon	24,449	LOW	6/19/1995	103	3.5	1.0
Saginaw	200,169	MEDIUM	7/13/1936	111	8.9	2.4
Sanilac	163,040	MEDIUM	7/15/1977	103	7.3	2.0
Schoolcraft	61,295	LOW	7/21/1934	107	.3	0.1
Shiawassee	43,114	MEDIUM	7/24/1934	105	8	2.2
St. Clair	8,485	HIGH	7/9/1936	103	10.2	2.8
St. Joseph	70,648	HIGH	9/18/1995	120	13.7	3.7
Tuscola	55,729	HIGH	7/13/1936	108	12.4	3.4
Van Buren	76,258	HIGH	7/5/1911	105	11.2	3.1
Washtenaw	344,791	HIGH	7/24/1934	107	9.7	2.7
Wayne	1,820,584	HIGH	7/20/1930	104	11.8	3.2
Wexford	32,735	LOW	7/13/1936	104	2.9	0.8
AVERAGE:				**103.9**	**7.0**	**1.91**

Notes: *2010 Census; **Days recorded from 1971-2001.

General Natural Hazard Vulnerability: Lifelines* (utility and transportation infrastructure)

LIFELINE	Component	Primary Ownership	Flood Vulnerability	Wind Vulnerability	Earthquake Vulnerability	Winter Storm Vulnerability (snow & ice)	Extreme Temperature Vulnerability (heat & cold)	Land Subsidence Vulnerability
Oil Products Systems:	Buried Pipelines	Private	•		•			•
	Above Ground Pipelines	Private	•		•			•
	Pumping Stations	Private	•		•			•
	Well Facilities	Private			•			
	Refineries	Private	•	•	•			
	Storage Tanks	Private	•	•	•			
Natural Gas Systems:	Buried Pipelines	Private	•		•			•
	Above Ground Pipelines	Private	•		•			•
	Compressor Stations	Private			•			•
	Well Facilities	Private			•			
	Liquid Natural Gas Storage	Private	•	•	•			•
Water Systems:	Buried Pipelines	Local	•		•		•	•
	Above Ground Pipelines	Local	•		•		•	•
	Pumping Stations	Local	•		•	•	•	•
	Treatment Plants	Local	•	•	•	•	•	•
	Storage Tanks	Local	•	•	•	•	•	•
Wastewater Systems:	Buried Pipelines	Local	•		•		•	•
	Above Ground Pipelines	Local	•		•		•	•
	Pumping Stations	Local	•		•	•	•	•
	Treatment Plants	Local	•	•	•	•	•	•
	Storage Basins	Local	•	•	•	•	•	•
Storm Drainage:	Buried Pipelines	Local	•		•		•	•
	Open Channels	Local	•		•	•	•	•
	Catch Basins / Outflows	Local	•		•	•		•
	Storage Basins	Private / Local	•		•	•	•	•
	Pump Stations	State / Local	•		•		•	•
Electric Power Systems:	Substations	Private / Local	•	•	•	•		•
	Transmission Towers / Poles	Private / Local	•	•	•	•		•
	Distribution Poles	Private / Local	•	•	•	•		•
	Buried Cables	Private / Local	•	•	•	•		•

General Natural Hazard Vulnerability: Lifelines* (utility and transportation infrastructure) – cont.

LIFELINE	Component	Primary Ownership	Flood Vulnerability	Wind Vulnerability	Earthquake Vulnerability	Winter Storm Vulnerability (snow & ice)	Extreme Temperature Vulnerability (heat & cold)	Land Subsidence Vulnerability
Telecommuni-cations:	Towers / Masts / Poles	Private	●	●	●	●		●
	Buried Cables	Private	●		●			●
	Underwater Cables	Private			●			
	Above Ground Cables	Private	●	●	●	●		●
	Switching Equipment	Private	●	●	●	●		●
Highways and Roads:	Bridges	Local / State	●		●	●		
	Embankments	Local / State	●		●	●		●
	Road Beds	Local / State	●		●	●	●	●
	Culverts	Local / State	●		●	●		●
	Tunnels	Local / State	●		●			●
	Signs / Signals	Local / State	●	●	●	●	●	●
Ports & Inland Waterways:	Breakwaters / Jetties	Local / State	●	●				
	Sea Walls	Local / State	●	●	●	●		
	Container Handling	Private	●	●		●		
	Cargo Movement Facilities	Private	●	●		●		
	Marine Oil Terminals	Private	●	●	●	●		
Railroads:	Bridges	Private	●		●	●		●
	Embankments	Private	●		●	●		●
	Rails / Ties / Ballast	Private / State	●		●	●	●	●
	Culverts	Private	●		●	●		●
	Signs / Signals	Private	●	●	●	●	●	●
Airports:	Terminal Buildings	Local	●	●	●	●		●
	Aircraft Hangars	Local / State / Private	●	●	●	●		●
	Runways / Taxiways	Local / State	●		●	●	●	●
	Lights / Signs / Signals	Local / State	●	●	●	●	●	●
	Access Roads / Parking Areas	Local / State	●		●	●	●	●

* Lifelines definition based on the American Lifelines Alliance 2003 and Michigan disaster events.

Most of this infrastructure is under private ownership or local control, and full details about every component and element are not available, but a general assessment of these systems' vulnerability to natural hazards can be estimated from actual events (detailed within the Michigan Hazard Analysis) and from a knowledge of these systems and their theoretical weaknesses. The first type of infrastructure involves pipes (either below or above ground) that could cause fuel or water supply breakdowns if they are sufficiently damaged or disrupted. Floods, freezes, and subsidence are the primary threats to these pipe delivery systems (although as noted within the pipeline chapter of the Michigan Hazard Analysis, pipelines still tend to be much more reliable and safe than alternative means of transport, such as trains or highway vehicles). In some cases, years of use simply causes a component to break, unless sufficient maintenance and repair operations are kept up with over time.

As described in each of these hazard chapters within the Michigan Hazard Analysis, earthquake vulnerabilities are primarily only expected in the southwestern areas of the state, during the most extreme seismic event that is estimated to be possible for Michigan (although any infrastructure that is sufficiently worn to the point of being ready to break down on its own may be considered to be vulnerable to potentially simultaneous breakdowns under Michigan's limited level of seismic risk). Deep-freeze events have mainly revealed vulnerabilities within water supply infrastructure (e.g. the deep freeze of 1994—see Disaster #1028 in Appendices 6 and 14), although regular hot/cold temperature cycles eventually take a toll upon highway infrastructure as well. The largest flood impacts involve storm drainage systems, which can be overwhelmed with the quantity of water that needs to be drained. Where combined sanitary and storm sewer systems exist, two different infrastructure functions are placed at risk, during heavy rain, snowmelt, and runoff events (as described in the new chapter on pluvial/urban flooding). Subsidence events have exposed pipes that then become vulnerable to freezing or further wear, especially during the long winters of Michigan's north, as was the case in Gaastra's emergency event of 2001. Most such events are local, and identified for hazard mitigation within local plans, but in the case of the 2016 subsidence event in Fraser (north of Detroit), the local initial collapse revealed the potential for a system breakdown that could have caused many thousands of persons to have sewage service disruptions.

Of greater concern is the potential for cascading effects, in which a loss of electrical power causes other forms of infrastructure to break down. Many critical facilities are already equipped with back-up power generators, but there is still a widespread need for additional generators, and the generators usually rely upon an ongoing supply of fuel. Without some sort of power supply, key pumps, lift stations, and facilities can stop working, which is an especially problematic cause of urban floods. The Michigan Department of Transportation had to deal with these issues in flood disaster #4195, in 2014. Pumps were in place to keep expressways well-drained, under ideal conditions, but under widespread flood conditions, many of these pumps became difficult to access, and eventually failed to clear their sections of expressway, further exacerbating the initial transportation and access problems. An estimated 1,000 personal vehicles were reportedly abandoned around the Detroit metropolitan area during that disaster, and resources had to be dedicated to rescuing drivers who were trapped in their stalled cars within rapidly flooding sections of below-grade expressway. The Great Blackout of 2003 showed how a power failure alone greatly slows vehicular traffic, as most traffic lights default to a "four-way stop" mode. Travel times were greatly increased for all vehicles attempting to navigate through roadways in which most traffic lights no longer had green phases or synchronized timing to improve traffic flows. Power failures are the most frequent form of hazard-caused infrastructure failure, and although most of them are recovered from fairly quickly as a result of utility company responses, there is still a potential for cascading effects involving multiple hazards and system failures, which could result in a mass casualty event. For example, a power failure in the midst of an extreme heat event could cause widespread medical trauma to result, unless residents can make use of available cooling centers or find similar substitutes until the temperatures have cooled or the power is restored. Severe winds are the most common and widespread cause of power failures, but ice storms are also an important source of impact during cooler seasons. Some power failures even result from vehicles crashing into power system components.

Floods, erosion, and lake conditions often disrupt transportation systems located nearby. Winds can blow snow, surf, and even sand across coastal roadways, making them less safe for vehicles. Floods have frequently covered roadways and eroded bridge support materials, causing road collapses and even the loss of lives. A secondary cause of road collapse is subsidence, either from a natural cause or from water leaks or broken pipes that remove the ground support from beneath the roadway. Road and bridge work has become a very high priority for the new gubernatorial administration. Less frequently used by ordinary citizens, but vital in their own ways (especially to business and industry) are Michigan's ports, railroads, and airport facilities. These transportation modes may be slowed or stalled by many natural hazards, ranging from fog, inclement weather, and geomagnetic storms. Hazardous lake conditions can inhibit ship-bound supplies (important for industrial supply-chains), snow or other weather can cause flight cancellations, and floods may affect the integrity of multiple transportation systems.

Every year usually sees dozens of power failures that are at least locally significant, although most of these are temporary. There are usually a few major interstate crashes involving dozens of vehicles or hazardous materials, and requiring the highway to close for recovery. A few water system breakdowns are usually of primarily local

significance each year. Many delays occur at airports, especially during winter, but also from the most severe summer storms. More details on all these impacts is provided within the Michigan Hazard Analysis.

Inventorying Assets: State Owned/Operated Critical Facilities

Several hundred state-owned/operated critical facilities have been identified by MSP/EMHSD and partnering state agencies. These facilities were identified using a federally provided definition of a critical facility as well as the results of a continuity of operations planning (COOP) effort undertaken by Michigan's state agencies. A list of state facilities was provided by the Michigan Department of Technology, Management, and Budget, in 2013, and was used as the basis for the list of critical facilities in this plan, including a careful comparison with the lists in previous editions of this plan, to verify that comparable standards were being used to assign or verify the criticality of new facilities. Some facilities (e.g. State Police posts) had closed down and were removed from the list, while a couple recently built facilities had been added to the list. Information about property values (or, when unavailable, an estimate of those values based upon the floor area of the facility, its type of use, and the standard values recently provided in RS Means, reflecting the disaster period being assessed) was included to enable the calculation of potential losses from each hazard. For this 2019 update, all risk information was updated to reflect the results of the updated hazard analysis (county risk information by hazard), and an inflation adjustment was made to the facility values information, based upon official information provided by RS Means.

*<u>**VERY IMPORTANT NOTE REGARDING SUPPRESSION OF DATA**</u>: All references to specific state owned or operated critical facilities have been **SUPPRESSED** in the federal review and public-distribution versions of this plan due to security concerns. For this 2019 edition, this has been limited just to facility-specific data within a single (12 page long) loss estimation table. Loss estimates for state facilities in general have not been suppressed. The detailed facility information is available for inspection only by appropriate personnel, based upon homeland security concerns. Although the State of Michigan has passed legislation that protects certain types of homeland security and planning information from release under the Freedom of Information Act, the same type of FOIA exemption is not in place at FEMA, and therefore FEMA has also been provided with a data-suppressed edition of this plan.

Facility vs. Function

When determining the criticality of state facilities, it is necessary to differentiate between the functions performed within the facility, and the facility itself. In most instances, the truly critical assets of a facility are the workers, equipment, and information within the facility, not the actual building or location. In other cases, the building itself is critical because the functions performed at the facility are necessarily intertwined with the structure. For example, there may be specialized equipment that cannot be moved or replaced, or the facility may be critical because of its location, or perhaps the unique engineering aspects of the facility cannot be easily replicated in another structure. A good example would be state correctional facilities, which typically are hardened structures with very specialized security features that are generally not found in other buildings.

Utility Infrastructure

This plan will only address those critical state-owned and operated infrastructures identified in the General Natural Hazard Vulnerability tables above. This generalized analysis for critical infrastructure, called "lifelines," is intended to show the types of infrastructures that are present in Michigan and to identify the major hazards to which the infrastructures are most vulnerable. It is based on general vulnerability assessments conducted by the American Lifelines Alliance, as well as damage assessment findings from recent Michigan's natural disasters. Locally owned and operated critical infrastructure is addressed as appropriate within local hazard mitigation plans. Privately owned and operated critical infrastructure is addressed in plans developed by the owner/operator of the infrastructure, or as part of a larger critical facility/infrastructure program under the umbrella of homeland security or the Michigan Public Service Commission.

Vulnerability of State Owned/Operated Critical Facilities

The identification of state owned/operated critical facilities that are vulnerable to various types of hazards is a key component of this plan. By identifying those facilities that are most vulnerable to hazards, cost-effective hazard mitigation measures can be developed and implemented to help permanently reduce or eliminate that vulnerability.

These measures will help ensure that the most critical assets of state government remain operational at all times—and especially in times of disaster or emergency—to provide for the continuation of emergency operations, continuity of government, critical public safety, health care, transportation and educational functions, and the provision of other essential services to the public.

General Facility Vulnerability to Natural Hazards

The vulnerability of a state owned or operated critical facility is a function of its location with respect to identified natural hazard areas, building specific information such as its design, construction type and material, the number of individuals typically present in the facility, and the types of functions performed at the facility. In Michigan, all state owned or operated critical facilities have a general exposure to wind, snow, ice, and temperature extremes. In addition, critical facilities located in floodplains and other low-lying areas have a vulnerability to flooding. Facilities located in some areas may also be vulnerable to land subsidence due to previous mining activities or other causes. Facilities located in extreme southwestern and southern Lower Michigan may be vulnerable to minor damage in the event of a strong earthquake in the New Madrid Seismic Zone. Critical infrastructures such as natural gas and petroleum pipelines that pass through this area may be damaged as well, creating possible fuel shortages within the state. Several state-owned or operated facilities could potentially be affected by a failure that partially or completely inundates the hydraulic vulnerability zone ("footprint") of a high or significant hazard dam as determined by EGLE. There were also a few state owned/operated facilities are located within a "high concern" wildland/urban interface area previously identified by the Michigan Department of Natural Resources (MDNR).

"Lifeline" Vulnerability to Natural Hazards

"Lifelines" (critical utility and transportation infrastructure) are essential to the health, safety, and general welfare of the residents of Michigan. (Note: the definition of "lifeline" can vary in different emergency management sources.) Some lifelines, such as highways, water supply pipelines, power transmission lines, and petroleum pipelines, are linear in nature with key nodes, such as pumping stations and compressor stations, located at specific locations. Other lifelines, such as bridges, water treatment plants, petroleum refineries, and storage tanks, are more location-specific. Linear lifelines, because of the distances they cover, may be exposed to a full range of natural hazards. Location-specific lifelines, on the other hand, will only be exposed to the natural hazards that are present at that particular location. Most lifelines are designed and built in such a manner (usually with hardened materials) that they can withstand a wide variety of natural forces. For example, buried pipelines and transmission lines have almost no vulnerability to wind damage because they are protected by the surrounding soil. (Underground installations, however, may be more vulnerable to earthquake or subsidence threats or accidental breakage during construction activities.) Most highways, bridges, and other public transportation facilities are able to withstand a wide variety of natural forces and still remain intact and operational.

As indicated earlier, this plan addressed those critical infrastructures (lifelines) that are owned and operated by the State of Michigan as identified in the "State Owned/Operated Critical Facilities" tables that follow. Critical infrastructure owned/operated by local governments or private entities will not be included in this plan and are clearly beyond the scope of this planning effort. However, the "General Natural Hazard Vulnerability: Lifelines" table does provide a listing of the general types of lifelines present in Michigan and identifies the major natural hazards to which the lifelines are most vulnerable. The information for that table was based on general vulnerability assessments conducted by the American Lifelines Alliance, as well as damage assessment findings from Michigan's natural disasters. In that table, each lifeline or lifeline component that potentially has a high level of vulnerability for a particular natural hazard is marked with a "•". This assessment is provided for general reference purposes, to highlight potential key vulnerabilities. An indication of potentially high vulnerability to a given hazard means that the lifeline or lifeline component may incur 1) significant physical damage, 2) a denial of use or loss of function, or 3) both physical damage and loss of function. For example, snow and ice may cause a temporary loss of function on a stretch of highway but rarely does a single event cause permanent physical damage. On the other hand, severe winds may cause both physical damage and a loss of function to overhead electrical transmission lines if they are blown down.

LOSS ESTIMATION TABLES FOR STATE CRITICAL FACILITIES

NOTE: Actual information about facility names, addresses, etc. are withheld from public versions of this document. They are only available for access to authorized persons.

General Methodology

In late 2013, the Michigan Department of Technology, Management, and Budget had provided its latest list of state facilities for analysis in this plan. These included state-owned facilities as well as leased facilities, thus constituting the best available list of state owned/operated facilities and infrastructure. This list is difficult to compile, maintain, and obtain and therefore does not routinely get updated with every update of this plan. Instead, the key data is usually obtained and processed about once per decade (like census data) and the analyses get adjusted for inflation during the "in-between" edition(s) of this plan. The data was fully analyzed within the previous edition of this plan (during early 2014) and this edition has substantially improved upon that analysis by including a consideration of freeze events, plus a fully detailed breakdown of estimated wildfire risks. This updated 2019 analysis process assessed the available information and found it questionable whether the previous edition's "smoothing" of data had truly added enough precision to replicate. Instead, the unadjusted factual data from NCEI (now amounting to more than 20 years' worth and thus a larger sample for estimating Michigan's risks), was adapted from spreadsheets compiled for the natural hazards in the 2019 Michigan Hazard Analysis. Although the Michigan Hazard Analysis had assessed information on crop damage and casualties in addition to property damage, the task of assessing state facility losses required a narrower focus upon property damages.

The calculated annual property damages for each county were compared with the assessed values for all property within each county (using the year 2013 which thus fell within the timeframe for damage values which had not been adjusted for inflation), and ratios were calculated so that documented property damage from each type of hazard was expressed in terms of a percentage of the assessed real properties within each county. Each respective county damage ratio was then multiplied by the value of each state facility within that county, to result in estimated annual damage figures for each type of natural hazard, for each facility. Totals were calculated by county, by hazard type, and overall. There were 537 facilities, but 6 were located outside of the state. The value of each facility was either already provided by MDTMB (for the list of state-owned facilities), or had been estimated for the list of state-leased facilities, by multiplying square-footage information by an RS Means value representing the type of facility use. The list of RS Means building types had been matched up with the closest corresponding state facilities' use classifications, as shown in the following table:

State Facility Use Classification	Selected RSMeans Building Type Classification
Hospital	Hospital, 2-3 story
Laboratory	College laboratory
Mechanic Shop	Garage, repair
Mixed Use	Store, Department, 2-story
Office Building	Office, 2-4 story
Retail	Store, retail
Training	College, classroom
Warehouse	Warehouse
(Parking, Other)	(No structures; not assessed)

The categories were selected so that the averages for each facility type would represent the average characteristics of each classification type, between the two sources. For example, the office building classification (the majority of state facilities), had an average of $359 per square foot applied. To adjust mid-2013 property information to current RS Means values, an official conversion factor was obtained (1.13) that would represent the estimated current value of these properties as of early 2019, while preserving the correct damage ratios that had been used in the risk assessment portion of this procedure. RS Means offered three estimation ranges—low, medium, and high, and the medium level was considered to be an appropriate estimate of facility replacement costs, on average.

Although not included in public versions of this document, the facilities list includes address, city, and county location information, which state department controls the facility, a classification and/or description of each facility's use, and its 2019-adjusted value. Columns were added to this spreadsheet to representing the newest results of NCEI property losses by county, for nine significant natural hazards. Cells of the spreadsheet were populated with formulas that took the annual expected damages from each significant natural hazard, in each county, and divided it by the total assessed property values within that county, to produce a ratio that represents the expected damages per unit-value of assessed property. The county property assessment information had been obtained from the Michigan Department of Treasury. The ratio of the county's average annual damages by hazard, compared with the total assessed property value in that county, resulted in a value for each county that represented the average damage from each hazard per property valuation. This factor thus provided the necessary link to estimate the expected losses to each state facility in Michigan's numerous counties. The derived ratio was in effect an average percentage of property values in each county that is annually lost to each hazard, and when applied as a factor to the full list of state facility property values, resulted in multiple columns of estimated annual losses to each facility, by hazard type. Note that the described risk-estimation factor does vary by county, according to each facility's county of location. A combined statewide estimate of damages from all significant natural hazards was also produced, from columns totals within the spreadsheet, as well as total expected annual losses for all state facilities. The following shows the results for nine important natural hazards:

General Findings

The results of the loss estimation procedure for all facilities are presented in the following list:

1.	State facility annual expected losses from flooding:	$1,227,270
2.	State facility annual expected losses from severe winds	$487,912
3.	State facility annual expected losses from tornadoes	$338,636
4.	State facility annual expected losses from hail	$214,561
5.	State facility annual expected losses from ice/sleet storms	$ 92,003
6.	State facility annual expected losses from snowstorms	$ 16,034
7.	State facility annual expected losses from wildfire	$ 15,323
8.	State facility annual expected losses from lightning	$ 4,934
9.	State facility annual expected losses from freeze events	$ 1,070

Total state facility annual expected losses from all significant natural hazards: $2,397,743. On their face, these values all seem plausible. In particular, although most of the estimated impacts from each hazard have increased significantly since 2014 (except lightning), the same rank order for each hazard resulted from both analyses. Therefore, even though some additional calibration is probably necessary before these estimates can be considered fully valid as site-level indicators, they do appear to be effective in illuminating which types of natural hazards are highest priority. Although state facilities are more heavily concentrated in some areas than others (e.g. the state Capitol), the distribution of state facilities nevertheless has a strong enough association with the overall state population and development patterns that the priorities for state facility risks have turned out to be similar to the general statewide hazard priorities as determined by the Michigan Hazard Analysis (summarized in Chapter 5). The estimate suggests that state facilities are in locations that make them less vulnerable to hail damage and freeze events, but otherwise the ranking of overall hazard impacts and facility loss estimates were similar.

An estimated 11 state facilities appeared to have some level of official flood risk, although only of these fell squarely within the floodplains, and based upon recent trends and data (which caused the additional of fluvial/urban flood chapter within the newest edition of the Michigan Hazard Analysis), this updated assessment of state facilities has used a less conservative estimate of flood risks in general, rather than limiting the analysis to official mapped floodplains. (For example, one of the previously leased locations no longer included in the state list was a Lansing facility that had experienced multiple flood damages from run-off and backup causes, even though not officially listed in a floodplain—a situation that is acknowledged by FEMA and the NFIP to be quite common.)

NOTE: Public versions of this document do not include pages 189-203. Michigan's critical facility information may be examined by authorized personnel only. so that it is not misused.

Appendix 9: Tracking Public Confidence

SPECIAL SECTION: Consequence Analysis – Impact on Public Confidence in State Governance

In late 2009 and early 2010, in order to meet additional planning requirements of the Emergency Management Accreditation Program (EMAP), contacts were made with representatives of the following agencies, who were considered to be potentially knowledgeable authorities on the subject of evaluating public confidence in governance:

Disaster Research Center (University of Delaware)
Institute for Public Policy and Social Research (Michigan State University)
National Opinion Research Center
Public Sector Consultants (Lansing, MI)
The Rand Corporation

Especially helpful was a discussion with Dr. Joe Trainor, of the Disaster Research Center. He reported that public confidence in government is rooted in the public's expectations of its government, and that this varies by community. (For example, more conservative political jurisdictions tend to have a greater sense of local independence, and correspondingly lessened expectations in State government.) There is an ongoing need to synchronize planning objectives with community expectations (especially in recovery operations, but also in response). This procedure typically involves the encouragement of consensus among stakeholders who disagree.

Since public expectations vary by community, information was sought concerning the variables that correlate with such expectations, and thus would also be expected to correlate with public confidence, and thus suggest something about how various hazards may affect such confidence. Andrew Morral, of the Rand Corporation, pointed out that negative impacts on public confidence in governance typically stem from gaps in response capabilities (as in the case of Hurricane Katrina).

Actual survey information is available for the State of Michigan, and its numerous regions. The Institute for Public Policy and Social Research, located at Michigan State University, conducts a "State of the State" survey (SOSS) four times per year. These scientific surveys include ongoing "tracking" questions that are asked regularly, as well as many specialized one-time questions designed to assess specific topics of current interest. Among the longitudinal questions (which can be assessed for change over time) are several that pertain to public confidence in government. The survey regularly asks separate questions about each level of government (local, state, and federal), and allows the responses to be analyzed for correlations and trends among 7 pre-defined survey regions as well as by the type of community that respondents live in (rural, small town, suburb, major city).

Longitudinal data was found for a 15-year period that included all SOSS surveys performed during the (full) years from 1994 to 2008. The overall survey has a reported margin of error of 3.1% (although error is larger for various individual cells within the tables used in this Plan Annex). Regional sampling data for each region were weighted to produce statewide figures. The various survey rounds each tended to cover a sample of between about 950 and 1450 Michigan adults. Additional information about the SOSS can be found at http://www.ippsr.msu.edu/SOSS. **The interpretations, analysis, and conclusions drawn from this survey data in this planning annex are solely those of MSP/EMHSD staff, and do not necessarily represent the ideas, views, or conclusions of Michigan State University or of IPPSR or its staff.** For the 2014 update of the MHMP, it was noticed that the same resources that had been accessed in 2010 were no longer readily available online. These would have been useful to simply replace previous tables and extend graph lines in this section of the MHMP, but instead, new information was able to be obtained in a matter that is described with new text and separate tables. Most of this new information supplements that which was obtained three years earlier, rather than replaces it. It is useful to compare trends in this kind of opinion data by viewing the most recent information in comparison with that from previous years.

In general, the public has more trust in government at the local and state level, and less trust in the federal level of government. The latest SOSS data (2012) on key questions regarding emergency management and trust in public governance reports that about 32% of Michigan respondents expressed the sentiment that the federal government can be trusted "seldom" or "almost never." Only about 22% expressed such an attitude about State government, and 19% about local governments. The survey used separate questions that distinguished between general trust in government and the respondents' assessment of specific public figures, such as the president and governor.

In 2010 longitudinal data, it was found that trust in state government was significantly lower in Detroit, where 31% expressed mistrust, compared to only 19% statewide at that time. The table on the next page shows the results obtained from the survey item which asked respondents, "How much of the time do you think you can trust the state government in Lansing to do what is right – nearly always or most of the time, some of the time, seldom, or almost never." Responses are presented in each row of the table, with separate columns (labeled along the top) that show how the answers varied across each of the seven survey regions of the state.

In addition to the lower trust expressed in the City of Detroit, the other statistically significant pattern found in the 2010 longitudinal table pertains to two other broad areas of the state: (1) the Upper Peninsula, and (2) the areas of the central and southern Lower Peninsula that are outside of the Metro-Detroit Regions. These areas were slightly more likely (a difference of only a few percentage points) to express a high level of trust in state government. Please note that this area does not include the northern Lower Peninsula region, which for survey purposes was considered to be composed of the 20 counties that are east and northeast of (but not including) Manistee County.

The SOSS analysis tables reprinted here are color-coded so that the most significant cell values are given darker shadings, and denote statistically significant correlations (either positive or negative). The standard used here for statistical significance is a Z-statistic that is greater than 2.0, which means that there is just over a 95% chance that the value in question does indeed vary significantly from the population as a whole (i.e. that it is "statistically significant"), rather than effectively being considered as approximately the same.

For readers who are not well-versed in statistical theory, it should be noted that statistical significance expresses a degree of reliability in measured survey data but not necessarily the strength, magnitude, or importance of the observed relationship. In other words, a high z score shows the extent of our confidence in the measurement, but the measurement itself may show only a very small demonstrated relationship between two variables. (For example, although we can state with certainty that a 1% income tax will lower a person's net income when it's deducted from a paycheck, this demonstrated relationship between that level of taxation and income may be small enough that many people might consider it to be of little concern, while for others it may be of enormous concern. Statistical significance means an estimate of the certainty that a relationship exists between measured variables, not the extent or importance of any such relationship, which is measured according to the extent of change seen in one variable as a result of some change in another.)

In addition, new information for 2012 has been found and included in the table on this page.

2012 SOSS Information about trust in different levels of government			
Trust in:	Federal government	State government	Local government
Nearly all/most of the time	19.5%	25.3%	39.5%
Some of the time	48.1%	52.4%	41.6%
Seldom	21.8%	15.5%	11.6%
Never	10.6%	6.8%	7.3%

How Often Trust State Government - Frequency Distribution, 1994-2008 Longitudinal Data File								
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)							
	1 Upper Peninsula	2 Northern Lower Peninsula	3 West Central L.P.	4 East Central L.P.	5 Southwest L.P.	6 Southeast L.P. (- Detroit)	7 Detroit	***ROW TOTAL***
1: NEARLY ALL OR MOST OF THE TIME	**32.5** 2.20 160	**27.2** -.58 207	**31.9** 4.09 652	**32.2** 3.39 403	**31.3** 3.39 634	**26.8** -3.15 1,782	**19.1** -7.73 258	***28.1*** --- *4,095*
2: SOME OF THE TIME	**49.1** -1.58 242	**50.7** -1.08 387	**51.7** -.86 1,058	**52.6** -.02 657	**51.9** -.70 1,053	**54.2** 3.40 3,596	**49.9** -2.13 673	***52.6*** --- *7,665*
3: SELDOM	**13.2** -.05 65	**15.6** 1.97 119	**11.4** -2.64 233	**10.8** -2.69 134	**11.6** -2.40 235	**13.2** .03 880	**19.5** 7.09 263	***13.2*** --- *1,928*
4: NEVER	**5.2** -.77 26	**6.5** .56 50	**5.0** -2.16 101	**4.4** -2.53 55	**5.3** -1.51 107	**5.8** -1.23 382	**11.6** 8.99 156	***6.0*** --- *876*
COL TOTAL	***100.0*** --- *492*	***100.0*** --- *763*	***100.0*** --- *2,045*	***100.0*** --- *1,248*	***100.0*** --- *2,029*	***100.0*** --- *6,639*	***100.0*** --- *1,349*	***100.0*** --- *14,565*
Means	1.91	2.01	1.89	1.87	1.91	1.98	2.24	1.97
Std Devs	.81	.83	.79	.77	.79	.79	.89	.81
Unweighted N	898	1,263	2,971	2,193	2,325	2,752	2,136	14,538

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

Expressed trust in state government was also analyzed with respect to the type of community in which respondents lived. The results of this analysis, for 2010 longitudinal data, appear in the table on the following page. Although higher levels of distrust were expressed within urban areas, collectively, this is actually explained by the inclusion of the City of Detroit within the "Urban Community" category, for when the data are further broken down while controlling for community type, respondents in urban communities in all other regions outside of Detroit expressed below-average levels of distrust. Since 41% of all "Urban Community" respondents were from Detroit, the greater proportion of dissatisfaction among Detroit responses pulled down the numbers for urban residents as a category. It should be kept in mind, however, that far fewer than half of all respondents, in any combination of these categories, stated that they seldom or almost never trusted state government. The analysis merely identifies varying proportions of distrust between state regions.

These types of analytic breakdowns of the level of trust by community and region were not conveniently available for use when this data was updated in 2014. When the EMAP re-accreditation process is underway, this information source will be used again to update this information with the best available data. Later inquiry with IPPSR may be needed to provide additional detail to update of this analysis, but some of these specific issues are already a bit abstracted from the main question of how emergency management or disasters might affect public confidence in governance. The attempt to establish some plausible reason to account for trends in trust or mistrust (the closest survey information available to express "confidence") will be addressed in subsequent pages in this section.

How Often Trust State Government - Frequency Distribution, 1994-2008 Longitudinal Data File						
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)					
	1 RURAL COMMUNITY	2 SMALL CITY OR TOWN, VILLAGE	3 A SUBURB	4 URBAN COMMUNITY	7 OTHER	***ROW TOTAL***
1: NEARLY ALL OR MOST OF THE TIME	**28.8** 2.04 953	**28.4** 1.60 1,193	**26.3** -1.64 807	**25.7** -1.89 471	**17.6** -2.65 25	***27.5*** --- *3,449*
2: SOME OF THE TIME	**52.5** -.47 1,736	**50.5** -3.80 2,121	**57.6** 6.08 1,766	**50.6** -2.06 929	**57.3** 1.08 83	***52.8*** --- *6,634*
3: SELDOM	**13.7** .31 454	**14.1** 1.20 592	**11.7** -3.38 360	**14.7** 1.55 270	**18.9** 1.89 27	***13.6*** --- *1,702*
4: NEVER	**4.9** -3.26 164	**7.1** 3.22 298	**4.3** -4.79 132	**9.0** 5.59 165	**6.1** -.01 9	***6.1*** --- *768*
COL TOTAL	***100.0*** --- *3,306*	***100.0*** --- *4,203*	***100.0*** --- *3,065*	***100.0*** --- *1,834*	***100.0*** --- *144*	***100.0*** --- *12,553*
Means	1.95	2.00	1.94	2.07	2.13	1.98
Std Devs	.79	.84	.74	.87	.77	.81
Unweighted N	3,703	4,300	2,191	2,168	140	12,502

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

What might be some reasons for distrust in government, where it exists? Perhaps some clues can be found in the survey questions that ask respondents about the "most important problem" facing their local community, the most important problem for the State governor and legislature, and the "overall quality of life" in their community. As the table on the following page shows, Detroit also stands out as being more frequently assessed as having "fair" or "poor" overall quality of life. The only other areas with (statistically significant) critical or ambivalent opinions on this topic were small cities/towns in the nearby Metro area (who had a slightly higher proportion, 7%, responding "poor"), and suburban respondents in the East Lower Peninsula region (who had a relatively high percentage, 42%, responding "fair"). Please note that these types of more detailed multivariate analysis have not been included in this document, which only includes a few of the most relevant two-variable cross tables obtained from this information source in 2010 (supplemented where possible with readily available 2012 survey information).

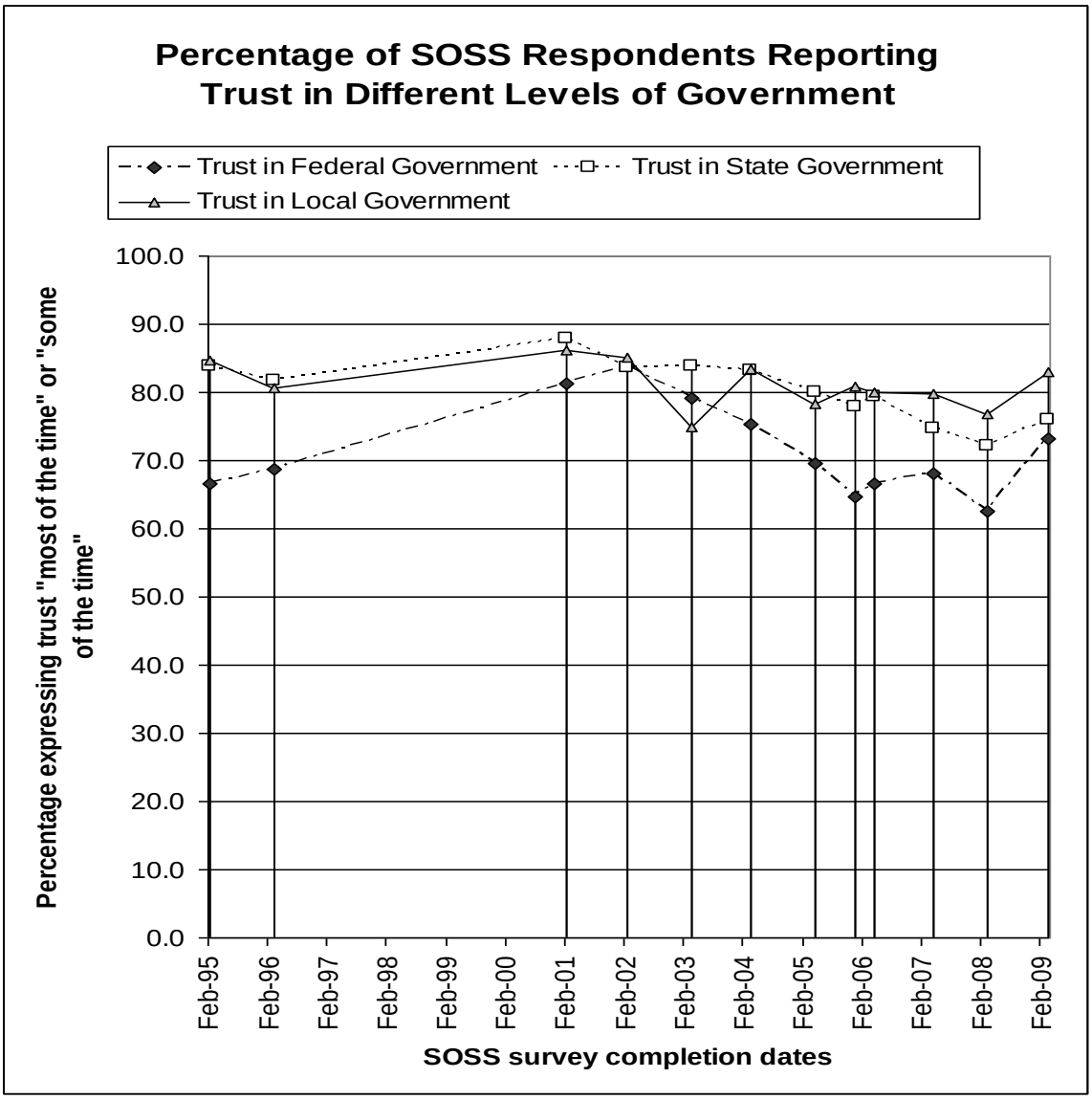
NOTE: 2012 survey results for the quality of life question were readily available for the total column only (in the far-right side of the following table) and were found to be unchanged from the 2010 longitudinal results.

Overall Quality of Life In Community - Frequency Distribution, 1994-2008 Longitudinal Data File								
Cells contain: -Column percent -Z-statistic -N of cases	Source: MSU IPPSR SOSS (online data analysis run Feb. 2010)							
	1 Upper Peninsula	2 Northern Lower Peninsula	3 West Central L.P.	4 East Central L.P.	5 Southwest L.P.	6 Southeast L.P. (-Detroit)	7 Detroit	***ROW TOTAL***
1: EXCELLENT	**17.8** -.06 30	**22.1** 1.76 56	**19.5** 1.13 133	**19.8** 1.05 84	**13.0** -3.60 89	**20.6** 4.40 461	**6.3** -6.86 30	***17.9*** --- *883*
2: GOOD	**57.4** .30 96	**53.1** -1.02 135	**59.3** 1.75 405	**55.4** -.35 236	**63.0** 3.83 431	**59.0** 3.57 1,322	**30.6** -11.75 143	***56.2*** --- *2,769*
3: FAIR	**23.0** .36 39	**20.1** -.69 51	**18.7** -2.20 128	**22.7** .43 97	**21.6** -.22 148	**17.1** -7.48 382	**50.0** 15.46 233	***21.9*** --- *1,078*
4: POOR	**1.8** -1.43 3	**4.7** .60 12	**2.6** -2.02 18	**2.1** -2.10 9	**2.4** -2.20 17	**3.4** -1.88 76	**13.1** 10.62 61	***4.0*** --- *195*
COL TOTAL	***100.0*** --- *168*	***100.0*** --- *254*	***100.0*** --- *684*	***100.0*** --- *426*	***100.0*** --- *685*	***100.0*** --- *2,241*	***100.0*** --- *467*	***100.0*** --- *4,925*
Means	2.09	2.07	2.04	2.07	2.13	2.03	2.70	2.12
Std Devs	.69	.78	.69	.71	.65	.71	.77	.74
Unweighted N	314	394	1,013	747	789	925	745	4,927

Color coding:	<-2.0	<-1.0	<0.0	>0.0	>1.0	>2.0	**Z**
N in each cell:	Smaller than expected			Larger than expected			

Assessing levels of government trust over time may provide some additional insight on possible connections between hazards, vulnerabilities, and public confidence. We might expect that variations in public trust would occur after major disaster or emergency events, if such conditions really do have a major impact on public trust in government. The graph on the following page shows how public trust in three levels of government have varied over time, as assessed by SOSS surveys. Most of the time, there was a lower level of trust in federal government than there was in state or local government, but in survey responses following the events of 9-11-2001, trust in federal government was at a peak, equivalent to the other two levels of government, before dropping down again. A lower point followed the Hurricane Katrina and Rita events. These trends may be purely circumstantial, however, and not actually have been caused by those events—more scrutiny of the data would be necessary to try to draw any specific conclusions of that type. But it may be possible to use this survey data and analyze it to see whether certain types of local or state disaster events were followed by a drop in public trust. In the current assessment, the concerns identified by respondents will be focused upon.

NOTE: As shown in a preceding table, 2012 data was incorporated into this assessment so far, and had indicated a 67.6% level of trust in federal government, 77.7% trust in state government, and 81.1% trust in local government. This information was incorporated into the data presented on the next page.



SOSS 2012 data were also obtained about the types of issues respondents felt were the most significant problems that needed to be addressed, and these have been compared with the information that was available in 2010 (actually surveyed in 2008) for the previous edition of this plan. Community problems most commonly identified by respondents (statewide) included:

2012	2008	
32.8%	20.8%	Unemployment/jobs/young people lack good jobs
12.9%	17.2%	Crime, drugs, gangs, teen violence, safety, street violence, theft (Respondents in the City of Detroit were more likely to select these problems, except for the "gang" and "teen violence" phrasing, which was more often reported by respondents in the broader Metro area.)
8.8%	10.2%	School finance/quality, education funding, similar education topics
9.2%	8.4%	Development, growth, economy, loss of businesses
4.9%	5.8%	Miscellaneous other problems
3.4%	4.5%	Roads: need repair, street upkeep
3.0%	4.2%	No problems
2.4%	3.3%	Overexpansion/growth, population growth, land use, preservation of wetland and natural areas
3.3%	3.2%	Taxes, city taxes, city finances, city commissioners

Most identified problems have declined over the past few years, replaced with a huge jump in the unemployment problem.

Some of these topics, such as crime, roads, and land use and environment, have relevance to Michigan hazard mitigation topics. Some less-frequently selected topics that also have relevance to hazard mitigation include:

2012	2008	
1.5%	2.1%	Water/sewer, trash collection, police/fire services
1.2%	1.7%	Traffic, transportation, buses, etc., other public services
1.1%	1.6%	Pollution, dirty city appearance, junk lying around, other environmental

When asked to identify the most important problem for the State Governor and legislature, respondents most frequently selected the following:

2012	2008	
26.6%	17.7%	Jobs, unemployment, employment, more work, etc.
18.6%	22.9%	Education, schools, school financing & funding
13.0%	12.4%	The economy, business in state, encourage business growth
6.2%	6.9%	Health care, medical care, mental health, etc.
5.1%	6.6%	Crime, safety, drugs, violence, law & order, prisons
4.5%	5.4%	Taxes, property taxes, etc.
4.6%	5.1%	(Miscellaneous)

In addition to crime & safety, some of the less frequently selected topics that are of relevance to hazard mitigation planning include:

2012	2008	
2.6%	3.2%	Roads, highways, bridges (repairs, maintenance)
2.2%	2.6%	Environment, clean-up, pollution control, etc.
0.5%	0.6%	Foreign policy, world affairs, defense (Note: Responsibility for these affairs is usually assigned to federal government.)
0.1%	0.1%	Infrastructure of cities

It must be noted that the breakdown of roadway quality across the state is still of great concern in 2019 and was an important issue in the recent gubernatorial election. It is safe to say that the survey information in this section does not yet reflect the true current level of concern with the widespread poor condition of local surface streets, roads, and highways which was already noted in the 2014 edition of this plan.

Books and documents recommended by Joe Trainor (of the Disaster Research Center) had produced the following additional information. A chapter in the Handbook of Disaster Research stated that the public envisions disaster recovery in terms of a return to "normalcy," while administrators, planners, and other experts instead wish to emphasize changes, which include improvements and hazard mitigation. A "sustainable development" approach to disaster recovery thus requires public involvement, effective pre-disaster planning, and a focus on equity. Recovery activities should meet local needs, match local capabilities, and, where possible, be rooted in effective recovery plans.

In the light of all this information, it does not appear that disasters have played much role in shaping residents' trust in Michigan government, although national circumstances (e.g. Hurricane Katrina) have suggested that it is indeed possible for such events to have a significant influence. Economic and political problems seem to be more directly connected with public confidence in government, and even though disasters can have economic impacts, Michigan's vulnerability has been rather limited, and the trends seen in the most recent survey data about these matters suggest a relative reduction in the amount of concern, in the face of economic/employment issues. One of the survey questions (Winter 1995) asked respondents whether the most important problem they had identified is something that should be addressed by government, by voluntary/community organizations, by business, or by people themselves. About 34% said government should address the problem. Although this was the most common of all the answers, as categorized (followed by "people themselves," with 32%), it needs to be noted that the idea was still expressed by a minority of respondents. The majority felt that non-governmental solutions were better, or that a combination of multiple entities should work together.

Issues such as crime and the environment were highlighted in the various editions of SOSS, but since only certain types of crime and environmental issues are potential disaster situations, most of the details of those surveys will not be addressed here. However, in the Winter 1996 survey, 51% of respondents felt that the government was doing too little to protect the environment (while 38% felt it was doing about the right amount). About 57% felt it was very important to have environmental information, but 47% felt that it was somewhat difficult or very difficult to obtain accurate information about the subject. Although questions on this topic were not repeated in any later survey, it may be assumed that the availability of information on this topic has increased greatly since the rise of the internet (which was at the time being cited as a main source of information by fewer than 1% of respondents).

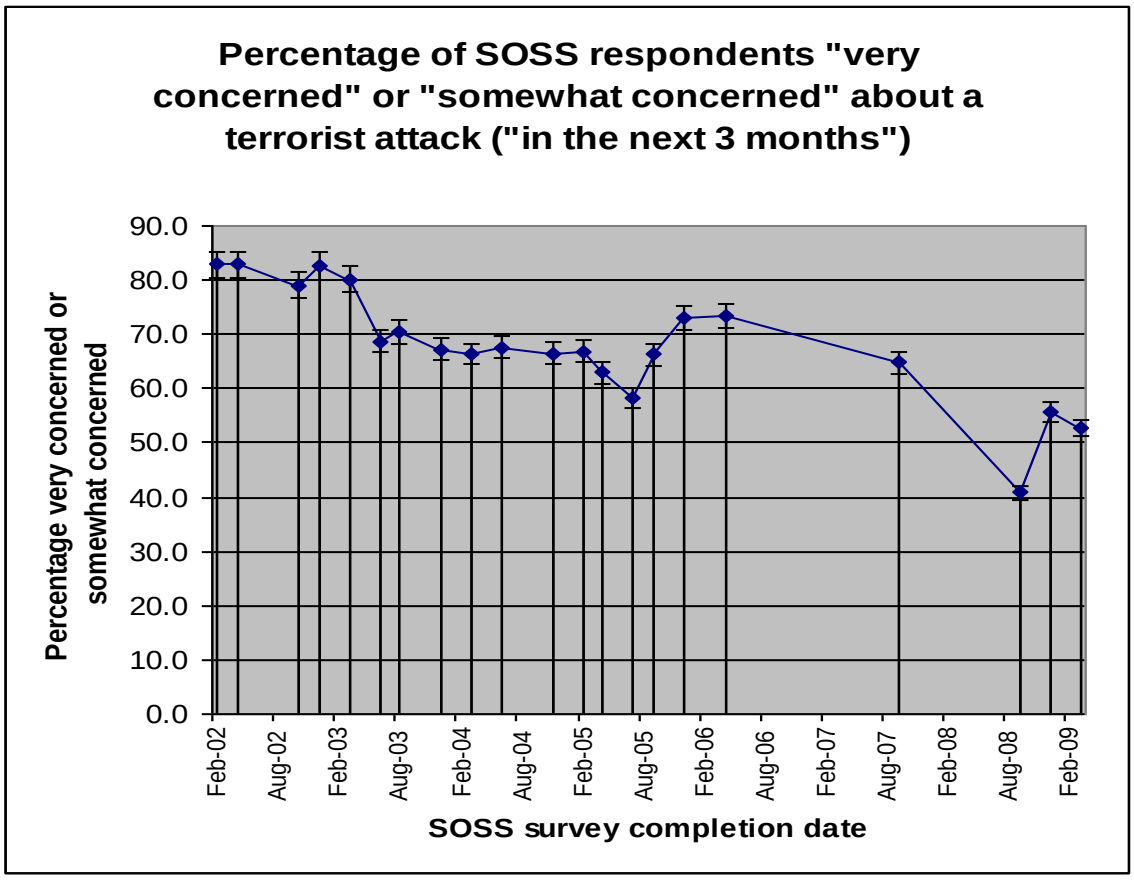
One of the specific hazards that was tracked by the SOSS surveys was the issue of terrorism and nuclear attack. In the Spring of 1999, when respondents were asked how much the development of atomic weapons in Pakistan and India may affect the well-being of persons in the United States, 58% responded "a great deal" and 30% responded "somewhat." When respondents were asked about the extent of American interests in the Middle East, 59% stated that these interests were "very significant," and 35% said "somewhat significant."

After the events of 9-11-2001, many additional questions were asked to gauge public opinion and attitudes toward various aspects of terrorist threats and activities. One of the questions included regularly in the survey each year asks respondents to express how much concern they have about another terrorist attack, and the likelihood that such an attack may affect Michigan or some other location in the United States. Overall (across all SOSS surveys), about 20 percent of respondents said that they were "very concerned" that "the United States might suffer another terrorist attack in the next 3 months," and another 43 percent said that they were "somewhat concerned." The level of concern has varied over time, as shown in the graph below, which shows the percentage of SOSS respondents who were either "very concerned" or "somewhat concerned" about a terrorist attack "in the next 3 months" following their dates of response. New 2012 data shows that this percentage has increased a bit from the 2009 figure shown in the table, at 61.7%. Given that the attempted airliner bombing as it flew near and over Detroit had taken place in Michigan at the end of 2009, this increased level of concern is not at all surprising. Recent state and national events involving shootings (near I-96, Sandy Hill Elementary) and bombings (e.g. Boston Marathon) can be expected to increase concern still further within the past couple of years since the 2012 data were collected.

A 3% margin of error is marked for each data point on the graph. Data points that appear within the range marked by these lines cannot with much confidence be considered to differ significantly from each other. It can easily be seen that concern was much higher during the period immediately following the events of 9-11-2001 (and subsequent anthrax scares). By mid-2003, however, a lower degree of concern had become evident but remained quite stable for a couple of years. A minor dip is suggested by the mid-2005 survey results, but levels of concern were a bit higher by 2006. Concern was substantially lower again by mid-2008 but did not seem particularly stable in recent years, based on the most recent survey results.

It seems reasonable that concern would decline over time if there are no significant events that remind people of a threat or vulnerability, and that may be the case here. The rise in concern after mid-2005 may have been caused by the July 7, 2005 London subway and bus bombings. The years 2005 and 2006 also marked a peak in terrorist casualties in Iraq, which were given a great deal of media attention and, despite their geographic remoteness from U.S. domestic security affairs, may have reminded the public of the terrorist threat. The lower concern expressed in 2008 may have subsequently been elevated by the Mumbai hotel attacks of November 8, reflected in the subsequent survey results.

This discussion brings back the question of what effect these types of hazards may have had on the public's trust in government. One question that was asked repeatedly involved the amount of responsibility that the United States bears "for the hatred that led to the 9/11 terrorist attacks." Overall (not breaking the results down by year, but according to 2010 the longitudinal search), 59.4 percent of respondents expressed the opinion that the United States either bears "a lot" of responsibility, or "some" responsibility, while 40.5 percent stated that the United States bears only "a little" responsibility, or "none at all" for the events that occurred that day.



Despite this, when respondents were specifically asked, in early 2002, to "rate the job the U.S. government is doing defending Americans at home from future terrorist attacks," 76.1 percent responded with either "excellent" or "good." (21.4% said "fair" and only 2.5% said poor.) Respondents were similarly asked to assess the job that the State of Michigan was doing, and 62.9 percent said either "excellent" or "good" (with only 6.7% saying "poor). In 2005, the assessment had fallen, with 50.8% of respondents saying "excellent" or "good."

Another 2002 survey asked respondents how much confidence they had in "the ability of the U.S. government to prevent further terrorist attacks against Americans in this country," and 58.4% of respondents said either "a great deal" or "a good amount" of confidence. (35.5% said "only a fair amount," while only 6.1% said "none at all.") Survey results on these questions obtained later in 2002 showed a slight decrease (54.1%) in such confidence. A re-worded 2004 question asking how well the federal government has prevented or prepared "for the possibility of another terrorist attack" resulted in 53.6% responding "excellent" or "good" and 16% saying "poor," and a similar 2005 question resulted in only 48.6% of respondents selecting "excellent" or "good."

In 2002, respondents were also asked how well prepared they think that their state and local governments are for a potential terrorist attack in Michigan. "Very prepared" was reported by only 8.6%, but 67% said "somewhat prepared," and only 5.9% said "not prepared at all." When asked specifically about state and local preparedness for a potential bio-terrorist attack, the results were slightly less confident (6.5% "very prepared," 60.6% "somewhat prepared," 22.4% "not very prepared," and 10.6% "not prepared at all.") Most respondents felt that neighborhood watch groups and utility service workers (meter readers, repairmen, etc.) should play some role in helping to identify potential terrorists. Most respondents also felt there was a role to be played by "special citizen patrols created solely for the purpose of looking for suspicious activity" in the neighborhood.

Follow-up questions in 2004 revealed that 51.1% of respondents felt that the ability of terrorists "to launch another major attack on the U.S." had lessened over the previous year (while 15.9% thought it had strengthened and 33% felt it was about the same). Most respondents in 2005 felt that Detroit was a less likely target for terrorism than Los

Angeles, but 20.5% felt that it was "very likely" or "somewhat likely" that a terrorist attack would occur somewhere in the state over the following year. When the same respondents were asked to estimate the likelihood of a terrorist attack somewhere in the United States during the following year, 69.2% said "very likely" or "somewhat likely." Most respondents felt that terrorists preferred high-profile targets rather than random targets that would merely promote a sense of chaos and fear. Respondents preferred (80% versus 20%) that anti-terrorist funding be distributed based upon the geography of higher-profile targets, rather than assigned equally to each of Michigan's counties.

Appendix 10: Hazard Mitigation Ideas, Resources, and Capabilities

State/Local Capability Assessment: Existing Hazard Mitigation Tools and Measures

This section of the plan expands upon many of the hazard mitigation strategies listed within each hazard subsection, with a greater emphasis on those strategies that can be implemented or promoted in some manner by staff and/or funding at the level. This description includes some strengths and weaknesses of hazard mitigation strategies, which is useful to explain the types of considerations that may make certain strategies more or less feasible at the state government level, or for promotion by state government.

Land Use and Development Measures

The relationship between wise land use planning and the reduction of a community's exposure 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) hazardous areas and vulnerable structures suffer far less disaster-related damage and impacts 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.
- Less financial impact in terms of local participation in disaster program cost-sharing and the rebuilding of damaged community facilities.

In addition, communities that are more vulnerable to disaster damage may be less likely to be looked upon favorably by potential business enterprises as a safe, secure place in which to do business. Clearly, wise land use planning and development practices have very practical ramifications from that standpoint of attracting and retaining business and industry in the community.

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 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 in harm's way or vulnerable by 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 primarily 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 vulnerability to hazards must, out of necessity, be a joint cooperative effort between the state and local governments. State government provides the means (i.e., enabling laws and local governing authority) for regulating land development, and local governments put that means to use and actually make land use and development decisions.

For land use and development decision-making to be effective in limiting or eliminating hazard 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 increasing hazard 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 hazard risk and vulnerability. Successful implementation of this process will help ensure that the State of Michigan's land use and development pattern lends itself to a reduction, to the extent possible, of risk and vulnerability to natural, technological and human-related hazards.

Existing Measures and Their Effectiveness at Mitigating Hazards

Local governments in Michigan can utilize the following measures to effectively guide land use and development:

- Comprehensive planning;
- Zoning ordinances;
- Building codes;
- Subdivision regulations;
- Special area, use and design regulations; and
- Capital improvements planning.

These measures can be used to reduce risk and vulnerability to many types of hazards. However, political, social and economic pressure at the local level often leads to approval of land uses and developments that may not be appropriate for a particular site or area. In some instances, code enforcement may be a problem. In others, adequate funding may not be available to support planning or regulatory activities, or there may be a lack of community support for such activities. The end result is that local communities may not be able to effectively utilize the measures they have at their disposal.

The one commonality that these land use and development guidance measures have is that they are coordinated, at least to some degree, by a planning commission. In Michigan, local and regional planning commissions are authorized to develop, review and implement long-range, comprehensive development plans. Although local planning commissions in Michigan are primarily advisory bodies as opposed to regulatory ones, they can wield power and influence in land use and development decisions. Similarly, regional planning commissions have authority to review and comment on local federally funded development projects, which also places them in a position to offer insight on possible mitigation opportunities within or affecting local jurisdictions.

These measures provide local governments with the tools necessary to effectively guide and regulate land use and development. The primary mitigation opportunities lie not in the <u>structure</u> of the measures, but in the <u>coordination and application</u> of the measures at the local level.

Some planning commissions have been successful in effectively coordinating land use and development measures to reduce community risk and vulnerability to hazards. However, community decision makers do not always follow the recommendations of their planning commission. Often, local economic considerations take precedence over the need for mitigation. This may be compounded, at least in part, by differences or bias in risk perception. For example, certain hazards (or perhaps hazards in general) may not be viewed as a threat worth addressing, other issues may be ranked higher than hazard risk reduction, or the community may not be aware of the potential impacts of a hazard. Also, time horizons vary a great deal. For example, a homeowner has a lengthy time horizon because they usually want to protect their investment for as long as possible. The bank holding the mortgage has a 30-year time horizon (the period for which the loan proceeds are at risk), although some lending institutions are remarkably short sighted when it comes to lending money for risky developments. The developer who proposes a project has a time horizon of only a few years, long enough to build a structure and then sell it. A political leader is often operating under a time horizon that may expire before the next disaster, and thus may choose to let the next generation of decision makers deal with the issue.

Planning commissioners may also fall under this last category. They may not be overly concerned with development issues that will crop up after their term expires. Another obstacle may be a general lack of knowledge in the planning community (both professional practitioner and commissioner) about the relationship between sound land use planning and development decisions and the community's risk and vulnerability to hazards. Many planners don't know a great deal about hazard mitigation and emergency management because they never received training in these disciplines and they are not part of their day-to-day work activities.

The general hazard mitigation goal of promoting safe, sustainable development that results in economically, socially and physically viable communities is virtually identical to the overall mission of the urban planning profession. However, more often than not, hazard vulnerability reduction is not considered much when decisions are made about land uses and land development because the concept is not formally institutionalized in the decision-making process. Institutionalizing hazard mitigation principles into land use planning and development decision making is the key to limiting community risk and vulnerability to hazards. That institutionalization must occur at the policy making level (the "tools of the trade")—incorporating hazard mitigation into the comprehensive plan, zoning ordinance, capital improvements plan and other mechanisms for guiding land development—and at the implementation level where the actual land use and development decisions are made by the planning commission and local governing body.

Following is a description of the major provisions of the aforementioned basic land use and development measures as they relate to the implementation of hazard mitigation objectives:

Comprehensive Planning

The purpose of a comprehensive plan is to establish an orderly, convenient, efficient and enjoyable environment in a community, and to improve the quality of life for all its citizens. A comprehensive plan provides for future development or improvement of the land use pattern and public service program of the community. In Michigan, planning commissions are required to prepare and adopt a comprehensive plan if the community is enforcing a zoning ordinance. (The zoning ordinance must be based on an adopted comprehensive plan to be legally defensible and enforceable.) This is probably the most significant responsibility of the planning commission. Once adopted (by the planning commission and/or the community's legislative body), the comprehensive plan serves as the foundation document for the preparation and subsequent implementation of other land use and development measures such as the zoning ordinance, public works capital improvements plan, subdivision regulations, and special area, use or design regulations. All of these other measures can be used to implement hazard mitigation measures, so the importance of the comprehensive plan in relation to mitigation cannot be understated.

In terms of content, comprehensive plans typically address such subjects as land use, transportation, utilities, schools, public facilities, parks, economic development, and other subjects that relate to the physical development of the community. Although there are no absolute required elements for comprehensive plans in Michigan, 2006 PA 110 (Michigan Zoning Enabling Act*) does provide some guidance with regard to the types of zoning districts that may be established. Section 201 (1) of the Act states: "A local unit of government may provide by zoning ordinance for the regulation of land development and the establishment of one or more districts within its zoning jurisdiction which regulate the use of land and structures to meet the needs of the state's citizens for food, fiber, energy, and other natural resources, places of residence, recreation, industry, trade, service, and other uses of land, to ensure that use of the land is situated in appropriate locations and relationships, to limit the inappropriate overcrowding of land and congestion of population, transportation systems, and other public facilities, to facilitate adequate and efficient provision for transportation systems, sewage disposal, water, energy, education, recreation, and other public service and facility requirements, and to promote public health, safety, and welfare."

Section 201 (3) of the Zoning Enabling Act provides for the establishment of zoning districts to address special land use problems or achieve specific land management objectives. It states: "A local unit of government may provide under the zoning ordinance for the regulation of land development and the establishment of districts which apply only to land areas and activities involved in a special program to achieve specific land management objectives and avert or solve specific land use problems, including the regulation of land development and the establishment of districts in areas subject to damage from flooding or beach erosion." This allows for such activities as floodplain management under the National Flood Insurance Program (NFIP) and coastal zone

management under the Michigan Natural Resources and Environmental Protection Act (1994 PA 451, as amended). Although the Act specifically mentioned flooding and beach erosion hazards as examples, this provision is certainly flexible enough to address other known hazard areas in a community as long as the regulatory measure is legally defensible and consistently applied.

The Michigan Zoning Enabling Act, and especially Section 201 (3), appears to provide sufficient flexibility and regulatory framework to allow communities to effectively use comprehensive planning and zoning to reduce their natural hazard risk and vulnerability.

***Background Notes:** On July 1, 2006, Michigan's three zoning enabling acts (one each for cities and villages, townships, and counties) were officially repealed and combined into one new statute, the Michigan Zoning Enabling Act (2006 PA 110). The new Zoning Enabling Act has many improvements over the former enabling legislation. It is roughly one-third the length of the previous acts, the language is clearer, and the notification process is easier and more consistent. Enactment of the Zoning Enabling Act was the culmination of years of work by many stakeholder groups, including the Michigan Association of Planning, Michigan Townships Association, Michigan Municipal League, Michigan Association of Counties, Michigan Homebuilders Association, Michigan Realtors Association, Michigan Department of Environmental Quality, and the Michigan Department of Energy, Labor and Economic Growth. Unification and modernization of the three zoning enabling acts was also one of the recommendations of the final report of the Michigan Land Use Leadership Council in August of 2003. (Note: Only counties, cities, villages, and townships that have a zoning ordinance are affected by the new Zoning Enabling Act.)

On February 29, 2008, 2006 PA 110 was amended by 2008 PA 12 to make several needed "corrective amendments" to various administrative mechanisms and processes contained in the original act. Act 33 of 2008, the Michigan Planning Enabling Act, unified and amended Michigan's three planning enabling acts (one each for cities and villages, townships, and counties) into a single, coordinated planning act. This new act was widely supported by various professional and advocacy organizations, with the anticipation that it would do for planning what the Michigan Zoning Enabling Act (described above) had done for zoning. The enactment of a new coordinated planning act was also one of the recommendations contained in the final report of the Michigan Land Use Leadership Council in August 2003. The new act was designed to strengthen the ability of local communities to effectively use comprehensive planning along with zoning and other regulatory tools.

Zoning Ordinances

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 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 the comprehensive plan has been formally adopted by the community. 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 20 years or more, whereas the zoning ordinance will typically be adopted on the basis of a 7 to 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 no 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 type of districts that must be included in an ordinance. As indicated in the "Comprehensive Planning" section above, the new Michigan Zoning Enabling Act is suggestive but not prescriptive in its provisions for zoning districts. Section 201 (1) of the Act suggests a variety of land uses that may be addressed by formal zoning districts but it does not mandate a standardized list of zoning districts that must be applied in each Michigan community that has a zoning ordinance. Section 201 (1) is sufficiently flexible to allow each community to develop a zoning ordinance to meet its individual circumstances. Obviously, any zoning ordinance must allow sufficient uses to be legally defensible if challenged in court. Essentially, it is left up to each planning commission to determine the type of zoning districts that are appropriate for the community, based on its unique characteristics. Section 201 (3) of the Act also provides communities with the option to establish zoning districts and regulate land uses to address specific land use or land management problems. As indicated in the "Comprehensive Planning" section above, the Michigan Zoning Enabling Act provides sufficient flexibility and regulatory framework to allow communities to use comprehensive planning and zoning to effectively reduce their natural hazard risk and vulnerability.

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. They also contain minimum construction standards for natural hazard resistance.

Pursuant to 1972 PA 230, adopted November 5, 1974 and amended by 1999 PA 245, all communities in Michigan are subject to the State Construction Code, which establishes general minimum construction standards for buildings and structures in all Michigan municipalities. The State Construction Code is a compilation of the International Residential Code, the International Building Code, the International Mechanical Code, 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 Energy, Labor and Economic Growth determines appropriate. The Code became effective statewide on July 31, 2001. The State Construction Code provides for statewide uniformity of application and implementation of rules governing the construction, use, and occupancy of buildings and structures. (Prior to the 1999 PA 245 amendment, communities had the option of adopting the State Construction Code – which was 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.)

Provisions of the State Construction Code and other building codes are enforced through authorized local building inspection agencies and state inspectors. In Michigan, there is a huge number of registered local inspectors and dozens of 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 and development guidance measures, can be effective in reducing or eliminating damage caused by many types of hazards such as high winds, fire and flooding. For example, proper adherence to wind load requirements for roof systems can substantially reduce damage to structures from straight-line and tornadic winds. 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.

For residential structures within the floodplain, the State Construction Code requires that the structure have the lowest floor one foot above the base flood elevation (the depth of peak elevation of flooding, including wave height, which has a 1% or greater chance of being equaled or exceeded in any given year). This is called the "design flood elevation." Basements (defined as being below-grade on all sides) must be at or above the base flood elevation (BFE). The one foot of freeboard is more restrictive than the NFIP minimum criteria involving elevation

above the BFE. In addition to FEMA-mapped floodplains, the floodplain criteria of the Construction Codes apply to state-regulated floodplains. This includes all unmapped streams with a drainage area greater than 2 square miles. This means that floodplain management requirements are much more broadly applied in Michigan.

The Code also requires that utilities and mechanical equipment be elevated above the base flood elevation or protected so as to prevent water from entering or accumulating within the components during the occurrence of a 1%-annual-chance flood.

For non-residential structures, the level of flood protection required by the State Construction Code is dependent on the classification of the building use. Category III and IV buildings (critical facilities) such as hospitals, emergency response facilities, power generation stations, and other public utilities must have the lowest flood elevated or dry-floodproofed one foot above the "500-year" flood elevation (a flood level with an estimated 0.2% annual probability of occurring). The critical facilities requirement is more restrictive than NFIP requirements, which only require elevation above the BFE. Buildings that do not fall within Category III or IV must have the lowest floor elevated or floodproofed one foot above the base flood elevation. (A listing of Category III and IV buildings may be found in the publication "American Society of Civil Engineers Flood Resistant Design and Construction—ASCE 24.") Non-residential buildings using the watertight floodproofing option must be designed and certified by a registered architect or professional engineer.

By enforcing the flood resistant construction provisions of the State Construction Code, inspectors can help ensure that new construction within flood-prone areas will be built in such a manner as to minimize future flood losses.

The State of Michigan has taken a number of steps to increase the effectiveness of Building Code enforcement by targeting both state and local building code Inspectors. 1986 PA 54, the Building Officials Registration Act, requires all building inspectors to be registered with the State and continue training throughout their careers. Training sessions conducted by the Bureau of Construction Codes (within the Department of Licensing and Regulatory Affairs) are required for all building code Inspectors every three years in order to be registered with the State. Michigan Department of Environmental Quality personnel also participate in these training sessions to provide information relating to floodplain management, the NFIP, and EGLE permit requirements. The training sessions make the inspectors aware of the Code requirements related to flooding and are an important phase of flood hazard mitigation. Because of the continual turnover in the number of building officials, there is a need to foster an ongoing education program. The local building officials are an essential component of the effort to ensure that future development is not flood-prone.

Following the training sessions, evaluations are given in order to set high standards for the quality of building inspectors in Michigan. The Bureau of Construction Codes also evaluates the performance of a community's building inspection and enforcement effort. These performance evaluations are usually done when a community requests an audit, or a complaint is filed by a private citizen.

At the national level, the Insurance Services Office (ISO) has fostered better building code enforcement. Under the ISO's Building Code Effectiveness Grading Schedule—part of the insurance industry's continuing efforts to reduce natural hazard damage—local building departments are "graded" on their code enforcement efforts. A community's grade is determined by the resources devoted to code enforcement activities. Communities that have good codes and code enforcement programs in place receive a higher grade than those communities that don't, and property owners in the higher-graded communities are rewarded with homeowners' insurance premium credits.

The ISO developed the Grading Schedule after determining that much of the construction failure resulting from natural disasters was due, in large part, from the construction not being built to comply with codes. The insurance industry's experience has shown that communities with effective codes and code enforcement have a more favorable (lower) insurance loss experience because they have less disaster-related damage to structures. The Building Code Effectiveness Grading Schedule was modeled after a similar and long-standing ISO fire-grading program, which assesses local fire departments and water supplies. From a practical standpoint, implementation of this initiative in Michigan should mean better local codes and code enforcement, and therefore reduced disaster-related structural damage and disaster costs.

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 (1967 PA 288, as amended by 1996 PA 591, 1997 PA 87, and 2004 PA 524) 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.

In terms of process, the subdivision of land has three major phases. The first involves a preliminary review of the engineering aspects of the project—roads, drainage, utilities, and other necessary services, by local and county reviewing agencies. The second phase involves a review of the proposal by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), the Michigan Department of Transportation (MDOT), and the Michigan Department of Licensing and Regulatory Affairs (LARA) to ensure compliance with state standards regarding location and engineering. At the end of this phase, the developer can obtain tentative approval from the local governing body of the jurisdiction in which the project is located. The final phase involves preparation of the final plat or map of the subdivision. Local and state reviewing agencies again review the final design to ensure compliance with local and state standards. Once approved, the plat is registered with the county register of deeds.

Subdivision regulations can be an effective tool in reducing 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 a basic level of protection to developed home sites and the residents occupying those home sites.

From a flood hazards viewpoint, proposed subdivisions are reviewed by the County Drain Commissioner for proper drainage, and for floodplain impacts by the Michigan Department of Environmental Quality, Water Resources Division. (Please refer to the Riverine Flooding chapter of the Michigan Hazard Analysis attachment for specific EGLE provisions that directly address flood mitigation.) The subdivision rules require a minimum buildable area above the BFE and outside of any wetlands, for each platted lot.

The subdivision rules relating to flooding are implemented through a review of the proposed plat and the use of restrictive deed covenants. However, the restrictive deed covenants that are filed under the Act are minimally effective as no agency has jurisdiction to enforce them. Enforcement would have to be accomplished by civil litigation from neighboring property owners. The building official has no jurisdiction over deed restrictions and cannot legally require applicants to follow them. However, the floodplain requirements of the Construction Codes must still be met, and developers are required to provide a subdivision layout that has a buildable area on each lot (which helps to prevent violations).

The land-division rules currently allow the construction of basements below the BFE, but these basements must be floodproofed, or it must be demonstrated by an engineering analysis that the basement will not be adversely impacted by hydrostatic pressures exerted by floodwaters. However, the Michigan Residential Code prohibits all basements below the BFE within the 1% annual chance floodplain. So, the developer must also obtain a letter of map revision based on fill (LOMR-f) from FEMA prior to construction, certifying that the property has been filled above the base flood elevation and the soil has been properly compacted. The LOMR-f officially removes the property from the Special Flood Hazard Area.

Non-residential construction can be either elevated 1 foot above the BFE, or dry-floodproofed to one foot above the BFE in certain circumstances. Dry floodproofing is not permitted in High-Risk Flood Areas, Coastal High-Hazard Areas, and Coastal A Zones.

The design standards for a floodproofed basement are fairly involved. Unless the building official is aware of the Construction Code requirements and is enforcing these requirements, there is considerable potential for flood damage to basements even in subdivisions platted under the current act. Thus, as noted earlier, continuing education is essential.

It should be noted that Michigan's subdivision regulations are under continual attack by home builders and developers as being too restrictive. If the regulations are reduced in the future, the potential for future flood damages will be increased considerably.

Special Area, Use and Design Regulations
Examples of special area, use and design regulations include:

- Local floodplain management ordinances;
- Coastal zone management regulations;
- Watershed management regulations;
- Special infrastructure design standards and regulations;
- Drainage regulations;
- Housing regulations;
- Wetland protection regulations;
- Natural rivers protection regulations;
- Farmland and open space protection regulations;
- Endangered species and habitat regulations; and
- Historic preservation regulations (among many others).

These regulations (most of which are administered by a state or federal agency in cooperation with local officials) are designed to regulate a certain aspect of the natural or built environment to ensure protection of the public health, safety and welfare, or some significant or unique natural feature. Not surprisingly, most of the regulations have goals that are remarkably similar to those of hazard mitigation. They provide valuable mechanisms for achieving mitigation objectives. These regulations are discussed in greater detail in the following sections of this plan.

To be effective, the provisions of these special regulations must be fully integrated into the comprehensive planning process at the local level. Major provisions of pertinent regulations must be included or addressed in the comprehensive plan and primary implementing mechanisms such as the zoning ordinance, capital improvements plan, etc. In addition, state agencies administering the regulations must coordinate development-related actions so that one agency's work does not conflict with those of another agency.

Two programs administered by the State of Michigan provide good examples of special area and special use measures that, while originally designed to accomplish something else, also contribute to a reduction in a community's risk and vulnerability to hazards (flooding and wildfires in these two instances):

<u>Natural Rivers Program</u>
This program, administered by the Michigan Department of Natural Resources, seeks to establish a system of outstanding rivers in Michigan and to preserve, protect and enhance their wildlife, fisheries, scenic, historical, recreational and other values. Through the natural rivers designation process, a natural river district is established and a zoning ordinance is adopted. Within the natural river district, permits are required for building construction, land alteration, platting of lots, cutting of vegetation, and bridge construction. Not all of the zoning ordinances on the natural rivers have the same requirements, although they all have building setback requirements and vegetative strip requirements.

Although not specifically designed to reduce flood losses, the program nonetheless has flood hazard mitigation benefits by requiring building to be constructed away from the river and out of the floodplain. The program is very

effective when administered as intended. Like any regulatory program, if the administrator and the variance board are aware of the requirements of the program and their duties, it is very effective.

Capital Improvements Planning

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. Under Michigan law, planning commissions are required 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 against each other (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, then, 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 the community's risk and vulnerability to hazards.

Other Considerations: Local Mitigation Policies, Programs, and Capabilities

Local jurisdictions vary widely in the number and experience of staff that are, or can be, devoted to hazard mitigation activities. All counties are represented by Emergency Management Coordinators who handle emergency response activities, exercises, response planning, and related duties, and these persons are involved in hazard mitigation planning activities, hazard mitigation project grant applications, monitoring the implementation of local hazard mitigation activities, and promoting the hazard mitigation concept within their communities (and sometimes beyond).

Unfortunately, some jurisdictions seem to have a frequent turnover of emergency management staff. While this has been one of the reasons why the development of a local hazard mitigation plan is helpful (information acquired by one person can be easily passed on to his or her replacement in the form of a printed document), nevertheless it can remain a significant problem for some jurisdictions when new emergency management staff enters and needs to take the time to become familiarized with existing conditions, information, relevant agency contacts, policies, forms, procedures, equipment, existing resources, interagency agreements, mutual assistance arrangements, and so on. Some communities may not be fully aware of the great number of things that a good emergency management coordinator needs to keep track of or be able to accomplish, with very short notice. Some communities have provided only minimal staff time and resource commitment to their emergency management programs. In some cases, a quarter time position is all that has been arranged, and serious consideration should be given to the expansion of emergency management staffing and staff hours.

In some areas of the State, local sentiments reveal a mistrust of higher levels of government. In some cases, there is suspicion that the acceptance of federal funding will come "with strings attached" that will cause the loss of some aspect of local authority to state or federal officials or agencies. Emergency management coordinators tend to be aware of various local needs that can be supplemented with state and federal assistance, but sometimes must accept the decisions of local officials who may be reluctant to admit any vulnerabilities or community preparedness weaknesses. If fundamental preparedness issues are sometimes difficult for local emergency managers to explain and "sell" to their community decision-makers, then preventive actions such hazard mitigation planning and projects can be perceived as even harder to successfully explain and promote under such circumstances. This trend is evidently not a broadly generalizable condition, since Keweenaw County, the smallest in population and one of the smaller counties in land area, contained some of the most enthusiastic proponents of hazard mitigation planning and one of the swiftest mobilizations of support for the process. At the other end of the state, many jurisdictions in the Metropolitan Detroit area were also very enthusiastic and efficient in their planning activities. Similarly, areas of differing degrees of urbanization and population density, and with different types of land uses and economies throughout the state have shown a good responsiveness to hazard mitigation planning initiatives and their requests for project grant funds. Variation in the extent and effectiveness of support for hazard mitigation activities appears to me more related to the circumstances of local agencies and officials than it is to general attributes such as regional location, population size and density, wealth or economic specializations.

Most local programs have in some way utilized available state and federal grant funds, or at least submitted applications at some point requesting the use of such funds. Appendix 11 provides detailed listings of the history of funding that has been directed toward hazard mitigation activities.

As can be seen from the information in **Appendix 11**, the use of hazard mitigation funds to support specific projects has been widespread throughout the state, and has been quite balanced so as not to unduly favor any particular regions or jurisdictions. Some areas may have received lighter funding due to cases (described previously) in which local authorities have been reluctant to authorize the application for and acceptance of state and federal dollars. For every case in which that may have happened, some comparable case can readily be found in which an adjacent county that was economically, demographically, and geographically similar has been more active in applying for, and receiving, funds for hazard mitigation projects. In other cases, such an interpretation may be misleading, in that such projects are meant to address specific vulnerabilities that other communities may not have. Therefore, a lack of funding may only indicate that a community has a lesser need to make use of such funds, or that the types of projects preferred by the community are of a nature that has difficulty matching with the types of projects that are currently eligible under state and federal funding sources. (For example, if a community has a problem with aging dams, there are no clear means to obtain funding for dam maintenance projects from available programs.)

Another issue that arises in many communities is the lack of a clear means by which to assemble the local match requirements for most federal sources of funding. For most communities, a cash match is out of the question, and even with the acceptability of "soft matches," there remain problems with assembling (and documenting) all of the qualifying services that could add up to the match value for a project of substantial expense. Since the State of Michigan has not been providing any matching funds for the non-federal share, it tends to fall upon local grant applicants to determine what sources of matching funds are possible, and then to shoulder the substantial administrative burden of documenting match items, which can be very difficult for a complicated or expensive project.

Climate Change Considerations

In 2010 MSP/EMHSD planning staff began participating in multiple activities to explore and assess the effects that climate change might have on Michigan's hazards. These activities eventually included coordination with the Michigan Health and Human Services, attendance at multiple climate change conferences at MSU and U-M Ann Arbor, MDOT climate impact meetings, participation in the 4th National Climate Assessment, and many years of attendance at meetings of the Michigan Climate Coalition in Lansing. Attendance, participation, and activities vary by government department, but most active participants have included the MDMVA, MDNR, MDEQ, MDHHS, MSP/EMHSD, and MDOT. After the addition of "climate change considerations" subsections within the analysis of various natural hazards in 2012 and the refinement of these sections in 2014 (prior to FEMA's addition of the topic as a required planning element), an entirely new chapter was added to the newest (2019) edition of the Michigan Hazard Analysis. Climate change in Michigan's area of the country has been determined to exacerbate the severity of thunderstorms, severe winds, extreme temperatures, flooding, drought, erosion, wildfires, and invasive species. Climate change issues also tie in with the problems of infrastructure failures and public health emergencies. From an emergency management and emergency planning perspective, the climate change issue seems to be easiest to handle in terms of the specific hazards (already described in this plan) through which its effects are known. Tangible indicators of climate change are already present. For example, in Michigan's daily record temperatures at weather stations, new heat records outnumbered new cold records by 3 to 1 during the 1990s, and by 6 to 1 during the 2000s. Long-term planning and mitigation are being undertaken by agencies that deal specifically with long-term environmental and ecological issues, and the MSP/EMHSD has continued to coordinate with these agencies about the climate change issue, becoming an active member of the Michigan Climate Coalition as part of its coordination and outreach on the subject.

Michigan Land Use Policy: Governor's Land Use Leadership Council of 2003

In February 2003, Governor Granholm, supported by bipartisan leadership from the Michigan Legislature, created the 26-member Michigan Land Use Leadership Council (MLULC) to develop recommendations for charting the course of Michigan's future land use policy. Specifically, the MLULC was given the responsibility to find ways to minimize the negative impacts of current and projected land use patterns on Michigan's environment and economy. The MLULC represented a broad spectrum of stakeholders (representing governmental, private sector, and private-nonprofit entities) concerned and knowledgeable about Michigan's land use policy, laws, regulations, and trends.

For a six-month period in 2003, the MLULC studied dozens of complex and often controversial land use and land development issues. The MLULC held six public hearings during that six-month period and a total of 398 individuals provided oral testimony. In addition, 1,330 written or e-mail comments were received for consideration by the MLULC. One of those written responses was developed by the Michigan Hazard Mitigation Coordinating Council (MHMCC), which submitted a three-page letter urging the MLULC to consider a consolidation of the State's three separate planning and zoning enabling laws into a single, coordinated enabling law that also addresses hazard vulnerability reduction as a required planning element in all land use (comprehensive) plans and land use change decisions. The MHMCC letter even offered specific language that could be incorporated into the new statute. The ultimate goal of the MHMCC effort was to institutionalize hazard vulnerability reduction into the land use and land development structures at the state, regional, and local levels of government.

In August 2003, the MLULC issued its final report which contained more than 160 recommendations for Michigan land use policy reforms. Although the MLULC report did not specifically mention the MHMCC's recommendations, the final report clearly espouses the creation of *sustainable* communities in Michigan, which fits hand-in-glove with the basic hazard mitigation goal of creating sustainable, disaster-resistant communities. To that end, the MLULC final report advocates several general land use measures that also support the basic hazard mitigation principles of sustainability and disaster resistance.

<u>Policies that Aid in Reducing Flood Vulnerability</u>

In Chapter 5, the MLULC report discussed the need to "explain the role and value of wetland, natural river, and sand dune protection and other state environment land use programs in protecting and enhancing natural environments." This recommendation, while aimed primarily at environmental protection, had the additional benefit of addressing flooding and Great Lakes shoreline erosion—two of Michigan's significant natural hazards. Chapter 5 recommended the creation of "Agricultural Production Areas" under Michigan's PA 116 Farmland

Preservation Program, to minimize the encroachment of development on valuable agricultural lands. This measure has the added benefit of flood mitigation, since many farms border rivers and drains that frequently flood. Agricultural land is a much more desirable land use bordering rivers and drains (because of its ability to serve as a "sponge" to absorb floodwaters) than would be residential housing or commercial development (which could be damaged by flood waters). In addition, Chapter 5 advocated expanding the State's Conservation Reserve Enhancement Program (CREP), which pays farmers to establish and maintain buffer strips along watercourses. The CREP also supported hazard mitigation by keeping areas adjoining watercourses open and free of development, thereby reducing potential flood losses.

Chapter 5 also recommended measures to prioritize Great Lakes shoreline protection measures, preserve critical headwaters areas through land or land rights acquisition, revise and streamline the Land Division Act, encourage greater participation in several land conservation programs, and create a clearinghouse for various land protection grant programs. All of these measures have the added benefit of potentially aiding in the mitigation of flooding and other natural hazards.

Improving Land Use Planning and Land Development Policies

Chapter 6 of the MLULC final report recommends measures that address land use planning and land development in Michigan. Again, several of these measures have the added benefit of supporting basic hazard mitigation principles. For example, Chapter 6 advocates an expansion of land use education for local planning and zoning officials, local elected officials, and possibly even teachers through intermediate school districts. If this land use education also included elements pertaining to hazard mitigation and its relationship to land use planning and land development, it would be consistent with and fully support similar objectives found in the Michigan Hazard Mitigation Plan. Chapter 6 also advocates the inclusion of storm water retention in improved road corridors (which can help reduce flooding of adjacent properties), and studying the negative impacts of impervious surfaces on both urban and rural watersheds. The latter objective is consistent with two objectives in the Michigan Hazard Mitigation Plan that seek to institute enhanced watershed planning and decision making, and to study land character and its influence on storm water runoff.

Perhaps most importantly, Chapter 6 of the MLULC final report discusses the need to modernize Michigan's antiquated planning and zoning enabling laws. Again, this is consistent with and supports several objectives in the Michigan Hazard Mitigation Plan and was the primary subject of the Council's 2003 letter to the MLULC. Fortunately, the effort was successful and resulted in the enactment of the Michigan Zoning Enabling Act, 2006 PA 110, which took effect on July 1, 2006. (Note: 2006 PA 110 was subsequently amended on February 29, 2008, by 2008 PA 12 to make several needed "corrective amendments" to various administrative mechanisms and processes contained in the original act. This can be found online at the following internet address: http://www.legislature.mi.gov/documents/mcl/pdf/mcl-Act-33-of-2008.pdf.)

The MLULC Chapter 6 also discussed the desirability of enhanced governmental cooperation at the regional level for land use planning and decision making, specifically recommending the preparation of regional emergency preparedness plans. In addition, Chapter 6 recommended that special assessment districts or adequate public facilities ordinances be authorized to allow for provision of, among other things, adequate storm drain infrastructure in new developments. This provision seeks to greatly reduce future flood risks.

Reducing the Vulnerability of Infrastructure

Chapter 7 of the report addressed a variety of infrastructure issues. One recommendation in particular—the desirability of burying electrical and telecommunications lines—had hazard mitigation implications in that buried lines are much less vulnerable to damage caused by natural forces such as wind, lightning, ice and snow, and severe storms. This recommendation is also included in the Michigan Hazard Analysis and MHMP.

The MSP/EMHSD and the MCCERCC will work with the Governor's office and other involved agencies and organizations (as time, resources, and circumstances allow) in implementing those elements of the MLULC report that address hazard mitigation and will ultimately aid in reducing Michigan's risk and vulnerability to natural, technological and human-related hazards.

Implementation of MLULC Report Recommendations

To date, progress on the 160 MLULC final report recommendations has been slow but steady. More than 30 recommendations have either been fully or partially addressed and another 30 are being implemented. The Michigan Zoning Enabling Act was a major step forward in the effort to further institutionalize natural hazard risk and vulnerability reduction into land use and land development decision making processes.

Existing Hazard-Specific Mitigation Measures

Mitigation is occurring in many facets of Michigan state government, local government, and private industry. Mitigation can be found in many laws, programs and initiatives already being implemented on a daily basis, although it may not specifically be called hazard mitigation. Even though hazard mitigation may not be the expressed purpose of the law, program or initiative, the efforts often eliminate or reduce hazard risk and vulnerability. Each hazard chapter of the Michigan Hazard Analysis provides an overview of the laws, programs, and initiatives in effect in Michigan and elsewhere that have (or could have) a mitigating impact on the hazards facing Michigan communities. (Please refer to the Michigan Hazard Analysis for the complete lists.)

Following are synopses of the overall effectiveness of existing laws, programs, policies and initiatives for the hazards deemed most problematic in Michigan. Where applicable, suggestions have been made for ways to make the measure more beneficial in reducing long-term hazard risk and vulnerability. Those suggestions have then been translated into specific objectives and action items for short-term and long-term implementation by MCCERCC, working in partnership with appropriate entities. Please refer to the Mitigation Opportunities, Recommendations, and Implementation section in Chapter 9 for lists of these objectives.

Riverine Flooding

Measures taken to reduce the State's risk and vulnerability to flooding have been primarily non-structural with a focus on discouraging floodplain occupation and improving building code enforcement. In addition, an emphasis on the regulation and management of land adjacent to a river is seen in many of the laws and programs administered by the State. A culmination of efforts has resulted in a generally positive trend towards riverine flood mitigation. In evaluating the effectiveness of the measures being initiated at the state level, a discussion of the local governing process has to be included. Because so much of the success of state level programs and initiatives relies on the cooperation of and coordination with local government, an evaluation of state government effectiveness cannot be void of local government actions.

Floodplain Regulatory Authority

The Floodplain Regulatory Authority found in Part 31, Water Resources Protection of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, is the primary state regulation that deals with construction within floodplains, and is effective at maintaining the flow carrying capacity of a watercourse for those projects that are permitted. The "harmful increase" phrase used in the rules is flexible enough to allow reasonable development within the riverine floodplain without increasing flood damages.

The Act is also effective at prohibiting the construction of new residential structures within the floodway. However, there are areas of concern related to the Act:

Small Watersheds. The Act only deals with watercourses that have a drainage area greater than two square miles. There are many flooding problems on smaller watercourses that do not fall under the authority of the Act, which must be administered at the local level. Some communities are very effective at regulating the floodplains of the smaller watersheds, but to many communities, floodplain regulation does not rate high on the priority list of things to do.

Inland Lake Floodplains. The Act does require a permit for filling or construction within the floodplain of inland lakes. The local building code would also require elevating structures in lake floodplains. However, if the floodplain of the lake is not identified by a floodplain map, the local building official may not be aware of the flooding potential and may not require adequate elevation.

Education Regarding Permit Requirements. There is still a need to continually make building officials and property owners aware of the need for a permit from EGLE under Part 31. A common response from a property owner is, "I did not know I needed a permit for building in the floodplain." It is difficult to determine the amount of construction that is occurring in the floodplain without benefit of an EGLE permit, although it is happening on a regular basis. The more informed local building officials are about the requirements, the greater the compliance. There is a continuing need to educate both the public and local officials on state permitting requirements.

Structures Occupying Floodways. Part 31 of the Water Resources Protection of the Natural Resources and Environmental Protection Act is quite specific about prohibiting habitation of the floodway. However, there are many existing structures within floodways of Michigan rivers. These structures are existing non-conforming used, constructed before the prohibition took effect from the statute. An existing structure in the floodway can be remodeled, as long as the footprint of the structure is not increased. However, if the cost of the remodeling is 50% or more of the value of the structure (excluding land), then the entire structure must be elevated above BFE (substantial improvement). The structure can, in many cases, remain in the floodway indefinitely. However, floodway structures that are destroyed or suffer more than 50% damages (from floods, fire, etc.) and then sit in a damaged state for a period of time can lose their "grandfathered" status and may not be permitted to be rebuilt. Informal AG opinions have stated that if there is an existing habitation, it may continue. Exactly when a habitation ceases is not defined in statute and can cause uncertainty in permit reviews.

Education of Building Officials. For buildings constructed in a filled portion of a floodplain, Part 31 has specific requirements to ensure that the building will not be damaged by floodwaters. However, the effectiveness of these requirements is dependent upon the awareness of the local building officials. Again, the education of building officials is essential to the reduction of future flood losses.

Flood Storage. "Critical" flood storage has been evaluated in only a few areas of the state. A critical flood storage area is determined based on an engineering analysis of the impact that the elimination of floodplain storage would have on downstream flood stages. The loss of flood storage in a "critical" area would result in increased flood discharges and stages in the downstream areas. To help combat this problem, in 2000 the MDEQ implemented a requirement for compensating cut for all floodplain fills statewide, except for projects involving less than 300 cubic yards of floodplain fill.

At both the state and national level, very little has been done to determine the long-term effects of the elimination of floodplain storage areas. There is a need to continue to identify critical storage areas within the state.

Floodplains Not Mapped. Part 31 applies to all riverine floodplains having a watershed greater than two square miles. However, not all of the floodplains in the state have been mapped under the NFIP. This causes considerable confusion among local officials and property owners. There is a common misconception that "if a floodplain is not identified on a map published by FEMA, then there are no state floodplain permits required." There is a continuing need to educate both the public and local officials on state permitting requirements.

In addition to unmapped communities, the accuracy and delineation of many mapped floodplains is subject to continuing debate. The existing federal floodplain mapping program was inadequate, and for that reason, FEMA is undertaking a nationwide initiative to map all communities in the nation and produce updated digitized flood maps. The MDEQ implemented a statewide floodplain mapping business plan to complement and supplement the federal program. Today, this coordination continues in the form of the RiskMAP program, which involves mapping, assessments, and planning processes on a watershed-level basis, in coordination with a large array of stakeholders from the local level up through the state and federal levels.

Stormwater Management. There is currently no state-wide law that regulates stormwater runoff quantity. National Pollutant Discharge Elimination System permits require municipalities to develop post-construction stormwater standards at the local or county level. As a result, there is a wide variety of requirements across the state. There is a growing awareness of the need for stormwater management on a "watershed" basis, although a statewide approach will not likely occur in the near future. EGLE has a stormwater management best management practices guidebook to assist local governments in their stormwater management efforts.

Building Codes
See Existing Mitigation Tools and Measures, Effectiveness of Land Use and Development Measures – Building Codes.

Subdivision Regulations
See Existing Mitigation Tools and Measures, Effectiveness of Land Use and Development Measures – Subdivision Regulations.

Inland Lakes and Streams, Pt.301 Natural Resources and Environmental Protection Act, 1994 PA451, as amended
This Act is reasonably effective for what it was enacted to do—regulate construction, excavation, and commercial marina operations on the State's inland waters, and to protect the "public trust." From a flood hazard perspective, the Act discourages lengthy stream enclosures and extensive filling below the ordinary high-water mark, which helps to maintain the flow-carrying capacity of a watercourse. Since the Act applies to all watercourses that have a defined bed and bank, there are no drainage area limitations. This provides EGLE with some input into watercourse alterations, even if the drainage area is less than two square miles.

Dam Safety Program, Pt. 315 Natural Resources and Environmental Protection Act, 1994 PA 451, as amended
The Dam Safety Act provides review and inspection requirements for dams, along with emergency action plans for "high" and "significant" hazard dams. The Act provides the necessary means for adequately regulating dam safety, provided adequate staffing levels are maintained. The Act will not prevent dam failures. However, it will help to reduce the chance of and potential impacts of a dam failure.

There are no laws that regulate development downstream of a dam. Existing floodplain, subdivision, and NFIP requirements provide no consideration for a dam failure. However, the flood elevations that can result from a dam failure are significantly higher than would be shown in an existing flood insurance study or a typical floodplain determination. Development can take place downstream of a dam, which could be destroyed in the event of a dam failure. In fact, a dam that was initially classified as a low hazard dam could be reclassified as a high hazard dam as development occurs downstream.

In some states, development is regulated downstream of dams, as consideration is given to the possibility of failure of the dam. Currently, Michigan does not have any requirements relating to development in the hydraulic "shadow" of a dam.

Floodplain Service Program
EGLE provides site-specific estimates of base flood elevations (BFEs) for unmapped areas and unnumbered A Zones (zones with no published BFEs). There is no fee assessed for this service, but EGLE does receive CAP-SSSE Grant funding to process these requests. The service also provides general permitting requirements before an applicant must go through the application review process. As a result, informed decisions can be made which can result in lower future flood damages. During the peak permitting season, it is possible that some service requests will not receive a prompt response. However, this is a critical service in Michigan—to provide accurate BFE estimates, leading to properly elevated structures. Many local governments do not have the professional engineering capacity to develop BFEs at their level. EGLE processes approximately 500 requests per year.

National Flood Insurance Program

The NFIP has provided a needed stimulus for state and local officials to focus on floodplain management. The benefits and drawbacks of the NFIP have been discussed for years, and it is not the intent of this plan to reiterate those discussions.

Community Assistance. As the coordinator for the NFIP in Michigan, EGLE contracts with FEMA to work with communities to ensure that they understand their duties under the NFIP. Community contacts are done by telephone and by visiting the community. These contacts provide local officials with a "refresher" on the NFIP, in addition to EGLE permit requirements. These contacts are a very effective means of keeping officials up-to-date. However, due to the number of communities in the NFIP, some communities may be contacted only once every five years or so. Due to the turnover of local officials, more frequent contacts would be extremely beneficial.

Community Participation. Within Michigan there are 1,775 communities, of which 1,028 (about 57%) were participating in the NFIP as of March 8, 2019. This marks a sizable increase from the 49% that were participating when the previous edition of this plan was completed five years ago. Because of the existing state laws and the building codes, every community in Michigan meets the minimum standards to participate in the NFIP. The only actions necessary to join the NFIP would be the passing of a resolution indicating an interest in joining the NFIP, adopting an ordinance indicating the State Construction Code is enforced in the community, and completing an application. EGLE, in cooperation with the Michigan Attorney General's Office has developed a sample ordinance that may be used by communities when joining the NFIP. A continued effort is needed to make the communities in Michigan aware of the NFIP and floodplain management.

Flood Insurance Purchases. Nationally, it has been estimated that only about 10 to 12% of the eligible properties within the flood hazard areas of participating communities have flood insurance. It is believed that a similar percentage of participation is occurring in Michigan. There is currently a national advertising campaign to make homeowners aware that flood damages are not covered by their homeowners' policy. In recent years there has been an increased awareness on the part of lenders regarding the flood insurance purchase requirements.

Combining the low participation rate on flood-prone properties with the fact that property owners in non-participating communities cannot purchase flood insurance, it can be inferred that Michigan's roughly 20,000 active NFIP policies represent a very small portion of the total number of structures that are considered to be flood-prone within Michigan. It is estimated that there are about 200,000 structures in Michigan that are within the 1% annual chance floodplain. This means that only about 10% of Michigan's flood-prone properties are insured against the peril of flooding.

While not a Michigan problem alone, there is still a need to increase the awareness of the public of flooding problems and the availability of flood insurance.

Repetitive Losses. Nationally, it is estimated that about 10% of the properties account for about 40% of all NFIP claims. These properties which continually receive flood damage and are reimbursed for their insured losses are referred to as repetitive loss properties, and are a primary concern for the NFIP. The NFIP Reform Act of 1994 is a first step at addressing repetitive loss properties through mitigation.

The NFIP Reform Act established the Flood Mitigation Assistance Program (FMAP). Funding is made available annually to states and local governments to mitigate future flood losses. The fund is used primarily on repetitive loss structures.

Since 1978, more than $89 million in claims have been paid due to flooding in Michigan. Although that figure is not as high as some areas of the country, Michigan does have its share of repetitive loss properties.

According to the most current official NFIP list (January 31, 2019), 47 of Michigan's 83 counties had structures that had suffered from repetitive flood claims. The following list shows the distribution of these structures by county, and specifies the communities within each county that contain these "repetitive loss" properties. (NOTE:

Boldfaced entries denote the presence of at least one of the 14 "severe repetitive loss" properties that had officially been listed for Michigan.)

NFIP Repetitive Loss Structures, by County and Community

(Precise address and loss information must be kept confidential, and is not included here.)

* The City of Midland had 6 structures listed under Bay County, but none listed within Midland County, even though only 157 of its 41,863 total residents live in the former, according to 2010 census data. An inspection of the (confidential) street addresses reveals that all 6 structures had been misclassified within the official list. This information has been corrected in this list, with the Bay County count adjusted from 42 down to 37, and the Midland County count adjusted from 5 up to 11.

** The City of East Lansing and the City of Lansing had 4 structures each listed under Clinton County in the official data, but inspection of these addresses revealed that they were all misclassified and should have been listed under Ingham County. Therefore, the figures in this list have been corrected, so that the Clinton County total has been adjusted from 10 down to 2, while the Ingham County total has been adjusted from 6 up to 14.

Allegan	2	Laketown Township (1), Saugatuck City (1)
Arenac	5	Arenac Township (2), Standish Township (3)
Barry	36	Castleton Twp. (27), Hastings Twp. (5), Thornapple Twp. (2), Yankee Springs Twp. (1)
Bay*	37	Bangor Twp. (19), Bay City (5), Hampton Twp. (1), Kawkawlin Twp. (10), Pinconning Twp. (1)
Benzie	1	Crystal Lake Twp.
Berrien	21	Baroda Twp. (1), Chikaming Twp. (1), Coloma City (1), Coloma Twp. (3), Hagar Twp. (1), Niles City (2), Royalton Twp. (5), St. Joseph City (1), Watervliet City (1) Watervliet Twp. (3)
Branch	5	Coldwater City (3), Coldwater Twp. (1), Quincy Twp. (1)
Calhoun	3	Battle Creek City (3)
Clinton**	2	Victor Twp. (1), Watertown Twp. (1)
Delta	1	Ford River Twp. (1)
Dickinson	1	Kingsford City (1)
Eaton	12	Delta Twp. (2), Eaton Rapids City (1), Eaton Rapids Twp. (1), Windsor Twp. (8)
Genesee	44	Burton City (11), Flint City (21), Flint Twp. (4), **Flushing Twp. (2)**, Gaines Twp. (1), Genesee Twp. (1), Grand Blanc City (3), **Grand Blanc Twp. (1)**
Gladwin	3	Hay Twp. (3)
Gd. Traverse	1	Blair Twp. (1)
Houghton	1	Chassell Twp. (1)
Huron	6	Fairhaven Twp. (5), McKinley Twp. (1)
Ingham**	14	East Lansing City (4), Lansing City (4), Lansing Twp. (1), Mason City (1), Meridian Township (4)
Ionia	2	Ionia City (2)
Isabella	1	Nottawa Twp. (1)
Jackson	3	Jackson City (1), Summit Twp. (2)
Kalamazoo	23	Comstock Twp. (2), **Kalamazoo City (15)**, Kalamazoo Twp. (5), Portage City (1)
Kent	68	**Ada Twp. (6)**, Algoma Twp. (3), Caledonia Twp. (1), East Grand Rapids City (1), Grand Rapids City (13), Grandville City (5), Lowell City (4), Plainfield Twp. (28), Sparta Village (1), Wyoming City (6)
Lake	7	Cherry Valley Twp. (1), Pleasant Plains Twp. (6)
Lenawee	7	Adrian City (1), Blissfield Village (4), Deerfield Twp. (1), Deerfield Village (1)
Livingston	9	Green Oak (2), **Hamburg Twp. (5)**, Howell City (1), Putnam Twp. (1)
Macomb	39	Chesterfield Twp. (3), Clinton Twp. (8), Harrison Twp. (10), Macomb Twp. (4), Mt. Clemens City (1), New Baltimore City (3), Shelby Twp. (1), St. Clair Shores City (5), Sterling Heights City (2), Utica City (2)
Manistee	1	Manistee Twp. (1)
Marquette	1	Chocolay Twp. (1)
Mason	1	Meade Twp. (1)

Mecosta	10	Big Rapids City (1), Big Rapids Twp. (2), **Fork Twp. (3)**, Mecosta Twp. (4)
Menominee	1	Menominee Twp. (1)
Midland*	11	Midland City (6), Sanford Village (5)
Monroe	133	Bedford Twp. (1), Berlin Twp. (7), Dundee Village (4), Erie Twp. (16), Estral Beach Village (12), Frenchtown Twp. (21), LaSalle Twp. (36), Luna Pier City (13), Monroe Twp. (16), Monroe City (7)
Muskegon	3	Laketon Twp. (1), Montague City (1), Norton Shores City (1)
Newaygo	15	Ashland Twp. (2), Bridgeton Twp. (8), Brooks Twp. (1), Garfield Township (3), Newaygo City (1)
Oakland	18	Birmingham City (2), **Farmington Hills City (11)**, Troy City (1), Waterford Twp. (4)
Osceola	5	Evart Twp. (2), Middle Branch Twp. (1), Osceola Twp. (2)
Ottawa	25	Georgetown Twp. (3), Holland Twp. (4), Park Twp. (4), **Robinson Twp. (10)**, Spring Lake Twp. (1), Tallmadge Twp. (1), Wright Twp. (1), Zeeland City (1)
Saginaw	20	Bridgeport Twp. (2), Buena Vista Twp. (1), Carrollton Twp. (2), James Twp. (1), Saginaw Township (4), Saginaw City (4), Spaulding Twp. (3), **Tittabawassee Twp. (2)**, Zilwaukee City (1)
Shiawassee	2	Corunna City (1), Owosso City (1)
St. Clair	65	Algonac City (3), China Twp. (3), Clay Twp. (21), Cottrellville Twp. (2), East China Township (11), Fort Gratiot (8), Ira Twp. (7), Kimball Twp. (1), Marine City (7), Port Huron City (2)
St. Joseph	7	Colon Village (2), Nottawa Twp. (1), Three Rivers City (4)
Tuscola	15	Tuscola Twp. (1), Vassar City (9), Wisner Twp. (5)
Van Buren	3	Covert Twp. (2), South Haven City (1)
Washtenaw	11	Ann Arbor City (7), Northfield Twp. (4)
Wayne	169	Allen Park City (6), **Brownstown Twp. (8)**, Dearborn Heights (16), Dearborn City (1), Detroit City (32), Ecorse City (2), **Gibraltar City (85)**, Grosse Ile Twp. (4), Grosse Pointe City (1), Grosse Pointe Park City (1), Lincoln Park City (2), Northville Twp. (1), Plymouth City (1), Redford Twp. (3), Rockwood City (1), Trenton City (3), Wyandotte City (2)

The **bolded** entries show where at least one of the following severe repetitive loss properties can be found:

Genesee	2	Flushing Twp. (1), Grand Blanc Twp. (1)
Kalamazoo	1	Kalamazoo City (1)
Kent	2	Ada Twp. (2)
Livingston	1	Hamburg Twp. (1)
Mecosta	1	Fork Twp. (1)
Oakland	3	Farmington Hills City (3)
Ottawa	1	Robinson Twp. (1)
Saginaw	1	Tittabawassee Twp. (1)
Wayne	2	Brownstown Twp. (1), Gibraltar City (1)

Repetitive Loss Reduction Project. Reducing claims of repetitive flood loss properties under the NFIP has been a major goal of both FEMA and the State of Michigan. To that end, in 2001 the MSP/EMHSD and the MHMCC (now MCCERCC) embarked on a $3 million statewide repetitive flood loss reduction project using HMGP funding from Federal Disaster 1346-DR-MI. The goal of this project was to acquire and remove or elevate as many as possible of Michigan's repetitive flood loss structures (which totaled 456 at the program start), with particular emphasis being placed on those communities that show a strong willingness and commitment toward repetitive flood loss reduction. For information about some of the flood mitigation activities that had been implemented with federal funds, please refer to **Appendix 11**.

Natural Rivers Program, Part 305 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended

Even though the Natural Rivers Program is not intended to reduce flood hazards, it does result in structures being constructed away from the river, and out of the floodplain. The program is very effective when administered as intended. Like any regulatory program, if the administrator and the variance board are aware of the requirements of the program, it is very effective.

Manufactured Housing Commission Act, 1987 PA 96, as amended
The Michigan Manufactured Housing Commission Act and its implementing Administrative Rules provide regulation on the placement of manufactured homes and establishes construction criteria. Manufactured homes are prohibited from being placed within a floodway, as determined by the Department of Environmental Quality. In addition, manufactured homes sited within a floodplain must install an approved anchoring system to prevent the home from being moved from the site by floodwaters, and be elevated above the base flood elevation. These provisions are highly effective when properly carried out and enforced.

Condominium Act, 1979 PA 59, as amended
Similar to the Manufactured Housing Commission Act (1987 PA 96, as amended) and the Land Division Act (1967 PA 288, as amended), the Condominium Act also requires identification of floodplain limits and places certain restrictions on structures in floodplain areas. Administrative Rule 559.402 states: "The floodplain areas shall be clearly labeled…A common element or a condominium unit, other than a campsite or a marina unit, shall not be constructed where it may be reasonably anticipated that the structures will be damaged by flooding…"

In practice, flood-prone condominium projects are identified during the permit application review by EGLE. To avoid damage by flooding, the elevation of the lowest floor is stipulated in the state floodplain permit issued under authority of the state Floodplain Regulatory Authority found in Part 31 of 1994 PA 451, as amended. These provisions are highly effective when properly carried out and enforced.

Seller Disclosure Act, 1993 PA 92, as amended
This law requires the seller of any 1-4 family residential property to disclose (on a form prescribed by the Act) known defects including whether the property has flooded or is flood-prone. It is hoped that this change in regulation regarding the sale of residential structures will reduce the number of dissatisfied home buyers. The law, however, only applies to existing 1-4 family structures, not vacant land, and it is only as good as the knowledge (and honesty) of the seller.

Michigan Agricultural Programs and Flood Hazard Mitigation
The Michigan Department of Agriculture and Rural Development has several programs designed to reduce the negative impacts of weather related disasters on agriculture and the environment. These programs help maintain adequate drainage, preserve farmland and open space, and develop practices to prevent erosion to reduce the water impacts of flooding. Instituting sound practices on farms – from better design and siting decisions to better management of manure, fertilizer and pesticides – all help to reduce the negative environmental impacts that accompany flooding and other natural disasters.

Michigan Agriculture Environmental Assurance Program. This program helps prevent agriculture related pollution by ensuring that participating producers are using effective stewardship practices that comply with state and federal environmental laws and standards. The proactive, comprehensive program provides education, on-farm technical assistance, environmental risk assessments, and site or farm-specific action plans. This program does not mitigate flood damage, but does help mitigate the negative environmental impacts associated with flooding.

Conservation Reserve Enhancement Program. This program implements environmentally sound practices on agricultural lands which enhance wildlife habitat, reduce soil erosion on high-risk farmland, increase soil productivity, and improve surface and groundwater quality in and downstream of agricultural areas. Specifically, agricultural land along targeted waterways is taken out of production and improved to prevent erosion and run-off, in exchange for rental payments. This program can be effective in reducing soil erosion and sedimentation in waterways, which in turn helps to reduce the potential for flooding.

Pre-Disaster Mitigation Program
Since its inception in 2002, the Pre-Disaster Mitigation Program (PDMP) has been successfully utilized in Michigan to fund hazard mitigation activities. Forty-seven PDMP grants have been completed, spanning 57 Michigan counties. Completed activities include early warning systems, erosion stabilization, floodplain acquisitions, hazard mitigation planning, and stormwater management improvements. Please refer to **Appendix 11** for a full list of these funded activities.

Shoreline Flooding and Erosion
Much of Michigan's character is defined by the Great Lakes. The beaches provide numerous recreational opportunities, and are also considered prime real estate. Unfortunately, the hazards inherent in coastal areas are not always apparent. In addition, development activities along the shoreline significantly alter the natural ebb and flow of coastal dynamics. The continuing and increasing development of the coastal areas, and the resulting conflicts that arise between users, has resulted in passage of various laws designed to establish regulations to mitigate conflict and environmental degradation.

Great Lakes Shoreland Management Program
Under the Great Lakes Shorelands Administrative Rules, local governments may assume permitting responsibility in erosion, flooding, and environmental areas. In communities designated as flood risk areas, ordinances adopted for participation in the NFIP generally meet the requirements under Part 323 prior to the 1992 amendments and allowed the community to assume permitting authority under Part 323. However, most communities have not taken on the additional enforcement responsibility in high-risk erosion and environmental areas. Therefore, in these communities, a state permit is required for most construction proposed in designated areas. In the high-risk erosion area program, an intergovernmental agreement with the Michigan Department of Energy, Labor and Economic Growth directs building inspectors to withhold building permits in high-risk erosion areas until the state permit is issued. Development proposed in environmental areas is also typically reviewed by EGLE in conjunction with wetland regulations.

Local building departments are generally cooperative in enforcing coastal regulations. Efforts are made to keep communication lines open between local enforcing agents to minimize misunderstanding. Thorough knowledge of all regulations prior to start of construction has proven to be the best approach to compliance.

Political Pressures: Anti-Land Use Regulation
Shoreland flooding and erosion mitigation occurs through EGLE as mandated by Part 323 of the Natural Resources and Environmental Protection Act. The State relies heavily on local government to inform property owners of the regulations and the need for state permits. Strong communication between state and local officials is a priority to EGLE staff. The value of lakefront property and the increase in tax revenue is attractive to local governments, resulting in strong political pressure to reduce or eliminate regulation of shorelands. In some instances, zoning ordinances are circumvented through the use of variances, resulting in flood- or erosion-prone structures being constructed.

Tornadoes
Tornadoes are nature's most destructive and unpredictable storms, and so it is difficult to economically build structures on a widespread basis, using today's construction methods and materials, that can totally withstand the direct wind forces of a strong tornado. However, effective mitigation includes the reduction of damages and lost lives, not just the complete prevention of harm. Although tornadoes themselves cannot be prevented, it is possible to reduce the loss of life and property damages that result from these hazardous events.

Current data indicate that approximately 85% of reported tornadoes in the United States have wind speeds of 112 miles per hour or less. Most homes or commercial buildings built to conform to the State Construction Code will stand up well to the direct wind forces of these weaker tornadoes. Damage from flying debris may still cause considerable damage to the outside walls and roof of a structure, but code compliance is still an effective start for resisting harm from tornadic winds.

Tornadic winds try to lift off the roof and blow out the walls of buildings. If the structure is built to code, the pressures to lift the roof off are transferred down to the wall frame and foundation, thus reducing the likelihood of failure. In addition, construction techniques of securely fastening roof sheathing to its support frame, tightly fastening rafters to the top of the walls, securely bolting wall base plates to the foundation, and cross bracing gable ends, can all be used to significantly reduce the extent of structural tornado damage. While some damages may still occur, these construction techniques reduce the likelihood of the type of catastrophic damage that results from failure of one or more of the main structural components of the building.

Some damages from flying debris can be prevented or reduced through the use of properly installed protective shutters over windows. (Residents should close such shutters soon after hearing that severe weather warnings are issued because there may not be the time or opportunity to do so as weather conditions worsen.) The use of reinforced masonry construction, although expensive, can also provide additional structural resistance to tornado-related damages. As the building industry continues to make strides in developing wind-resistant siding and roofing materials, and to employ the wind-resistant construction techniques described above, these damages may become less prevalent in the future.

Continued public education, along with early detection, tracking and warning, are also critical to reducing tornado-related deaths and injuries. The promotion of "safe space" concepts within homes, schools, commercial and governmental structures must continue to be stressed by local emergency management officials and other decision makers. The development of tornado "safe rooms" (interior reinforced concrete "closets") should be encouraged in any residential, commercial and governmental structures that do not already offer good protection against tornadoes and severe winds. Residents of mobile home parks are particularly vulnerable and should receive particular encouragement in the development of shelters and safe rooms, and the anchoring of the homes to a secure foundation. Anchoring increases the wind resistance of mobile homes and in this way prevents the extra damages and structural weaknesses that result from wind-induced tipping of the units.

Over the past several decades the number of deaths and injuries caused by tornadoes has dropped significantly in the United States. The widespread use of warning sirens, enhanced radar systems, and weather spotters, coupled with constant public education campaigns by government officials and the media, have dramatically improved public safety during tornado events. However, tornado-related deaths and injuries still occur that are both needless and preventable. Some of the reasons for this include building construction that doesn't meet current codes, people ignoring or not receiving weather warning information, people trying to "outrun" tornadoes in their cars, mobile homes that are not properly anchored, and people failing to secure loose items that turn into flying debris under the forces of severe winds. In addition, tornado "exposure" has increased as previously undeveloped areas are settled, so that what used to be sparsely populated farmland or open space is now more likely to contain homes and businesses that are vulnerable to damages and loss of life. All of these circumstances highlight the need for continued and improved public education, storm tracking and early warning, and the use and enforcement of modern construction techniques and requirements.

Winter Storms

Fortunately, winter storms are one of nature's most predictable weather phenomena. As a result, citizens and communities generally have several hours to several days' notice before a severe winter storm hits, thus allowing time to adequately prepare for the event. The physical elements of the event itself generally result in little damage on their own – the exception being death or severe injury caused by prolonged exposure to severe cold temperatures. However, the consequences of the accumulated effects of wind, ice, extreme cold and massive amounts of snow – loss of power and essential services, isolation, collapsed roofs due to snow and ice buildup, blocked roads, downed power lines and debris, traffic accidents, etc. – can cause tremendous (and often deadly) problems for individuals, families, businesses, critical facilities and local governments.

In some ways, snowstorms are the northern states' hurricanes. Generally large in size, they can result in massive debris removal operations (snow, downed trees), loss of power due to downed lines and other damaged electrical infrastructure, loss or reduction in essential services, isolation, and temporary economic disruption. However, damage to buildings is usually minimal if they are properly constructed and maintained. In terms of physical destruction, damage to trees and electrical infrastructure are generally the two primary concerns. Existing measures

aimed at mitigating these types of damages are very effective where implemented. However, the problem is that implementation is not widespread and consistent. An increasing number of cities in Michigan have active, ongoing urban forestry programs designed to minimize storm related damage to trees, although these programs may still wrestle with funding limitations.

Electrical infrastructure mitigation goes hand-in-hand with urban forestry, since most storm related damage to electrical infrastructure is caused by downed trees and limbs. Major electrical service providers in Michigan have ongoing system reliability improvement programs (which include forestry activities), and most new electrical infrastructure is placed underground. However, the vast majority of the existing infrastructure is above ground and therefore highly vulnerable to storm related damage. Over time, lines and equipment are upgraded with newer, stronger materials. However, severe storms still cause considerable damage to the electrical infrastructure every year. This results in power outages (often prolonged and widespread) that severely tax the capabilities of the utility companies to respond, and citizens and communities to cope with the consequences of the situation.
In terms of winter storm response, sheltering people from the elements, clearing roadways, and maintaining critical public safety services (i.e., police, fire, EMS) are the primary concerns of local officials. Michigan communities are generally well prepared to meet these challenges on their own, sometimes supplemented by mutual aid and state assistance. Fortunately, few people die or are severely injured as a direct result of winter storms in Michigan. In those cases where it does occur, it is usually the result of auto accidents, prolonged exposure to cold temperatures, or overexertion (i.e., heart attack) from snow shoveling. Keeping people inside and off the roads during winter storms would greatly minimize the numbers of deaths and injuries. Continued public information programs in that regard should help. In addition, most communities have active programs to check on the condition of elderly and homebound individuals, both of which are extremely vulnerable during severe winter storms.

Wildfires
The Michigan Department of Natural Resources Forest Resources Division (MDNR/FRD) is committed to a multi-jurisdictional, coordinated wildfire mitigation effort. The MDNR/FRD is actively working to reduce the State's vulnerability to wildfires by:

- Participating in multi-state and interagency mitigation efforts.
- Aiding local communities in developing zoning and subdivision control ordinances that adequately address wildfire mitigation.
- Regulating the time and number of permits that are given for prescribed burns.
- Conducting research on wildfire prevention, containment and suppression activities.
- Developing fire hazard assessments to aid community and property owners in determining their risk and vulnerability to wildfires.

Lack of Local Government Wildfire Mitigation Initiatives
Despite the ongoing initiatives of the MDNR/FMFRD, wildfire prevention and mitigation must be stressed at the local level if a meaningful reduction in risk and vulnerability is to occur. With fewer than 100 state fire prevention officers and funding often in jeopardy, fire prevention efforts need to be redirected more toward local community initiatives. There is ample room for improvement in mitigating forest fire risk and vulnerability at the local level. One main issue is the lack of emphasis on forest fire risk and vulnerability reduction in local zoning ordinances and comprehensive plans.

Most local zoning ordinances lack provisions for wildfire risk and vulnerability reduction. In addition, comprehensive plans are often not prepared far enough in advance in rural areas to adequately direct development and institute mitigation measures in high-risk fire hazard areas. Communities are not adequately utilizing land use systems that recognize special fire problems and requirements related to vegetation, topography, weather, transportation and access, water supply, and density of development.

Local fire agencies only sporadically review proposed lot splits, subdivisions, severances and other developments for fire protection needs. In general, communities are not requiring large developments to calculate the future fire vulnerability of the development. These calculations are also not required for most variances and special use

permits. Builders seeking building permits for additions to homes do not have to retrofit the existing structure to meet wildfire safety and mitigation measures. These measures would include such things as replacing an existing roof covering with a fire-resistant or non-combustible covering, installing smoke detectors and other fire safety controls, or maintaining a "firewise" landscape by providing adequate vehicular access, signing streets, roads and buildings, and providing adequate emergency water supplies.

Regulation of Outdoor Burning

The Michigan Solid Waste Management Act (1990 PA 264), which prohibits the burning of leaves and grass clippings in municipalities over 7,500 in population (unless a local ordinance allows such burning), has resulted in some reduction in accidental fires caused by the burning of vegetation and yard wastes. This is a significant step. However, there are clearly more steps that can be taken to reduce the number of wildfires, as well as minimize the spread of those that do occur.

Severe Winds (Non-Tornadic)

Severe winds occur with regularity in Michigan, and they often cause considerable damage to buildings, trees, and the electrical infrastructure. Existing measures designed to minimize or eliminate the effects of severe winds, such as enforcement of building codes, strengthening electrical transmission lines and equipment, and urban forestry programs, are effective where implemented in a concerted and consistent manner. As mentioned in the Tornadoes Section, the problem isn't in the mitigation techniques themselves. Rather, the problem is in getting the techniques implemented.

Street trees not properly pruned and maintained will incur damage in severe winds. Electrical transmission lines and equipment that is old, inadequate, or vulnerable to damage from trees and tree limbs is much more likely to fail in a storm. Above-ground electrical lines are more vulnerable to wind damage than below-ground lines are, but the vast majority of the electrical infrastructure is above ground. Building roofs that are properly and securely anchored to the wall structure are not as likely to be damaged by the uplifting force of winds.

Implementation is the key to all of these measures. Over time, these techniques have proven to be sound and cost-effective. However, unless the measures are implemented on a widespread and consistent basis, their effectiveness is greatly reduced.

Hail and Lightning (Thunderstorm Hazards)

As indicated in the Michigan Hazard Analysis, lightning prevention or protection, in an absolute sense, is impossible. However, the consequences of lightning strikes can be diminished (in terms of deaths, injuries, and property damage) through the implementation of such measures as:

- Enhanced early warning of lightning conditions by the National Weather Service;
- Enhanced public education of thunderstorm and lightning hazards through Severe Weather Awareness Week and other appropriate avenues;
- Lightning protection for all critical structures using the systematic lightning hazard mitigation approach advocated by the National Lightning Safety Institute (NLSI);
- Widespread use of local lightning detection systems at such locations as golf courses, pools, sports fields and stadiums, and other outdoor venues; and
- Enhanced emergency planning for all large outdoor gatherings (e.g., sporting events, concerts, campgrounds, fairs, festivals, etc.) that includes provisions for early detection, monitoring, and warning of approaching thunderstorms that could produce lightning.

Local emergency managers are central to all of these efforts and are the key players in the implementation of a community-wide lightning protection program. The MSP/EMHSD actively encourages local communities to address lightning risks as part of their overall emergency planning and hazard mitigation initiatives. Although lightning deaths, injuries and property damage can never be totally prevented, these negative impacts can at least be reduced through a combination of public education, human vigilance, technology, proper building safety provisions, and common-sense precautions.

These measures have been successfully implemented, in whole or in part, in many Michigan communities. Michigan still has many lightning deaths and injuries, and Michigan's status as an outdoor recreation state probably contributes to this. The MSP/EMHSD will continue to promote lightning safety and mitigation measures in its ongoing coordination activities with local emergency management programs.

Earthquake

Because Michigan is not located in an area subject to major earthquake activity, local emergency management programs and the MSP/EMHSD generally do not devote much time or effort to this hazard. Even if a major earthquake were to occur in the New Madrid Seismic Zone, the impacts to structures in Michigan would be minimal at best and mostly cosmetic in nature in well designed and constructed buildings. The greatest impact on the state would probably come from damage (that occurs outside of Michigan) to natural gas and petroleum pipelines that originate in the Gulf of Mexico region of the United States and enter Michigan along its southern border. Such infrastructure failures could cause temporary, but severe fuel shortages—especially during the winter heating months. During the hot summer months, a temporary cutoff of natural gas and petroleum supplies could cause a widespread reduction in the availability of air conditioning, which could adversely impact at-risk groups such as young children, the elderly, and persons in poor health.

Emergency Planning and Earthquake Monitoring

The best measure to address these potential contingencies is good emergency planning that includes provisions for the establishment and maintenance of heating and cooling centers and temporary shelters for the most seriously affected individuals. In general, most local communities in Michigan have adequate provisions in place in their emergency plans to address the conditions that would likely occur in the state in the event of a major earthquake in the New Madrid Seismic Zone. The MSP/EMHSD actively promotes these sheltering concepts in its planning guidance, training and exercising programs, and ongoing coordination activities with local emergency management programs—especially those in southern Lower Michigan. In 2011, state legislation created the Michigan Geological Survey at Western Michigan University, which then gained the responsibility for geological mapping and applied research.

Extreme Temperatures

Extreme temperatures are common in Michigan due to its Upper Midwest geographic location and proximity to the Great Lakes. Periods of extreme heat and extreme cold occur virtually every year and each phenomenon creates its own set of dangerous conditions that tend to most seriously impact the most vulnerable segments of the population—young children, the elderly, and persons in poor health. Nothing can be done to eliminate or reduce extreme temperatures; however, there are measures that can be taken to reduce the impacts of these conditions on Michigan's citizens and communities. Such measures include:

- Identification of at-risk persons, with emphasis on homebound individuals that have limited mobility and contact with the "outside world";
- Establishment of temperature and humidity trigger points that activate emergency provisions for the most at-risk groups in the community, including visits to homebound individuals;
- Good emergency planning that includes provisions for the establishment and maintenance of heating and cooling centers and temporary shelters for the most seriously affected individuals (these plans are particularly critical in urban areas and urban centers, as these areas are more likely to have larger numbers of at-risk individuals); and
- Community planning and engineering standards that require that appropriate mitigative measures be taken to prevent deep ground freeze damage to public infrastructure such as water distribution lines and sewer lines.

In general, most local communities in Michigan have adequate provisions in place in their emergency plans to address the impacts to individuals caused by extreme temperatures. The MSP/EMHSD actively promotes these sheltering concepts in its planning guidance, training and exercising programs, and ongoing coordination activities with local emergency management programs – particularly those that deal with large urban centers.

Public Infrastructure Impacts
In addition, EGLE regulates the design, construction and maintenance of community water distribution and wastewater collection and treatment systems in the state. EGLE, through its oversight and permitting processes, helps ensure that the newer elements of public water distribution and wastewater systems are able to function adequately during most periods of extreme cold temperatures. However, as was evidenced in the 1994 deep freeze in Northern Michigan (federal disaster 1028-DR-MI) and again with a state-declared deep freeze disaster in 2014, older infrastructure may not hold up as well during prolonged periods of deep ground freeze. As a result, temporary infrastructure failures due to extreme cold temperatures still occur with regularity throughout Michigan. As these older segments of the infrastructure are replaced over time, this problem is likely to decrease.

Land Subsidence
The primary historical cause of subsidence in Michigan is underground mining, although a substantial number of events have been occurring in urban areas, as a result of water main failures or construction mishaps. Although many areas of the state are potentially vulnerable to mine subsidence hazards, most communities had not identified it as a top hazard within their local plans (the main exception being some sections of the Upper Peninsula). Some specific data exists regarding the approximate locations of abandoned mines, but the data is not comprehensive and statewide. Although the amount of recent damages in urban areas now competes with the damage amounts caused by collapsing mines, the latter remains of great concern. Increased funding for urban infrastructure and maintenance would be a way to address the growing problem of urban infrastructure-related subsidence, but there is also a growing need to identify and address abandoned mine issues before those aging complexes collapse underneath cities and important roads.

Mine Subsidence Efforts
EGLE monitors and regulates mining activity in Michigan. Working with local officials and the U. S. Department of the Interior, EGLE mitigates mine subsidence problems through special projects aimed at properly sealing mine shafts and otherwise ensuring the structural integrity of underground coal mined areas. The primary federal funding source is the Abandoned Mine Lands (AML) Reclamation Fund in the Surface Mining Control and Reclamation Act (SMCRA), P.L. 95-87, administered by the U.S. Department of Interior's Office of Surface Mining Reclamation and Enforcement (OSMRE). AML funds are derived through a tax on coal production targeted at reclaiming land and water resources adversely affected by pre-1977 coal mining. These funds can also be used for mine subsidence mitigation measures and salt sealing, which Michigan has done on numerous occasions. Unfortunately, Michigan hasn't benefited from this federal funding within at least the last 10 years, and there is very limited state funding for mine subsidence mitigation. There is certainly not enough funding at this time to accomplish all of the mitigation and reclamation work that needs to be done within Michigan.

As recipient and administrator of Michigan's share of AML Fund monies, EGLE is responsible for prioritizing and selecting mitigation and reclamation projects for funding requests. Normally, priority is given to those emergency projects that involve mine lands that present an immediate danger to the public health, safety or general welfare. Typically, such emergencies include landslides near homes and across roads, subsidence occurring under houses and public buildings, mine and coal waste fires, and open mineshafts discovered near populated areas.

Despite those efforts, incidents of mine subsidence still occur with some regularity in areas with abandoned mines. Fortunately, the impact areas have so far been small and steps could usually be taken to prevent further collapse and major damage to structures.

Infrastructure-Caused Subsidence
Subsidence caused by leaking underground water and sewer lines is increasingly common in developed urban and suburban areas. This type of subsidence is difficult to detect and usually becomes known only when the collapse occurs. In most cases, whole sections of street and portions of adjacent private property are affected. Once the location of the leak is pinpointed, corrective measures can be put in place to prevent further subsidence incidents from occurring. These situations are typically handled by local public works agencies with engineering oversight provided by EGLE. There are no specific state programs designed to target this type of subsidence problem.

Sources of Hazard Mitigation Funds

This subsection of the Michigan Hazard Mitigation Plan starts by providing a comprehensive overview of hazard mitigation funding sources and projects. It can serve as a "roadmap" to more detailed information sources available on the Internet, using the Federal Assistance Listing web site at https://beta.sam.gov/, as well as numerous web sites for the federal and state agencies and private philanthropic organizations that are referred to in this section. This material supplements the descriptive section on Mitigation Opportunities, Recommendations, and Implementation, in the main body of the Plan (Chapter 9), providing detail about funding opportunities.

After an initial section that presents general techniques and resources for use in seeking and obtaining grant funding, a second section then presents funding sources for state and federal agency program information and nonprofit organizations and foundations (focusing on programs that may be useful for hazard mitigation projects). This is followed by a third section that describes the scoring and prioritization process used for project applications submitted to the State of Michigan. Finally, for a lengthy summary of all of the hazard mitigation grant projects that have gone through this selection process in Michigan, please refer to **Appendix 11**.

(NOTE: Some of the material in this appendix had originally been presented as a separate document, EMD-Pub. 207a, called "Funding Sources for Hazard Mitigation." In 2011, this material was integrated into the Michigan Hazard Mitigation Plan, and has been updated in this plan since that time.)

This subsection of the Michigan Hazard Mitigation Plan provides a compendium of federal, state, and private sector funding sources for hazard mitigation projects, and is intended to serve as a tool for local communities to use in developing funding "packages" to implement hazard mitigation projects in support of their hazard mitigation plan. It is NOT the "be-all, end-all" information source for hazard mitigation project funding. Rather, it is intended to serve as a roadmap to other, more detailed information sources such as the Federal Assistance Listing, federal and state-agency web sites, and private philanthropic organization web sites.

Funding sources open to local governments or that directly or indirectly benefit local governments, are listed in this compendium. Those programs that benefit a designated group only (i.e., Indian Tribes) are not included, nor are those programs for which a State Agency is the only eligible applicant. (However, it is possible that projects could be funded under a partnership arrangement with a State Agency. Such requests would have to be directed in writing to that agency.)

This document was compiled by personnel in the MSP/EMHSD, using available information sources at the time of publication. As new programs and funding opportunities become available in the future, every attempt will be made to revise this compendium in a timely manner (within staff capabilities and resources). If you are aware of a potential hazard mitigation funding source not listed here, please provide the information to the State and Local Planning Unit of MSP/EMHSD, for future revisions.

References to specific governmental funding programs are listed according to each agency's entry in either the Federal Assistance Listing (for federal programs) or an agency's web site (for state programs). Further instructions and information are included on web sites. Some private sector funding sources listed do not have a web site with program information, but additional information on such programs can usually be obtained through the Council of Michigan Foundations (online at http://www.cmif.org).

The mere availability of funding for mitigation projects does not guarantee success. "Grantsmanship"—the ability to formulate projects, determine probable costs, identify probable funding sources, coordinate with project "partners", and write successful project proposals—is an essential skill for today's emergency management professionals. Someone in the community has to have the "vision" to identify potential projects, handle the mechanics of obtaining funding, and then see the project through to fruition. Grantsmanship is both an art and

science. There are definite right and wrong ways to prepare project proposals. That is the science part of the equation. However, it is the "art" involved—the ability to see what others might not and then have the wherewithal to make something happen—that makes some communities successful and others not. Fortunately, technical assistance in proposal development and grant writing is available from a variety of sources. Many local communities may have their own Grants Coordinator on staff or under contract to assist local agencies in grant-related activities. Guidance on developing and writing grant proposals is also included within this section.

Two types of problems frequently appear when mitigation efforts are being considered. The first is when a planner or emergency manager doesn't even consider many mitigation possibilities because an area's hazards may seem too large-scale, expensive, or technically demanding for the resources of his or her community to address. On the other hand, you may have dared to "dream big" and produced a lengthy "wish list" of excellent hazard mitigation ideas for your community, but now you need to determine whether any of these solutions are realistically achievable within the technical and financial limits of your community's emergency management program. This section is intended to encourage planners to dare to "think big" in creating their ideas for hazard mitigation projects, and then to be able to realistically assess the feasibility of implementing these projects. This section hopes to enable you to explore a wider range of possibilities for gaining the technical and financial capabilities needed to implement your project ideas. Before you give up a great idea that you were bold enough to envision, you should read through this section to see if, just maybe, there is a way to assemble all the funding and technical requirements that will make it work. There may be cases where a proposal is rejected as *almost but not quite* feasible, because it lacks that last bit of funding or technical expertise that would ensure its viability for the community, and everyone wonders if there weren't some source of funding or expertise that could have provided the project with the last little "push" it needed to get rolling. Hopefully, the reader will gain more ideas and capability to implement his or her mitigation ideas as a result of this section.

"Start at Home"
(Local Sources of Funding and Technical Assistance for Hazard Mitigation Projects)

The hierarchy of emergency management functions in the United States is arranged so that assistance from higher levels of the hierarchy serves to supplement local resources when they would otherwise be exhausted. It is therefore important to ensure that local resources really are being fully utilized before appealing to state or federal government for assistance. It is also at the local level that the clearest picture is seen of what types of projects are needed, and for what purposes. Frequently, a great amount can be accomplished at the local level alone, as emergency managers learn to build partnerships and find creative ways to accomplish mitigation-oriented tasks in coordination with other types of community improvement projects.

It is a good idea to assess what capabilities your community currently possesses with which to carry out your mitigation project ideas, and what resources will be needed from other sources. It is essential to consider the nature of the mitigation project and its scope. Who will it affect in the community? Who will benefit the most from it? Answering these questions will often point to local people and organizations who can be asked to assist or participate in implementing the mitigation project.

Some mitigation strategies involve local ordinances or construction and safety codes. This sort of project would call for the mobilization of political and popular support to achieve the mitigation objective. Some strategies may entail a public education or awareness campaign that would involve local schools, community centers, or newspapers. Other projects may be physical construction or renovation projects that require engineering expertise and lots of funding to implement. The building of local partnerships and community awareness and support often is required for all these types of projects, and so this section will present many ideas emergency managers will want to explore from the outset. It is frequently the case that the amount of assistance available locally is far greater than that which is available from outside the community.

Building Community Awareness and Support through Volunteer Resources and Organizations

It is important to have community members aware of hazards so that they are less likely themselves to act in ways that increase risks to themselves or others, or to the community's property and environment. Community awareness and support has not only an educational and political component to it, however. Every community contains people

with a wide variety of skills and knowledge, and a willingness to help out in circumstances where they see a need for it. Advice, technical expertise, labor, and even funds might be available through the donations of community members who have come to believe in the importance of the mitigation objective that has been proposed. Individuals may be able to volunteer their knowledge and skills, labor, power, and money to support a good project. Local businesses may be willing to donate labor, materials, or funds for projects that benefit them. Many wealthy persons have been known to contribute generously to causes they believe in-especially if it benefits the community in which they live and work. More information on this aspect of fundraising can be found at http://staff.lib.msu.edu/harris23/grants/index.htm.

Contributions and volunteerism need not occur individually, but can be achieved through local community organizations that are able to inform their members about the need for the project and coordinate their members' efforts to promote the project's success. Many local organizations will be glad to participate in worthy local causes, and such participation helps strengthen their cohesion and sense of community as well. Local organizations are often experienced at fundraising, and frequently have members of local political importance who can be vital to the success of a mitigation project. Emergency managers should consider what kinds of local organizations are present in the community and how to involve them or their members in support of the proposed mitigation project.

The Use of Public/Private Partnerships

Emergency managers should also identify who the most important for-profit institutions are in the local community. Major employers, financial institutions, and insurance companies may all have an interest in supporting a mitigation project that benefits the community. (Such support is often needed to gain state or federal support for the project as well.) Often, large companies already have a corporate giving program or an associated foundation that will provide assistance. Utilities and transportation service providers should similarly be investigated to see if they can provide assistance. A large number of insurance organizations can be found listed at http://www.aiadc.org/

Gaining Assistance Through Creative Coordination with Other Projects and Local Government Functions

Many mitigation projects have elements of overlap with other projects, or coincide in some way with established goals of the community, some of its residents, or one of its governmental agencies. Emergency managers who have an ability to identify common elements that his/her mitigation project shares with other community or organizational activities will often be able to find ways to coordinate his/her mitigation efforts with those of the related activities. In some cases, the process may be very formal, as when a mitigation project is being linked in with some ongoing government function or project. In other cases, there may merely be some small alteration of an existing project to include mitigation goals (or to avoid interference with such goals).

A local government has many types of activities that often affect hazard mitigation prospects in the community, such as capital improvement projects, and initiatives for community and economic development. It may be that, after examining each other's projects, the emergency manager and some other local official will find that the two are mutually beneficial, and some degree of coordination can help everyone's resources go farther. In some cases where all that is needed is some staff time or technical advice, it may be very easy for mutual assistance to occur.

Sometimes, an important mitigation project may deserve some sort of distinct local government support mechanism. This could involve the use of government bonds to support the project, the formation of a benefit assessment district, or the adjustment of the municipal budget to provide funding for the project. In such cases, the emergency manager will benefit greatly from whatever popular and political support were gained through the building of community awareness discussed in item 1 above. More information on government bonds can be found through the Michigan Municipal Bond Authority, now part of the Michigan Finance Authority. Please see the website at https://www.michigan.gov/documents/dleg/016077-121-1753_37602_37604---001_220892_7.html.

Nonprofit Organizations and Foundations

Foundations can be investigated through the Council of Michigan Foundations (www.cmif.org) or The Foundation Center (http://fdncenter.org). There are a couple more web sites on foundations at www.cof.org and http://staff.lib.msu.edu/harris23/grants/privcomm.htm. Some foundations are private and some are company-sponsored. The National Science Foundation has an Earthquake Hazards Mitigation Program and a Natural and

Technological Hazards Mitigation Program. In addition, Michigan has a number of *community foundations*, a list of which can be found at the website listed above. If there is no such foundation for your area, perhaps one can be organized.

Not-for-profit organizations (and grant making public charities) may also be interested in helping, and at the very least tend to be excellent sources of information, advice, and favorable publicity that almost any project can benefit from. By talking with a variety of professionals, the local emergency manager will be able to assemble a lengthy list of professional organizations pertinent to local mitigation projects. Here are some examples:

- Advocates for Highway and Auto Safety
- American Institute of Architects
- American Planning Association
- American Public Works Association, Emergency Management Committee
- American Society for Civil Engineers
- Association of Contingency Planners
- Association of State Dam Safety Officials
- Association of State Floodplain Managers
- Building Officials and Code Administrators International (BOCA) – International Code Council (ICC)
- Building Seismic Safety Council
- Business and Industry Council for Emergency Planning and Preparedness
- Earthquake Engineering Research Institute
- Engineers Without Borders USA
- Institute for Business and Home Safety
- Insurance Institute for Highway Safety
- Insurance Services Office – Verisk Analytics, Inc.
- International Association of Emergency Managers (IAEM)
- International City/County Management Association
- Michigan Association of County Drain Commissioners
- Michigan Fire Chiefs Association
- Michigan State Firemen's Association
- Michigan Stormwater-Floodplain Association
- Multidisciplinary Center for Earthquake Engineering Research (MCEER)
- National Association of State Foresters
- National Emergency Management Association (NEMA)
- National Conference of States on Building Codes and Standards
- National Fire Protection Association
- National Lightning Safety Institute (NLSI)
- National Association of Abandoned Mine Land Programs
- State and Local Emergency Management Data Users Group (FEMA: HAZUS User Groups)
- U.S. Fire Administration

In the local section of this funding overview, local volunteer assistance was mentioned. It may also be possible to involve state or national volunteer groups as well. A good place to start is by contacting Michigan Voluntary Organizations Active in Disaster (MIVOAD). The National American Red Cross, religiously affiliated organizations (such as the Salvation Army or Southern Baptists Disaster Relief Services), or charitable organizations such as the United Way may also be of assistance in some cases.

Governmental Assistance

Much of the information collected here on state and federal sources of assistance can be found on the Internet. The simplest way to access information on federal government assistance is through the Federal Assistance Listing. Its web address is http://www.beta.SAM.gov. The program listings included in this document are organized by the

reference numbers used by the Federal Assistance Listing, to make it easy for anyone to locate the program in the federal catalog.

Unfortunately, the State of Michigan has no such catalog of assistance programs, making it necessary to search through information from many state agencies' web sites to come up with a list of programs. A good place to start such a general search is the Michigan Government Home Page at http://www.michigan.gov/. Click on the State Departments tab and then go to the specific agency desired.

For this document, searches were narrowed by focusing on activities that had a clear emphasis on, or applications toward, hazard mitigation and emergency management. However, it is possible that extra assistance may be obtained through programs not included here. As described in the section on local funding, it is sometimes possible to find areas where mitigation concerns overlap with other subjects, and to coordinate both concerns in existing projects funded from other sources. Consider the special features of your community that might be affected by hazards. Programs dealing with housing, farms, fisheries, natural resources, parks and wildlife, for example, may in some way be applicable to a hazard mitigation goal in your community. There are many state and federal programs and projects dealing with pollution, the environment, conservation, and economic development. Upon discussion, their administrators might approve some mitigation components in these programs/projects, or at least ensure that hazards are not worsened by program/project implementation.

Consider also the special assistance that may be available because of the presence of particular institutions or government-owned resources. The presence of a university or military installation often means many more resources that a community can use. Such institutions are often willing, able, and eager to also provide assistance on technical matters involving hazard mitigation projects which benefit to their surrounding communities whenever the chance arises. Many universities have "extension" programs whose purpose is to find and provide such beneficial services. Many technical and engineering projects can be assisted by special research grants gained through partnering with colleges and universities, or by requesting the expertise of an organization such as the U. S. Army Corps of Engineers.

Projects dealing with school (and college) improvements may have mitigation components included in them. Other institutional facilities such as prisons, nursing homes, and health care providers should also have an interest in supporting mitigation projects that affect them. Additional funding may be available in some cases when a project involves the protection of designated historic districts or other areas of cultural or economic significance. Hazards that threaten businesses and tourism might merit funding from programs whose goal is economic development (or business attraction and retention).

In addition, areas of the community that have concentrations of persons from particular ethnic groups may provide an opportunity for organizations serving that group to become involved in mitigation projects that help maintain or improve its inhabitants' quality of life. There are a number of federal programs that make assistance available to Indian tribes, for example. Consultation with any such groups in your area might reveal useful means of facilitating or promoting mitigation projects.

More Information

There are many books and documents that give more advice on ways to collect funding information, write grant proposals, and so on. The Foundation Center has a number of libraries throughout Michigan that have extensive grants and funding information. Below is a list of the general locations, with web sites. A complete list with address, phone and contact information can be found at http://staff.lib.msu.edu/harris23/grants/michigan.htm.

Foundation Center Cooperating Collections: Internet addresses

Alpena – Alpena County Library	http://www.alpenalibrary.org/special/grantseeking/grantseeking.html
Ann Arbor – U of M Graduate Library	http://guides.lib.umich.edu/grants
Battle Creek – Nonprofit Alliance Collections	http://www.willard.lib.mi.us/#
Detroit – Wayne State Purdy/Kresge Library	http://www.lib.wayne.edu/resources/guides/guide.php?id=29
East Lansing – MSU Main Library Reference	http://staff.lib.msu.edu/harris23/grants/index.htm

Farmington Hills – Community Library	http://www.farmlib.org/grants.html
Flint – U of M Flint Thompson Library	http://www.umflint.edu/library/
Fremont Area District Library	http://fremontlibrary.net/nonprofit.html
Grand Rapids – Public Library Reference Dept.	http://www.grpl.org
Kalamazoo – Public Library	http://www.kpl.gov/
Marquette – Peter White Public Library	http://www.uproc.lib.mi.us/pwpl/resources/foundation-center.html
Mason County – District Library	http://www.masoncounty.lib.mi.us/
Petoskey – Public Library	http://www.petoskeylibrary.org/inside.phtml?catid=105
Portage Lake – District Library	http://www.pldl.org/
Romeo – District Library	http://www.macomb.lib.mi.us/romeo/
Saginaw – Hoyt Public Library	http://www.saginawlibrary.org/your-library/grant-resource-center
Sault Ste. Marie – LSSU Library	http://www.lssu.edu/library/Grants.php
Traverse City – Area District Library	http://www.tadl.org/

Using Environmental and Economic Development Programs in Commercial Flood Acquisition, Relocation, and Infrastructure-Oriented Hazard Mitigation Projects*

***NOTE:** A number of federal or state administered environmental and economic development programs could possibly be used in concert with other funding sources to develop a funding "package" for implementing hazard mitigation projects. Such a project would undoubtedly be multi-objective in nature. That is, the purpose of the project would include not only hazard vulnerability reduction, but also enhancement of the environment or the community's economic development posture. When assembling such a funding "package", it is important to be flexible and creative. Projects that achieve more than one objective are almost always more desirable and beneficial than are projects that simply achieve a reduction in the community's hazard vulnerability. Although they are more difficult and take longer to implement, multi-objective projects and partnerships can help build lasting bridges between governmental agencies and between government and the private sector. Those bridges, in turn, can lead to enhanced coordination and cooperation in future community endeavors, and better integration of hazard mitigation principles and practices in day-to-day public and private sector activities.

Examples of possible commercial flood acquisition/relocation or infrastructure mitigation projects might include:

- Strengthening infrastructure that services commercial and industrial areas to prevent failure and loss of critical services.
- Creating new business sites so that existing businesses in the floodplain can be more easily relocated to less hazardous areas within the community.
- Cleaning up "brownfields" and making them into productive business sites so that businesses in the floodplain or other hazardous areas can relocate to them.
- Floodproofing or elevating existing businesses to prevent flood-related damage and negative economic impacts for the community.
- Stabilizing river and stream banks and road crossings to prevent sedimentation, reduce flood potential, and prevent the loss of roadway or other community infrastructure due to collapse from flooding.
- Constructing wetlands and retention and detention basins to manage stormwater and create wildlife habitat and environmental conservation areas.
- Stabilizing the Great Lakes shoreline property to prevent erosion, sedimentation, and possible physical damage to commercial and residential structures.
- Acquiring and demolishing waterfront structures and then using the site for other, more appropriate uses such as park and recreation land or less vulnerable commercial activities.

(See the EGLE Clean Michigan Initiative web site for a listing of implemented multi-objective projects that have a mitigation component. Address: https://www.michigan.gov/deq/0,4561,7-135-3307_3515-314499--,00.html.)

PART ONE: DEVELOPING A GRANT PROPOSAL

Preparation
A successful grant proposal is one that is well-prepared, thoughtfully planned, and concisely packaged. The potential applicant should become familiar with all of the pertinent program criteria related to the Catalog program from which assistance is sought. Refer to the information contact person listed in the Catalog program description before developing a proposal to obtain information such as whether funding is available, when applicable deadlines occur, and the process used by the grantor agency for accepting applications. Applicants should remember that the basic requirements, application forms, information and procedures vary with the federal agency making the grant award.

Individuals without prior grant proposal writing experience may find it useful to attend a grantsmanship workshop. A workshop can amplify the basic information presented here. Applicants interested in additional readings on grantsmanship and proposal development should consult the references listed at the end of this section and explore other library resources.

INITIAL PROPOSAL DEVELOPMENT

Developing Ideas for the Proposal
When developing an idea for a proposal it is important to determine if the idea has been considered in the applicant's locality or State. A careful check should be made with legislators and area government agencies and related public and private agencies which may currently have grant awards or contracts to do similar work. If a similar program already exists, the applicant may need to reconsider submitting the proposed project, particularly if duplication of effort is perceived. If significant differences or improvements in the proposed project's goals can be clearly established, it may be worthwhile to pursue federal assistance.

Community Support
Community support for most proposals is essential. Once proposal summary is developed, look for individuals or groups representing academic, political, professional, and lay organizations which may be willing to support the proposal in writing. The type and caliber of community support is critical in the initial and subsequent review phases. Numerous letters of support can be persuasive to a grantor agency. Do not overlook support from local government agencies and public officials. Letters of endorsement detailing exact areas of project sanction and commitment are often requested as part of a proposal to a federal agency. Several months may be required to develop letters of endorsement since something of value (e.g., buildings, staff, services) is sometimes negotiated between the parties involved.

Many agencies require, in writing, affiliation agreements (a mutual agreement to share services between agencies) and building space commitments prior to either grant approval or award. A useful method of generating community support may be to hold meetings with the top decision makers in the community who would be concerned with the subject matter of the proposal. The forum for discussion may include a query into the merits of the proposal, development of a contract of support for the proposal, to generate data in support of the proposal, or development of a strategy to create proposal support from a large number of community groups.

Identification of a Funding Resource
A review of the Objectives and Uses and Use Restrictions sections of the Catalog program description can point out which programs might provide funding for an idea. Do not overlook the related programs as potential resources. Both the applicant and the grantor agency should have the same interests, intentions, and needs if a proposal is to be considered an acceptable candidate for funding.

Once a potential grantor agency is identified, call the contact telephone number identified in Information Contacts and ask for a grant application kit. Later, get to know some of the grantor agency personnel. Ask for suggestions,

criticisms, and advice about the proposed project. In many cases, the more agency personnel know about the proposal, the better the chance of support and of an eventual favorable decision. Sometimes it is useful to send the proposal summary to a specific agency official in a separate cover letter, and ask for review and comment at the earliest possible convenience. Always check with the federal agency to determine its preference if this approach is under consideration. If the review is unfavorable and differences cannot be resolved, ask the examining agency (official) to suggest another department or agency which may be interested in the proposal. A personal visit to the agency's regional office or headquarters is also important. A visit not only establishes face-to-face contact, but also may bring out some essential details about the proposal or help secure literature and references from the agency's library.

Federal agencies are required to report funding information as funds are approved, increased or decreased among projects within a given State depending on the type of required reporting. Also, consider reviewing the federal Budget for the current and budget fiscal years to determine proposed dollar amounts for particular budget functions.

The applicant should carefully study the eligibility requirements for each federal program under consideration (see the Applicant Eligibility section of the Catalog program description). The applicant may learn that he or she is required to provide services otherwise unintended such as a service to particular client groups, or involvement of specific institutions. It may necessitate the modification of the original concept in order for the project to be eligible for funding. Questions about eligibility should be discussed with the appropriate program officer.

Deadlines for submitting applications are often not negotiable. They are usually associated with strict timetables for agency review. Some programs have more than one application deadline during the fiscal year. Applicants should plan proposal development around the established deadlines.

Getting Organized to Write the Proposal

Throughout the proposal writing stage keep a notebook handy to write down ideas. Periodically, try to connect ideas by reviewing the notebook. Never throw away written ideas during the grant writing stage. Maintain a file labeled "Ideas" or by some other convenient title and review the ideas from time to time. The file should be easily accessible. The gathering of documents such as articles of incorporation, tax exemption certificates, and bylaws should be completed, if possible, before the writing begins.

REVIEW

Criticism

At some point, perhaps after the first or second draft is completed, seek out a neutral third party to review the proposal working draft for continuity, clarity and reasoning. Ask for constructive criticism at this point, rather than wait for the federal grantor agency to volunteer this information during the review cycle. For example, has the writer made unsupported assumptions or used jargon or excessive language in the proposal?

Signature

Most proposals are made to institutions rather than individuals. Often signatures of chief administrative officials are required. Check to make sure they are included in the proposal where appropriate.

Neatness

Proposals should be typed, collated, copied, and packaged correctly and neatly (according to agency instructions, if any). Each package should be inspected to ensure uniformity from cover to cover. Binding may require either clamps or hard covers. Check with the federal agency to determine its preference. A neat, organized, and attractive proposal package can leave a positive impression with the reader about the proposal contents.

Mailing

A cover letter should always accompany a proposal. Standard U.S. Postal Service requirements apply unless otherwise indicated by the federal agency. Make sure there is enough time for the proposals to reach their destinations. Otherwise, special arrangements may be necessary. Always coordinate such arrangements with the

federal grantor agency project office (the agency which will ultimately have the responsibility for the project), the grant office (the agency which will coordinate the grant review), and the contract office (the agency responsible for disbursement and grant award notices), if necessary.

PART TWO: WRITING THE GRANT PROPOSAL

The Basic Components of a Proposal
There are eight basic components to creating a solid proposal package: (1) the proposal summary; (2) introduction of organization; (3) the problem statement (or needs assessment); (4) project objectives; (5) project methods or design; (6) project evaluation; (7) future funding; and (8) the project budget. The following will provide an overview of these components.

The Proposal Summary: Outline of Project Goals
The proposal summary outlines the proposed project and should appear at the beginning of the proposal. It could be in the form of a cover letter or a separate page, but should definitely be brief—no longer than two or three paragraphs. The summary would be most useful if it were prepared after the proposal has been developed in order to encompass all the key summary points necessary to communicate the objectives of the project. It is this document that becomes the cornerstone of your proposal, and the initial impression it gives will be critical to the success of your venture. In many cases, the summary will be the first part of the proposal package seen by agency officials and very possibly could be the only part of the package that is carefully reviewed before the decision is made to consider the project any further.

The applicant must select a fundable project which can be supported in view of the local need. Alternatives, in the absence of federal support, should be pointed out. The influence of the project both during and after the project period should be explained. The consequences of the project as a result of funding should be highlighted.

Introduction: Presenting a Credible Applicant or Organization
The applicant should gather data about its organization from all available sources. Most proposals require a description of an applicant's organization to describe its past and present operations. Some features to consider are:

- A brief biography of board members and key staff members.
- The organization's goals, philosophy, track record with other grantors, and any success stories.
- The data should be relevant to the goals of the federal grantor agency and should establish the applicant's credibility.

The Problem Statement: Stating the Purpose at Hand
The problem statement (or needs assessment) is a key element of a proposal that makes a clear, concise, and well-supported statement of the problem to be addressed. The best way to collect information about the problem is to conduct and document both a formal and informal needs assessment for a program in the target or service area. The information provided should be both factual and directly related to the problem addressed by the proposal. Areas to document are:

- The purpose for developing the proposal.
- The beneficiaries—who are they and how will they benefit.
- The social and economic costs to be affected.
- The nature of the problem (provide as much hard evidence as possible).
- How the applicant organization came to realize the problem exists, and what is currently being done about the problem.
- The remaining alternatives available when funding has been exhausted. Explain what will happen to the project and the impending implications.
- Most importantly, the specific manner through which problems might be solved. Review the resources needed, considering how they will be used and to what end.

There is a considerable body of literature on the exact assessment techniques to be used. Any local, regional, or State government planning office, or local university offering course work in planning and evaluation techniques should be able to provide excellent background references. Types of data that may be collected include historical, geographic, quantitative, factual, statistical, and philosophical information, as well as studies completed by colleges, and literature searches from public or university libraries. Local colleges or universities which have a department or section related to the proposal topic may help determine if there is interest in developing a student or faculty project to conduct a needs assessment. It may be helpful to include examples of the findings for highlighting in the proposal.

Project Objectives: Goals and Desired Outcome

Program objectives refer to specific activities in a proposal. It is necessary to identify all objectives related to the goals to be reached, and the methods to be employed to achieve the stated objectives. Consider quantities or things measurable and refer to a problem statement and the outcome of proposed activities when developing a well-stated objective. The figures used should be verifiable. Remember, if the proposal is funded, the stated objectives will probably be used to evaluate program progress, so be realistic. There is literature available to help identify and write program objectives.

Program Methods and Program Design: A Plan of Action

The program design refers to how the project is expected to work and solve the stated problem. Sketch out the following:

- The activities to occur along with the related resources and staff needed to operate the project (inputs).
- A flow chart of the organizational features of the project. Describe how the parts interrelate, where personnel will be needed, and what they are expected to do. Identify the kinds of facilities, transportation, and support services required (throughputs).
- Explain what will be achieved through 1 and 2 above (outputs); i.e., plan for measurable results. Project staff may be required to produce evidence of program performance through an examination of stated objectives during either a site visit by the federal grantor agency and or grant reviews which may involve peer review committees.
- It may be useful to devise a diagram of the program design. For example, draw a three-column block. Each column is headed by one of the parts (inputs, throughputs and outputs), and on the left (next to the first column) specific program features should be identified (i.e., implementation, staffing, procurement, and systems development). In the grid, specify something about the program design, for example, assume the first column is labeled inputs and the first row is labeled staff. On the grid, one might specify under inputs five nurses to operate a child care unit. The throughput might be to maintain charts, counsel the children, and set up a daily routine; outputs might be to discharge 25 healthy children per week. This type of procedure will help to conceptualize both the scope and detail of the project.
- Wherever possible, justify in the narrative the course of action taken. The most economical method should be used that does not compromise or sacrifice project quality. The financial expenses associated with performance of the project will later become points of negotiation with the federal program staff. If everything is not carefully justified in writing in the proposal, after negotiation with the federal grantor agencies, the approved project may resemble less of the original concept. Carefully consider the pressures of the proposed implementation, that is, the time and money needed to acquire each part of the plan. A Program Evaluation and Review Technique (PERT) chart could be useful and supportive in justifying some proposals.
- Highlight the innovative features of the proposal which could be considered distinct from other proposals under consideration.
- Whenever possible, use appendices to provide details, supplementary data, references, and information requiring in-depth analysis. These types of data, although supportive of the proposal, if included in the body of the design, could detract from its readability. Appendices provide the proposal reader with immediate access to details if and when clarification of an idea, sequence or conclusion is required. Time tables, work plans, schedules, activities, methodologies, legal papers, personal vitae, letters of support, and endorsements are examples of appendices.

Evaluation: Product and Process Analysis
The evaluation component is two-fold: (1) product evaluation; and (2) process evaluation. Product evaluation addresses results that can be attributed to the project, as well as the extent to which the project has satisfied its desired objectives. Process evaluation addresses how the project was conducted, in terms of consistency with the stated plan of action and the effectiveness of the various activities within the plan.

Most federal agencies now require some form of program evaluation among grantees. The requirements of the proposed project should be explored carefully. Evaluations may be conducted by an internal staff member, an evaluation firm or both. The applicant should state the amount of time needed to evaluate, how the feedback will be distributed among the proposed staff, and a schedule for review and comment for this type of communication. Evaluation designs may start at the beginning, middle or end of a project, but the applicant should specify a start-up time. It is practical to submit an evaluation design at the start of a project for two reasons:

- Convincing evaluations require the collection of appropriate data before and during program operations; and,
- If the evaluation design cannot be prepared at the outset then a critical review of the program design may be advisable.

Even if the evaluation design has to be revised as the project progresses, it is much easier and cheaper to modify a good design. If the problem is not well defined and carefully analyzed for cause-and-effect relationships then a good evaluation design may be difficult to achieve. Sometimes a pilot study is needed to begin the identification of facts and relationships. Often a thorough literature search may be sufficient.

Evaluation requires both coordination and agreement among program decision makers (if known). Above all, the federal grantor agency's requirements should be highlighted in the evaluation design. Also, federal grantor agencies may require specific evaluation techniques such as designated data formats (an existing information collection system) or they may offer financial inducements for voluntary participation in a national evaluation study. The applicant should ask specifically about these points. Also, consult the Criteria for Selecting Proposals section of the Catalog program description to determine the exact evaluation methods to be required for the program if funded.

Future Funding: Long-Term Project Planning
Describe a plan for continuation beyond the grant period, and/or the availability of other resources necessary to implement the grant. Discuss maintenance and future program funding if program is for construction activity. Account for other needed expenditures if program includes purchase of equipment.

The Proposal Budget: Planning the Budget
Funding levels in federal assistance programs change yearly. It is useful to review the appropriations over the past several years to try to project future funding levels (see the Financial Information provided by the Federal Assistance Listing).

However, it is safer to never anticipate that the income from the grant will be the sole support for the project. This consideration should be given to the overall budget requirements, and in particular, to budget line items most subject to inflationary pressures. Restraint is important in determining inflationary cost projections (avoid padding budget line items), but attempt to anticipate possible future increases.

Some vulnerable budget areas are: utilities, rental of buildings and equipment, salary increases, food, telephones, insurance, and transportation. Budget adjustments are sometimes made after the grant award, but this can be a lengthy process. Be certain that implementation, continuation and phase-down costs can be met. Consider costs associated with leases, evaluation systems, hard/soft match requirements, audits, development, implementation and maintenance of information and accounting systems, and other long-term financial commitments.

A well-prepared budget justifies all expenses and is consistent with the proposal narrative. Some areas in need of an evaluation for consistency are: (1) the salaries in the proposal in relation to those of the applicant organization should be similar; (2) if new staff persons are being hired, additional space and equipment should be considered, as necessary; (3) if the budget calls for an equipment purchase, it should be the type allowed by the grantor agency; (4) if additional space is rented, the increase in insurance should be supported; (5) if an indirect cost rate applies to the proposal, the division between direct and indirect costs should not be in conflict, and the aggregate budget totals should refer directly to the approved formula; and (6) if matching costs are required, the contributions to the matching fund should be taken out of the budget unless otherwise specified in the application instructions.

It is very important to become familiar with Government-wide circular requirements. The Federal Assistance Listing identifies in its program description section (as information is provided from the agencies) the particular circulars applicable to a federal program, and summarizes the coordination of Executive Order 12372, "Intergovernmental Review of Programs" requirements in an appendix. The applicant should thoroughly review the appropriate circulars since they are essential in determining items such as cost principles and conforming to Government guidelines for federal domestic assistance.

GUIDELINES AND LITERATURE

United States Government Manual
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

OMB Circular Nos. A-87, A-102, A-110, and A-133, and Executive Order 12372:
Publications Office
Office of Administration
Room 2200, 725 Seventeenth Street, NW.
Washington, DC 20503

Government Printing Office (GPO) Resources
The government documents identified above as available from the GPO can be requested (supply the necessary identifying information) by writing to:

Superintendent of Documents
Government Printing Office
Washington, DC 20402

Regional and Federal Depository Libraries

Regional libraries can arrange for copies of Government documents through an interlibrary loan. All Federal Depository Libraries will receive copies of the Catalog directly. A list of depository and regional libraries is available by writing: Chief, Library Division, Superintendent of Documents, Stop SLL, Washington, DC 20402.

STATE AGENCY HAZARD MITIGATION FUNDING PROGRAMS

The following page presents a table that summarizes Michigan programs potentially available to support hazard mitigation activities.

STATE AGENCY HAZARD MITIGATION FUNDING PROGRAMS

Funding Sources for Hazard-Specific Measures	Drought	Earthquake	Extreme Temperatures	Wildfire	Dam Failure	Riverine Flooding	Great Lakes Shoreline Flooding and Erosion	Subsidence	Hail	Lightning	Severe Wind	Tornadoes	Ice and Sleet Storms	Snowstorms	FINANCIAL ASSISTANCE	TECHNICAL ASSISTANCE
MICHIGAN DEPARTMENT OF AGRICULTURE																
Conservation Reserve Enhancement Program (CREP)						X	X				X				X	X
Intercounty Drain Program (Available to drain commissioners only)					X	X										X
MICHIGAN DEPT. OF ENVIRONMENTAL QUALITY																
Coastal Management Program							X								X	X
Michigan Great Lakes Protection Fund							X								X	
State Revolving Fund (Loan)						X									X	
Wetland Program Development (USEPA) (see CFDA 66.461)						X	X								X	
MICHIGAN DEPT. OF NATURAL RESOURCES																
Land & Water Conservation Fund						X	X								X	
Michigan Habitat Improvement Fund Project Grants						X									X	
Michigan Natural Resources Trust Fund				X		X									X	
Michigan Volunteer Fire Assistance				X											X	
Snowmobile and ORV Trail Improvement Program						X	X								X	
Outdoor Recreation and Legacy Partnership Program						X	X			X	X	X			X	
Land and Water Conservation Fund						X	X			X	X	X				
Community Forestry Program											X	X	X		X	X
MICHIGAN DEPARTMENT OF STATE POLICE																
Emergency Management Performance Grants (see CFDA 97.042)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Flood Mitigation Assistance (see CFDA 97.029)						X	X								X	
Hazard Mitigation Grant Program (see CFDA 97.039)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Federal Disaster Assistance to Individuals and Households in Presidential Declared Disaster Areas (see CFDA 97.048)		X		X		X	X	X			X	X			X	
Presidential Declared Disaster Assistance - Disaster Housing Operations For Individuals And Households (CFDA 97.049)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Presidential Declared Disaster Assistance To Individuals And Households - Other Needs (see CFDA 97.050)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Disaster Grants-Public Assistance (Presidentially Declared Disasters) (see CFDA 97.036)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Pre-Disaster Mitigation (see CFDA 97.047)			X	X		X	X				X	X			X	
Severe Loss Repetitive Program (see CFDA 97.110)						X	X								X	
Repetitive Flood Claims (see CFDA 97.092)						X	X								X	
MICHIGAN DEPARTMENT OF TRANSPORTATION																
Transportation Economic Development Fund						X	X								X	
MICHIGAN ECONOMIC DEVELOPMENT CORP																
Community Development Block Grant Program (also see 14.218 and 14.228 in CFDA) Some are Disaster Resilience (DR) grants.						X	X								X	
Urban Land Assembly						X	X								X	
MICHIGAN STATE HOUSING DEVELOPMENT AUTHORITY																
CDBG Housing Resource Fund (Inc HOME) (CFDA 14.239)						X	X		X		X	X			X	
Home/Property Improvement Loans						X	X		X		X	X			X	
MICHIGAN DEPARTMENT OF TREASURY																
Michigan Finance Authority-Local Gov't Loan Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Michigan Finance Authority-State Aid Note Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

FEDERAL AGENCY HAZARD MITIGATION FUNDING PROGRAMS (FROM THE FEDERAL ASSISTANCE LISTING)

Federal Assistance Listing:
Index of Agencies

Agency Code	Agency
10	U.S. Department of Agriculture
11	U.S. Department of Commerce
12	U.S. Department of Defense
14	U.S. Department of Housing and Urban Development
15	U.S. Department of the Interior
47	National Science Foundation
59	Small Business Administration
66	U.S. Environmental Protection Agency
81	U.S. Department of Energy
97	Department of Homeland Security

FEDERAL HAZARD MITIGATION FUNDING SOURCES

Funding Sources for Hazard-Specific Measures	Drought	Earthquake	Extreme Temperatures	Wildfire	Dam Failure	Riverine Flooding	Gt Lakes Shoreline Flooding / Erosion	Subsidence	Hail	Lightning	Severe Wind	Tornadoes	Ice and Sleet Storms	Snowstorms	FINANCIAL ASSISTANCE	TECHNICAL ASSISTANCE
10.054 Emergency Conservation Program	X					X					X	X			X	
10.069 Conservation Reserve Program						X					X	X			X	X
10.202 Cooperative Forestry Research				X							X	X			X	
10.410 Very Low to Moderate Income Housing Loans			X	X		X	X	X	X	X	X	X			X	
10.417 Very Low Income Housing Repair Loans/Grants			X	X		X	X	X	X	X	X	X			X	
10.652 Forestry Research						X	X				X	X			X	
10.664 Cooperative Forestry Assistance				X											X	
10.760 Water & Waste Disposal Sys. for Rural Comm.						X	X								X	
10.763 Emergency Community Water Assistance Grants	X					X	X								X	
10.766 Community Facilities Loans & Grants	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
10.768 Business and Industry Loans	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
10.770 Water/Waste Disposal Loans/Grants						X	X								X	
10.773 Rural Business Opportunity Grants						X	X								X	
10.850 Rural Electrification Loans and Loan Guarantees										X	X	X	X	X	X	
10.902 Soil and Water Conservation	X	X	X	X		X	X									X
10.904 Watershed Protection and Flood Prevention					X	X	X								X	X
11.300 Investments for Public Works and Economic Development Facilities					X	X	X								X	
11.303 Economic Development Technical Assistance						X	X								X	X
11.307 Economic Adjustment Assistance					X	X	X				X	X			X	
11.419 Coastal Zone Mgmt. Administration Awards							X									X
11.462 Hydrologic Research	X				X	X	X								X	
11.463 Habitat Conservation							X								X	
11.478 Center for Sponsored Coastal Ocean Research Coastal Ocean Program							X								X	
12.101 Beach Erosion Control Projects							X								X	

FEDERAL HAZARD MITIGATION FUNDING SOURCES (pg. 2)

Funding Sources for Hazard-Specific Measures	Drought	Earthquake	Extreme Temperatures	Wildfire	Dam Failure	Riverine Flooding	Gt Lakes Shoreline Flooding / Erosion	Subsidence	Hail	Lightning	Severe Wind	Tornadoes	Ice and Sleet Storms	Snowstorms	FINANCIAL ASSISTANCE	TECHNICAL ASSISTANCE
12.102 Emergency Rehabilitation of Flood Control Works or Federally Authorized Coastal Protection Works					X	X	X								X	
12.103 Emergency Operations Flood Response & Post-Flood Response					X	X	X								X	
12.104 Flood Plain Management Services					X	X	X									X
12.105 Protection of Essential Highways, Highway Bridge Approaches, and Public Works					X	X	X								X	
12.106 Flood Control Projects					X	X	X								X	
12.108 Snagging and Clearing for Flood Control					X	X	X								X	
12.109 Protection, Clearing and Straightening Channels						X	X								X	
12.111 Emergency Advance Measures for Flood Protection					X	X	X								X	
14.218 Community Development Block Grants/Entitlement Grants	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
14.228 Community Development Block Grants-State's Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
14.239 HOME Investment Partnerships Program						X	X		X	X	X	X			X	
15.623 North American Wetlands Conservation Fund						X	X								X	
15.904 Historic Preservation Fund Grants-In-Aid						X	X	X	X	X	X	X	X	X		X
15.916 Outdoor Recreation-Acquisition, Development and Planning (Land and Water Conservation Fund Grants)						X	X								X	
15.918 Disposal of Federal Surplus Real Property for Parks, Recreation, and Historic Monuments						X	X									
15.921 Rivers, Trails, and Conservation Assistance						X	X									X
47.041 Engineering Grants	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
59.008 Disaster Assistance Loans		X		X		X	X	X	X	X	X	X	X	X	X	
66.461 Regional Wetlands Program Development Grants						X	X								X	

FEDERAL HAZARD MITIGATION FUNDING SOURCES (pg. 3)

Funding Sources for Hazard-Specific Measures	Drought	Earthquake	Extreme Temperatures	Wildfire	Dam Failure	Riverine Flooding	Gt Lakes Shoreline Flooding / Erosion	Subsidence	Hail	Lightning	Severe Wind	Tornadoes	Ice and Sleet Storms	Snowstorms	FINANCIAL ASSISTANCE	TECHNICAL ASSISTANCE
66.469 Great Lakes Program							X								X	
81.042 Weatherization Assistance for Low-Income Persons			X												X	
97.018 National Fire Academy Training Assistance				X												X
97.022 Flood Insurance						X	X									X
97.023 Community Assistance Program - State Support Services Element (NFIP)						X	X									X
97.024 Emergency Food and Shelter National Board Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.026 Emergency Management Institute-Training Assistance	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
97.028 Emergency Management Institute-Resident Education Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
97.029 Flood Mitigation Assistance						X	X								X	
97.030 Community Disaster Loans	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.036 Disaster Grants - Public Assistance (Presidentially Declared Disasters)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.039 Hazard Mitigation Grant Program	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.041 National Dam Safety Program					X											X
97.042 Emergency Management Performance Grants	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.044 Assistance to Firefighters Grant				X											X	
97.045 Cooperating Technical Partners						X	X								X	
97.046 Fire Management Assistance Grant				X											X	
97.047 Pre-Disaster Mitigation		X		X		X	X	X			X	X			X	
97.048 Federal Disaster Assistance to Individuals and Households in Presidential Declared Disaster Areas	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

FEDERAL HAZARD MITIGATION FUNDING SOURCES (pg. 4)

Funding Sources for Hazard-Specific Measures	Drought	Earthquake	Extreme Temperatures	Wildfire	Dam Failure	Riverine Flooding	Gt Lakes Shoreline Flooding / Erosion	Subsidence	Hail	Lightning	Severe Wind	Tornadoes	Ice and Sleet Storms	Snowstorms	FINANCIAL ASSISTANCE	TECHNICAL ASSISTANCE
97.050 Presidential Declared Disaster Assistance to Individual and Households - Other Needs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
97.092 Repetitive Flood Claims						X	X								X	
97.110 Severe Repetitive Loss Program						X	X								X	

The key FEMA programs that are dedicated specifically to hazard mitigation projects are summarized and explained on the following pages.

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) was created by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (PL 93-288, as amended). The HMGP provides funding for states and local communities to implement long-term hazard mitigation measures that reduce or eliminate risk to people and property from natural hazards and their effects. Funding for Michigan's HMGP is made available following a federal Major Disaster Declaration in the state. The amount available to the State for HMGP projects is based on 15% of the federal funds expended on the Public and Individual Assistance programs for the disaster, with an option to increase that amount to 20% with an approved "enhanced" state mitigation plan in place. The objective of the HMGP is to protect lives and property and significantly reduce or eliminate future disaster expenditures.

HMGP grants can be awarded to eligible applicants throughout the state, regardless of the boundaries of the disaster declaration. Eligible applicants include state agencies, local governments, certain private non-profit organizations, and Indian Tribes or authorized tribal organizations. Federal funds are available for up to 75% of eligible project costs ONLY for those applicants that have in place or are covered under an approved hazard mitigation plan that meets the requirements of the federal Disaster Mitigation Act (DMA) of 2000. The remainder of the cost for the project is the responsibility of the applicant.

The HMGP can be used to fund projects to protect either public or private property. Examples of the types of projects that can be funded by the HMGP include, but are not limited to:

- Voluntary acquisition or elevation of flood-prone structures
- Stormwater management projects that reduce flood risk
- Protective measures for utility infrastructure
- Vegetation management for dune restoration or wildfire prevention
- Construction of safe rooms
- Retrofitting structures for wind protection
- Development of community hazard mitigation plans (or the update of an existing hazard mitigation plan)

Applicants must apply for the HMGP through the MSP/EMHSD. The MCCERCC will set priorities for the HMGP following a disaster declaration. Based on those priorities, notification of available funding will be made to appropriate entities and organizations. The MCCERCC will review and prioritize eligible applications. Selected formal project applications will then be submitted by the MSP/EMHSD to FEMA for final funding approval.

Following a disaster declaration, prospective applicants, if not notified of available HMGP funds, may want to contact their local office of emergency management to see if HMGP funds are available. For additional information about the HMGP contact Matt Schnepp, State Hazard Mitigation Officer, by phone at (517) 284-3950 or by e-mail at schneppm1@michigan.gov.

Flood Mitigation Assistance Program

On September 23, 1994, the National Flood Insurance Reform Act (NFIRA) was signed into law. The purpose of the NFIRA is to improve the financial condition of the National Flood Insurance Program (NFIP) and to reduce the federal expenditures for federal disaster assistance to flood damaged properties. With the passage of the NFIRA, Congress authorized the establishment of a federal grant program to provide financial assistance to states and local communities for flood mitigation planning and activities. (Note: Flood mitigation is defined as any action taken before, during or after a flood to permanently eliminate or reduce the long-term risk to human life and property.) FEMA has designated this as the Flood Mitigation Assistance Program (FMAP). Under the FMAP, FEMA provides assistance to states and local communities for activities that will reduce the risk of flood damage to structures insurable under the NFIP.

The FMAP is a state administered, cost-sharing program through which the States and communities can receive grants for flood mitigation activities. FEMA encourages the State to assist the local community in prioritizing mitigation activities outlined in their hazard mitigation plan and to fund projects that will greatly reduce the risk of flood damage to buildings, manufactured homes and other NFIP-insurable structures. Mitigation of substantially damaged and repetitive loss structures is a high priority.

Mitigation measures under the FMAP are funded on a 75% federal / 25% non–federal basis. (Note: Unless by special appropriation of the Michigan Legislature, no state funding will be used for the 25% match. Contributions of other state agencies may be used as an in-kind contribution toward the 25% match.)

Applications for FMAP grants are made via the federal E-Grants system. The MCCERCC reviews all of the applications received and prioritizes applications. FEMA makes final project selections and approvals. For additional information about the FMAP contact Matt Schnepp, State Hazard Mitigation Officer, by phone at (517) 284-3950, facsimile at (517) 333-4987, or e-mail at schneppm1@michigan.gov.

Pre-Disaster Mitigation Program

The Pre-Disaster Mitigation Program (PDMP) provides funding to states and local communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property. The PDMP was authorized by Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Section 102 of the Disaster Mitigation Act of 2000. The PDMP is an annually appropriated, nationally competitive grant program.

States, local communities, and Indian Tribes can receive grants for mitigation activities such as planning and the implementation of projects identified through the evaluation of natural hazards. FEMA will set priorities for each appropriation of the PDMP. Eligible activities for the PDMP may include:

- Voluntary acquisition or elevation of flood-prone structures
- Stormwater management projects that reduce flood risk
- Protective measures for utility infrastructure
- Vegetation management for dune restoration or wildfire prevention
- Construction of safe rooms
- Retrofitting structures for wind protection
- Development of community hazard mitigation plans (or the update of an existing hazard mitigation plan)

Mitigation measures under the PDMP are funded on a 75% federal / 25% non–federal basis. (Note: Unless by special appropriation of the Michigan Legislature, no state funding will be used for the 25% match. Contributions of other state agencies may be used as an in-kind contribution toward the 25% match.) Grants to small and impoverished communities may receive a federal cost share of up to 90% of the total cost to implement eligible PDMP activities.

Applications for PDMP grants are made via the federal E-Grants system. The MCCERCC reviews all of the applications received and prioritizes applications. The MCCERCC priority order is a factor in the national competitive grant review and scoring process. FEMA makes final project selections and approvals. For additional information about the PDMP contact Matt Schnepp, State Hazard Mitigation Officer, by phone at (517) 284-3950 or by e-mail at schneppm1@michigan.gov.

The tables in **Appendix 11** demonstrate that FEMA's various HMA programs have been successfully used to fund a wide variety of mitigation measures in Michigan, ranging from small, localized measures up to and including statewide initiatives. Please note that most dollar amounts in those tables represent complete grant totals. However, in cases where a grant was still active at the time of the table's update, the amounts indicated in the tables represent projected amounts from the approved grant application.

Project Prioritization Criteria

A project will be evaluated based on the following criteria:

- The project demonstrates sound hazard mitigation techniques.
- The project is listed in the applicable local hazard mitigation plan.
- The project supports the Michigan Hazard Mitigation Plan.
- The project meets the required eligibility criteria.
- The project is suitable for funding under the HMGP, FMAP, or PDMP rather than other funding programs.
- The project is consistent with the MCCERCC approved strategy for the federally declared disaster (if applicable).
- The project completely or substantially solves the problem.
- The project provides a permanent or long-term solution.
- The project is likely to be cost-effective based on physical damages prevented. (NOTE: structures that were officially designated as "repetitive loss properties" or "severe repetitive loss properties" have already been identified from an NFIP perspective as meriting flood mitigation activities, and Michigan has tended to agree with and actively support such classifications and efforts, as described earlier in this appendix under the subsection called "Repetitive Losses.")
- The project will not create negative environmental effects.
- The project is consistent with other projects, initiatives, and state agency priorities.
- Communities with the highest risk.
- Communities with the greatest number of repetitive loss properties.
- Communities with the greatest number of NFIP insured structures.
- Communities with the most intense development pressures.
- Communities with the largest increases in population and/or physical development.
- Communities that have the ability to successfully implement hazard mitigation projects within the required timeframes.
- Communities that have expressed interest in hazard mitigation activities.

Project Eligibility Criteria

FEMA considers a project eligible for HMGP, FMAP, or PDMP funding only if the project:

- Conforms to the State Hazard Mitigation Plan.
- Conforms to environmental laws and regulations.
- Is cost-effective.
- Solves a problem independently or constitutes a functional portion of a solution.
- Cannot be funded by another program.
- The applicant community is a member, in good standing, of the NFIP (flood related projects only).
  *Note – technical study type projects may be eligible for funding if they are accompanied by a second project (phase II) for construction measures that are developed and determined eligible by the study project (phase I).

Eligible Project Types
Following is a list of potentially eligible project types as outlined in federal guidance (this list is not all inclusive):

- **Acquisition of real property** in a hazard area; **physical relocation of structures** from a hazard area.
- **Elevation of structures** in compliance with federal, state and local ordinances.
- **Retrofit of structures** – wet or dry floodproofing (according to local code and building standards, compliant with NFIP standards); high wind bracing; seismic strengthening of structures or their non-structural components; application of wildfire resistant materials; and structural fire safety measures.
- **Minor structural flood risk reduction measures** – debris basins; stormwater detention basins or infiltration wells; culvert upgrades; diversions; flapgates or floodgates; localized flood risk reduction system to protect critical facilities.
- **Vegetation management** – natural windbreaks; living snow fences; shoreline stabilization; natural stabilization; wildfire defensible space, etc.
- **Phase I or II design, engineering or feasibility study** for complex mitigation projects that are reasonably expected to be funded and implemented.

Explanation: Complete Solution
Approved projects should either completely solve a site-specific problem or be an element of a larger solution where there is assurance of project completion.

Explanation: Long-term Solution
Mitigation measures funded under the HMGP, FMAP, and PDMP are intended to provide a long-term or permanent solution. Ideally, the measure would be effective for the life of the property being protected. (For example, erecting an emergency berm on a beach to prevent wave damage to structures is a short-term solution, as opposed to a long-term solution such as elevation or relocation of the structures.)

Explanation: Cost Effective
For a project to be considered cost effective, the benefits gained by completing the project must be greater than the cost of the project. Cost effectiveness should take into account the following:

- The cost to complete the project.
- The life of the project.
- Past damages that have resulted from the situation that will be mitigated as a result of the project.
- The frequency and extent of damage that is likely to occur if the project is not completed.
- Annual costs of maintaining the project.

Explanation: Environmental Effects
All HMGP, FMAP, and PDMP projects must be in conformance with applicable environmental laws and regulations, including but not limited to:

- The National Environmental Policy Act.
- The National Historic Preservation Act.
- The Endangered Species Act.
- Executive Order 11988, Floodplain Management.
- Executive Order 11990, Protection of Wetlands.
- Executive Order 12898, Environmental Justice.

(Note: a project should not create an environmental problem or shift a hazard to a new location.)

Explanation: Consistent with Other Initiatives
HMGP, FMAP, and PDMP projects should be complementary to other mitigation projects, initiatives, and state agency priorities. At a minimum, projects should not undermine other identified mitigation priorities and activities.

Mitigation Grant Programs Project Prioritization Scoring Matrix

Project	Is the Project Mitigation? Y/N	Does it Support the MHMP? Y/N	Is it an Eligible Project? Y/N	Other Available Funding Sources?	Consistent with MCCERCC Priorities for this Federal Disaster?	Complete Solution?	Long-term Solution?	Cost Effective?	Environmentally Sound?	Consistent with other initiatives?	Total Score
	If yes, continue	If yes, continue	If yes, continue	If no, continue	1-5	1-5	1-5	1-5	1-5	1-5	

RESPONSE KEY:
5 = Strongly Agree
4 = Agree
3 = Neither Agree or Disagree (Neutral)
2 = Disagree
1 = Strongly Disagree

Appendix 11: Summary of Past Hazard Mitigation Projects

I. Summary of Past Hazard Mitigation Assistance (HMA): Project and Planning Grants Funded in Michigan

Hazard Mitigation Grant Program (HMGP) Projects

Federal Disaster #1028: 1994 Northern Michigan Deep Freeze
Federal Disaster #1128: 1996 East Michigan Tornado and Flooding
Federal Disaster #1181: 1997 Southeast Michigan Tornadoes and Flooding
Federal Disaster #1226: 1998 West Michigan Windstorm
Federal Disaster #1237: 1998 Detroit Area Windstorm
Federal Disaster #1346: 2000 Detroit Area Urban Flooding
Federal Disaster #1413: 2002 Central and Western Upper Peninsula Flooding
Federal Disaster #1527: 2004 Southern Michigan Severe Storms and Flooding
Federal Disaster #1777: 2008 Central Michigan Severe Storms and Flooding
Federal Disaster #4121: 2013 Central Michigan and Western Upper Peninsula Flooding
Federal Disaster #4195: 2014 Detroit Area Urban Flooding

Flood Mitigation Assistance Program (FMAP) Projects

Planning, Technical Assistance, and Project Grants Awarded
During Fiscal Years 1996-2015

Pre-Disaster Mitigation Program (PDMP) Projects

PDMP Planning and Project Grants Awarded
During Fiscal Years 2002-2017

Repetitive Flood Claims Program (RFCP) Projects

RFCP Project Grant Awarded
During Fiscal Year 2006 and 2012

II. Summary of Public Assistance, Section 406 Mitigation

Federal Disaster #4121
Federal Disaster#4195

NOTE: In addition to the descriptions on the following pages, a single grant was received by the City of Detroit in 2015, from the CDBG-DDR grant (not to be confused with CDBG-DR), which targeted stormwater management flood prevention activities and was specially awarded from recaptured CDBG funds, for the purpose of addressing recovery efforts from major disasters (in this case, federal disaster #4195). This Detroit grant of $8,900,000 was initially targeted toward 4 specific areas, and was then expanded, as documented in the program update description available online at https://detroitmi.gov/media/22991.

Hazard Mitigation Grant Program: Disaster #1028, Underground Freeze, 12/93-5/94

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Village of South Range	Houghton	1028.001	4th Street watermain/service replacements	$86,642	$28,880	$115,522
Village of Boyne Falls	Charlevoix	1028.002	Railroad Street watermain replacement	$44,991	$14,996	$59,987
City of Escanaba	Delta	1028.003	Sewer freeze protection - various locations	$9,432	$3,143	$12,575
Village of Lake Linden	Houghton	1028.005	Osceola/Pine Street watermain replacements	$48,630	$16,209	$64,839
City of Ironwood	Gogebic	1028.007	Cherry Place water main replacement	$66,810	$22,270	$89,080
City of Ironwood	Gogebic	1028.008	Rowe Street watermain/service replacements	$22,354	$7,450	$29,804
City of Ironwood	Gogebic	1028.009	Bonnie Street sewer insulation	$4,380	$1,460	$5,840
City of Ironwood	Gogebic	1028.01	Bundy Street sewer insulation	$4,490	$1,495	$5,985
City of Ishpeming	Marquette	1028.011	Willow Street water line improvements	$18,037	$6,011	$24,048
City of Ishpeming	Marquette	1028.012	Bessemer/Iron Street water line improvement	$57,570	$19,188	$76,758
City of Ishpeming	Marquette	1028.013	Davis Street water line improvement	$71,985	$23,994	$95,979
City of Ishpeming	Marquette	1028.014	Elm Street water line improvement	$47,324	$15,773	$63,097
City of Marquette	Marquette	1028.015	Pine Street/Kaye Avenue/Russell Street water/sewer replacement	$50,200	$350,834	$401,034

Hazard Mitigation Grant Program: Disaster #1028, Underground Freeze, 12/93-5/94 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
City of Boyne City	Charlevoix	1028.016	Clarke Street watermain replacement	$4,212	$1,404	$5,616
City of Boyne City	Charlevoix	1028.017	Elm Street sewermain replacement	$19,500	$6,499	$25,999
City of Boyne City	Charlevoix	1028.018	Clarke Street sewermain replacement	$3,039	$1,011	$4,050
City of Boyne City	Charlevoix	1028.019	Bailey Street watermain replacement	$18,605	$6,201	$24,806
City of Boyne City	Charlevoix	1028.02	West/Trent Street watermain replacement	$22,223	$7,406	$29,629
			Total for Disaster #1028:	**$600,424**	**$534,224**	**$1,134,648**

Hazard Mitigation Grant Program: Disaster #1128, Tornado and Flooding, 6/21-23/96

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Flint River Dike and Erosion Control Board	Saginaw	1128.002	Reconstruct sections of Flint River Dike	$90,000	$51,820	$141,820
City of Marlette	Sanilac	1128.003	Construct retention pond near William Little Subdivision	$371,250	$238,800	$610,050
Michigan Department of Agriculture & Rural Devel.	(State Agency)	1128.004	Digitize soil data for seven-county area	$146,245	$95,436	$241,681
Bay County Drain Commission	Bay	1128.005	Garfield Subdivision area flood relief project	$79,022	$22,243	$101,265
Bridgeport Charter Twp.	Saginaw	1128.006	Repair bank and install rip-rap along Cass River	$26,081	$8,919	$35,000
Midland County Drain Commission	Midland	1128.007	Reconstruct Lingle Drain outlet	$36,000	$17,874	$53,874
Saginaw County Road Commission	Saginaw	1128.008	River Road bank stabilization	$172,500	$204,137	$376,637
Bay Area Family "Y" Center	Bay	1128.009	Elevate 2 boiler control boxes in basement	$5,700	$1,900	$7,600
Saginaw County Road Commission	Saginaw	1128.010	Dixie Highway shoulder stabilization	$7,500	$3,763	$11,263
City of Frankenmuth	Tuscola	1128.012	Install sheetpile wall and rehabilitate/stabilize bank of Cass River	$142,500	$65,249	$207,749
City of Bay City	Bay	1128.013	Floodproof city wastewater treatment plant	$389,912	$129,971	$519,883
Bay County Road Commission	Bay	1128.014	Shoulder stabilization on Youngs Ditch Road	$92,954	$30,985	$123,939

Hazard Mitigation Grant Program: Disaster #1128, Tornado and Flooding, 6/21-23/96 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Bay County Road Commission	Bay	1128.015	Shoulder stabilization for Kinney Road	$16,227	$5,408	$21,635
Tuscola County Drain Commission	Tuscola	1128.016	Coleman Drainage District improvements	$123,500	$65,389	$188,889
City of Midland	Midland	1128.020	Acquisition and relocation of business out of Tittabawassee River floodplain **(Project cancelled by company)**	$11,250	$3,750	$15,000
			Total for Disaster #1128:	**$1,710,641**	**$945,644**	**$2,656,285**

Hazard Mitigation Grant Program: Disaster #1181, Tornado and Flooding, 7/2/97

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Michigan Department of Agriculture & Rural Devel.	(Statewide)	1181.001	Digitize soil survey data for four county area	$112,500	$88,672	$201,172
City of Hamtramck	Wayne	1181.003	Install warning siren	$15,064	$5,022	$20,086
Genesee County	Genesee	1181.004	Install additional radio activated warning notifiers	$4,890	$1,630	$6,520
City of River Rouge	Wayne	1181.005	Install early warning system	$9,375	$3,592	$12,967
Wayne County Emergency Management Division	Wayne	1181.006	Purchase and distribute NOAA weather radios to schools, hospitals and nursing homes	$15,737	$5,246	$20,983
Groveland Township	Oakland	1181.007	Install three warning sirens	$38,250	$12,750	$51,000
Macomb County	Macomb	1181.008	Install county Emergency Alert System	$10,481	$6,141	$16,622
City of Detroit Neighborhood City Halls	Wayne	1181.009	Implement long-term community outreach	$2,250	$757	$3,007
City of Plymouth	Wayne	1181.012	Install warning sirens	$9,750	$8,220	$17,970
Arenac County Emergency Management	Arenac	1181.013	Install early warning system	$45,000	$30,541	$75,541
Macomb County	Macomb	1181.014	Develop a family preparedness public information program	$4,144	$1,381	$5,525
Michigan Department of Natural Resources	(Statewide)	1181.015	Develop and deliver urban forestry educational program	$15,000	$16,237	$31,237
City of Flint	Genesee	1181.016	Acquire and relocate five flood-prone houses in repetitive flood area	$237,702	$79,234	$316,936

Hazard Mitigation Grant Program: Disaster #1181, Tornado and Flooding, 7/2/97 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
City of Flint	Genesee	1181.017	Acquire and relocate 16 flood-prone houses in repetitive flood area	$192,862	$64,287	$257,150
City of Flint	Genesee	1181.018	Acquire and relocate eight flood-prone houses in repetitive flood area	$359,785	$119,928	$479,714
Brownstown Charter Twp.	Wayne	1181.020	Elevate 12 flood-prone homes	$136,125	$60,325	$196,450
Oakland County Radio Communications	Oakland	1181.024	Install wind braces to microwave dishes on radio towers	$10,125	$5,555	$15,680
Bridgeport Charter Twp.	Saginaw	1181.025	Remove log jam in river and rebuild/stabilize banks with rip-rap	$28,613	$9,537	$38,150
Ottawa County Drain Commission	Ottawa	1181.028	Bore/jack additional culvert under M-21(Rose Drain)	$235,525	$91,843	$327,368
Ottawa County Drain Commission	Ottawa	1181.029	Construct relief drain on existing stormwater basins	$30,000	$80,000	$110,000
Michigan State Housing Development Authority	(Statewide)	1181.030	Wind-proof 75-100 homes in the Detroit area	$7,335	$2,445	$9,780
Detroit Fire Department	Wayne	1181.032	Install warning siren on Cadillac Building	$13,875	$4,745	$18,620
City of Holland (in conjunction with MDARD)	Ottawa	1181.033	Purchase and remove two homes located in floodway	$108,750	$60,490	$169,240
Michigan Department of Environmental Quality	(Statewide)	1181.036	Digitize floodplain mapping of the Grand River	$29,262	$9,927	$39,189
City of Birmingham	Oakland	1181.042	Install ejector pumps, backflow preventers, or standpipes in flood-prone houses	$211,392	$70,464	$281,856
Ottawa County	Ottawa	1181.043	Install NOAA weather radio transmitter for portions of Ottawa, Muskegon and Allegan Co.	$16,492	$17,689	$34,181
Grand Traverse County	Grand Traverse	1181.044	Phase I: study for area floodplain mapping; Phase II: acquisition and elevation of flood-prone structures	$52,500	$17,500	$70,000

Hazard Mitigation Grant Program: Disaster #1181, Tornado and Flooding, 7/2/97 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
City of Gibraltar	Wayne	1181.047	Elevate flood-prone homes	$124,506	$41,502	$166,008
Village of Reese	Tuscola	1181.048	Acquire and remove two homes located in floodway	$153,961	$51,320	$205,281
Bay County Drain Commission	Bay	1181.050	Acquire and remove several flood-prone homes	$609,005	$151	$609,156
City of Ishpeming	Marquette	1181.052	Insulate city water and sewer infrastructure to protect from ground freeze	$400,414	$133,441	$533,855
Tuscola County Drain Commission	Tuscola	1181.053	Construct flood relief drain in Village of Reese	$213,743	$71,248	$284,991
Antrim Conservation District	Antrim	1181.055	Safety upgrades for Cravens Pond Dam and Richardi Dam in Village of Bellaire	$276,938	$158,147	$435,085
			Total for Disaster #1181:	**$3,731,351**	**$1,329,969**	**$5,061,320**

Hazard Mitigation Grant Program Disaster: #1226, Thunderstorms and High Winds, 5/31/98

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Georgetown Charter Twp.	Ottawa	1226.001	Move existing warning sirens and add sirens to warning system	$48,000	$17,841	$65,841
Alpine Twp.	Kent	1226.003	Install three warning sirens (electronically operated by Emergency Dispatch)	$40,295	$13,432	$53,727
Orleans Twp.	Ionia	1226.004	Install warning sirens near two populated areas	$25,349	$8,450	$33,799
City of Coopersville	Ottawa	1226.005	Install early warning siren with generator; install two generators at existing sites	$14,419	$4,806	$19,225
City of Alma	Gratiot	1226.006	Install warning siren	$14,852	$6,317	$21,169
City of Ionia	Ionia	1226.007	Install four warning sirens	$51,870	$17,290	$69,160
City of Allen Park	Wayne	1226.008	Install four warning sirens	$48,416	$33,399	$81,815
City of Birmingham	Oakland	1226.009	Install two warning sirens	$32,594	$10,865	$43,459
City of Rochester Hills	Oakland	1226.01	Install two warning sirens	$22,755	$7,585	$30,340
City of Belding	Ionia	1226.011	Install three warning sirens	$13,404	$6,182	$19,586
Muskegon County Airport	Muskegon	1226.013	Modify roof ballast system of airport passenger terminal building	$6,592	$2,198	$8,790
Flint River Dike and Erosion Control Board	Saginaw	1226.015	Stump, tree, and debris removal; construction of offset earth dikes	$112,979	$37,659	$150,638

Hazard Mitigation Grant Program: Disaster #1226, Thunderstorms and High Winds, 5/31/98 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Tuscola County Drain Commission	Tuscola	1226.016	Study and implement flood mitigation measures for Moore Drain	$104,982	$34,994	$139,976
Mackinac County	Mackinac	1226.017	Install and house an existing generator at new shelter facility	$15,000	$17,669	$32,669
Monroe County Drain Commission	Monroe	1226.018	Modify, rebuild, retrofit existing intake structure	$32,462	$10,821	$43,283
City of Grand Haven	Ottawa	1226.019	Phase I Study: Mitigation of power source problems	$10,875	$3,625	$14,500
City of Grand Haven	Ottawa	1226.02	Rewire existing generators	$56,237	$18,746	$74,983
Village of Spring Lake	Ottawa	1226.021	Replace Village Hall roof with reinforced roof buttressed by support columns	$1,594	$531	$2,125
City of Birmingham	Oakland	1226.022	Install seawall along river at several businesses and offices	$67,210	$22,403	$89,613
Bay County Drain Commission	Bay	1226.025	Floodproof 36 flood-prone houses (subject to 1226.034 study findings)	$264,415	$88,138	$352,553
City of Wyoming	Kent	1226.026	Replace bridge over creek in industrial park with improved design to reduce flood damage	$451,144	$150,381	$601,525
Flint River Dike and Erosion Control Board	Saginaw	1226.027	Create a retention basin by constructing a new dike and removing the old one	$150,000	$185,797	$335,797
Iosco County Drain Commission	Iosco	1226.028	Install rock rip-rap along banks of Crosby Road	$7,511	$2,503	$10,014
Huron County Drain Commission	Huron	1226.03	Drain reconstruction and flow diversion	$114,750	$101,540	$216,290
City of Birmingham	Oakland	1226.031	Purchase NOAA weather radios	$2,668	$889	$3,557

Hazard Mitigation Grant Program: Disaster #1226, Thunderstorms and High Winds, 5/31/98 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Isabella County	Isabella	1226.032	Install NOAA transmitter - communication system for severe weather alerts	$44,059	$14,685	$58,744
Michigan Department of Environmental Quality	(Statewide)	1226.033	Scan and store on disk all flood modeling since 1968 by NFIP, for future distribution	$14,560	$10,029	$24,590
Bay County Drain Commission	Bay	1226.034	Flood study and designs for projects 1226.024 and 1226.025	$39,499	$13,146	$52,645
Michigan Department of Environmental Quality	Ottawa	1226.037	Study for acquisition of flood-prone homes project on Macatawa River (1226.044)	$80,540	$26,847	$107,386
City of Midland	Midland	1226.039	Acquire eight properties in the floodplain (8 properties proposed, only 1 was purchased)	$11,387	$3,795	$15,182
City of Gibraltar	Wayne	1226.04	Elevate flood-prone structures	$51,744	$29,874	$81,618
City of Luna Pier	Monroe	1226.042	Elevate flood-prone structures	$168,740	$56,247	$224,986
Clinton Charter Twp.	Macomb	1226.043	Acquire flood-prone properties (project canceled by applicant)	$2,250	$750	$3,000
Ottawa County Parks and Recreation Commission	Ottawa	1226.044	Acquire and remove flood-prone structures on the Macatawa River	$243,546	$81,182	$324,728
			Total for Disaster #1226:	**$2,366,697**	**$1,040,615**	**$3,407,312**

Hazard Mitigation Grant Program: Disaster #1237, Thunderstorms and High Winds, 7/21-22/98

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Otsego County RACES Radio Group	Otsego	1237.001	Purchase NOAA weather alert monitors	$1,575	$531	$2,106
City of Inkster	Wayne	1237.002	Install two warning sirens	$27,750	$12,150	$39,900
City of St. Clair Shores	Macomb	1237.003	Install four warning sirens	$27,750	$73,683	$101,433
VESSA	Kent	1237.004	Enhance early warning capability	$30,000	$10,159	$40,159
Antrim County	Antrim	1237.005	Purchase NOAA weather alert monitors	$9,320	$3,106	$12,426
Macomb County	Macomb	1237.009	Lightning protection-grounding, phasing	$26,100	$8,700	$34,800
Macomb County	Macomb	1237.010	Lightning protection-grounding, phasing	$7,395	$2,465	$9,860
City of Lowell	Kent	1237.014	Install two warning sirens; upgrade two existing sirens	$26,400	$8,800	$35,200
City of Wyoming	Kent	1237.015	Acquire five floodway properties	$280,224	$93,155	$373,379
			Total for Disaster #1237:	**$436,514**	**$212,749**	**$649,263**

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Ada Twp.	Kent	1346.538	Install six warning sirens	$81,375	$52,945	$134,320
Alcona County Road Commission	Alcona	1346.65	Replace undersized culverts with bridge	$180,000	$117,992	$297,992
Allegan County Drain Commission	Allegan	1346.71	Install flood walls and storm water pump	$256,923	$85,641	$342,564
Alpena County Road Commission	Alpena	1346.62	Culvert / bridge upgrade	$69,830	$23,277	$93,107
City of Alpena	Alpena	1346.43	Culvert upgrade	$82,500	$46,590	$129,090
City of Alpena	Alpena	1346.535	Install two warning sirens	$27,258	$9,125	$36,383
City of Alpena	Alpena	1346.6	Water recycling plant emergency backup generator	$187,500	$120,460	$307,960
Alpine Twp.	Kent	1346.529	Install warning siren	$13,500	$5,178	$18,678
Bay County Drain Commission	Bay	1346.89	Drainage improvements in Garfield Subdivision	$971,226	$323,742	$1,294,968
Blackman Charter Twp.	Jackson	1346.17	Portable generator for sewer	$22,422	$11,640	$34,062
Blackman Charter Twp.	Jackson	1346.540	Install four warning sirens	$54,375	$19,200	$73,575
Bloomfield Twp.	Oakland	1346.13	Franklin Branch Streambank Stabilization Project	$1,605,000	$949,503	$2,554,503
Bruce Twp. and Village of Romeo	Macomb	1346.528	Install four warning sirens	$54,375	$21,225	$75,600

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Charlevoix County Road Commission	Charlevoix	1346.67	Replace two culverts with box culvert	$167,045	$78,400	$245,445
Cheboygan County	Cheboygan	1346.9	Mullett Lake bank stabilization	$13,407	$4,469	$17,876
Chippewa County Road Commission	Chippewa	1346.81	Culvert and bank stabilization	$424,989	$141,663	$566,652
Village of Clinton	Lenawee	1346.33	Construct retention basin	$110,586	$36,862	$147,448
Commerce Township	Oakland	1346.59	Flood mitigation study	$102,097	$34,032	$136,130
City of Coopersville	Ottawa	1346.87	Culvert replacement and acquisition of one flood-prone house	$414,756	$138,381	$553,138
Crawford County	Crawford	1346.503	NOAA weather alert radio distribution	$1,475	$492	$1,967
City of Crystal Falls	Iron	1346.27	North 6th Street stormwater conveyance	$64,285	$32,624	$96,909
Central Upper Peninsula Planning and Development	Upper Peninsula	1346.523	Develop hazard analyses and identify mitigation needs for six UP counties	$75,000	$26,332	$101,332
Daycroft Montessori School	Washtenaw	1346.56	Construct floodwall around school	$84,789	$28,263	$113,052
City of Dearborn Heights	Wayne	1346.511	Ecorse Creek warning sensor	$9,255	$3,095	$12,350
City of Dearborn Heights	Wayne	1346.522	Install two warning sirens, plus electrical hookup and remote activation	$24,443	$8,147	$32,590

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Dickinson County Emergency Services	Dickinson	1346.72	Floodproof Cornish Pump Museum	$14,918	$4,973	$19,890
City of Dowagiac	Cass	1346.526	Install three warning sirens	$40,875	$20,425	$61,300
City of Fennville	Allegan	1346.539	Install warning siren	$12,279	$4,093	$16,371
Flint River Dike and Erosion Control Board	Saginaw	1346.53	Complete Flint River flood risk reduction project	$1,845,000	$568,121	$2,413,121
City of Gaastra	Iron	1346.54	Relocate main sewer line and stabilize bank next to abandoned Baltic Mine Pit	$36,078	$12,026	$48,104
Genesee County Drain Commission	Genesee	1346.82	Floodproof Pumping Station No. 1 in Flint Twp.	$559,068	$186,356	$745,423
Genesee County Drain Commission	Genesee	1346.83	Elevate and floodproof manholes in Flint Twp.	$274,697	$91,566	$366,262
City of Grand Blanc	Genesee	1346.29	Bella Vista Subdivision drainage system	$553,252	$184,417	$737,670
City of Grand Blanc	Genesee	1346.30	Indian Hills Subdivision drainage system	$195,000	$65,205	$260,205
City of Grand Blanc	Genesee	1346.88	Acquire five flood-prone homes; storm sewer upgrades	$1,230,050	$410,017	$1,640,067
City of Grand Rapids	Kent	1346.68	Plaster Creek flood mitigation	$571,658	$425,652	$997,310
Grand Traverse County	Grand Traverse	1346.502	NOAA weather alert radio distribution	$5,242	$1,747	$6,989
Gratiot County Road Commission	Gratiot	1346.77	Lakeside Drive culvert upgrade	$262,500	$121,512	$384,012

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Grand Traverse Bay Ottawa / Chippewa Indians	(Native American Tribe)	1346.536	Install warning siren	$13,875	$8,100	$21,975
City of Holland	Ottawa	1346.524	Install warning siren	$13,155	$6,145	$19,300
City of Hudsonville	Ottawa	1346.530	Install warning siren	$13,875	$6,547	$20,422
Iosco County Road Commission	Iosco	1346.76	Update undersized culvert and enlarge / deepen drainage channels	$60,000	$84,682	$144,682
Village of Kent City	Kent	1346.34	Upgrade undersized culvert and replace with box beam bridge	$257,627	$85,876	$343,503
City of Kentwood	Kent	1346.23	Ridgemoor Center flood mitigation (stormwater control)	$568,818	$189,606	$758,424
Livingston County Drain Commission	Livingston	1346.61	Flood mitigation study	$4,188	$1,396	$5,583
Livingston County Drain Commission	Livingston	1346.75	Acquisition and relocation of flood-prone homes	$438,665	$146,222	$584,886
City of Luna Pier	Monroe	1346.504	Install permanent elevation benchmark monuments along Lake Erie	$16,539	$5,513	$22,052
Lyon Township	Oakland	1346.42	Stormwater drainage improvements	$255,715	$85,238	$340,953
Macomb County	Macomb	1346.506	Purchase weather alert radios	$15,000	$5,257	$20,257
Macomb County	Macomb	1346.507	Streambank and road crossing inventory (for Middle Branch of the Clinton River)	$22,493	$8,206	$30,699
Macomb County Emergency Management	Macomb	1346.51	Acquisition of 2 vacant parcels and acquisition/demolition of 4 homes	$571,673	$190,558	$762,231

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Macomb County Public Works Office	Macomb	1346.44	Upgrade two pumping stations	$225,000	$494,227	$719,227
Macomb Twp.	Macomb	1346.534	Install two warning sirens	$27,375	$20,725	$48,100
City of Manton	Wexford	1346.79	Floodproof wastewater treatment plant	$634,823	$211,608	$846,431
Marquette County Conservation District	Marquette	1346.38	Dam removal	$94,971	$31,657	$126,628
Michigan Association of Broadcasters	(Statewide)	1346.541	Emergency Alert System (EAS) upgrade	$54,525	$18,488	$73,013
Michigan Department of Environmental Quality	(Statewide)	1346.521	Develop floodplain management guidance document	$6,000	$2,000	$8,000
Michigan Department of Natural Resources	(Southern Michigan)	1346.517	Develop FIREWISE communities in Southern Michigan	$202,500	$102,452	$304,952
Michigan Department of Natural Resources	(Various Upper Peninsula Sites)	1346.537	Closing and capping abandoned mines	$193,518	$65,726	$259,244
Michigan Department of State Police/EMHSD	(Statewide)	1346.90	Administering consultant for statewide repetitive flood loss properties project	$194,796	$0	$194,796
Michigan Department of State Police/EMHSD	(Statewide)	1346.91	Construction costs (elevation or acquisition) for repetitive flood loss properties project	$754,034	$251,346	$1,005,379
Michigan Department of State Police/EMHSD	(Statewide)	1346.519	Produce and distribute emergency management educational materials	$15,000	$5,000	$20,000
Michigan Department of State Police/EMHSD	(Statewide)	1346.518	Develop and implement statewide mitigation marketing and public education program	$19,717	$0	$19,717
Michigan Department of State Police/EMHSD	(State Agency)	1346.516	Expand and enhance Geographic Information Systems (GIS) capabilities and products	$181,732	$60,577	$242,310

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Michigan Department of State Police/EMHSD	(Statewide)	1346.802	Develop hazard mitigation plans in all emergency management program jurisdictions	$2,033,313	$774,843	$2,808,156
Michigan Department of Transportation	Baraga	1346.45	Shoreline protection on US-41 at Red Rocks	$41,255	$13,752	$55,007
Michigan Department of Transportation	Keweenaw	1346.46	Upgrade culvert on M-26 at Jacob Falls	$112,500	$38,152	$150,652
Michigan Department of Transportation	Marquette	1346.47	Shoreline protection and stabilization of sand dunes on M-28	$168,750	$94,302	$263,052
Michigan Department of Transportation	Baraga	1346.48	Upgrade culverts at Alberta Ponds	$15,000	$8,695	$23,695
Michigan Department of Transportation	Gogebic	1346.49	Upgrade culvert on US-2 at Black River	$112,500	$172,497	$284,997
Michigan Department of Transportation	Mackinac	1346.50	Stabilize sand dune along US-2	$168,750	$72,335	$241,085
Michigan State University	Ingham	1346.11	Construct storm shelters (“safe rooms”) in the Spartan Child Development Center	$123,750	$41,250	$165,000
Michigan Technological University	Houghton	1346.501	Research on the development of a composite shear wall for resisting high wind loads	$34,500	$11,562	$46,062
City of Montague	Muskegon	1346.66	Purchase and remove a commercial structure from the floodplain	$251,331	$83,777	$335,108
Northwest County Drainage District	Tuscola	1346.543	Install automated weather station	$4,066	$1,355	$5,421
City of Novi	Oakland	1346.31	Upgrade undersized culvert	$69,706	$23,235	$92,941
Osceola County	Lake, Mason, Osceola	1346.510	Upgrade NOAA weather radio coverage in three county area	$60,000	$23,821	$83,821
Ottawa County Parks and Recreation Commission	Ottawa	1346.93	Purchase and remove a home along the Grand River	$187,500	$83,230	$270,730

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Ottawa County Road Commission	Ottawa	1346.60	Upgrade undersized culvert and stabilize with rip-rap	$82,500	$73,916	$156,416
Ottawa County	Ottawa	1346.505	Purchase and distribute NOAA weather radios	$12,000	$4,015	$16,015
City of Parchment	Kalamazoo	1346.52	Improve / upgrade stormwater collection system	$63,239	$21,080	$84,318
City of Port Huron	St. Clair	1346.10	Standby power for water treatment plant	$175,253	$58,418	$233,671
City of Portland	Ionia	1346.80	Bury power lines to prevent recurring outages	$207,620	$69,207	$276,827
Rich Intercounty Drainage District	Lapeer	1346.545	Install automated weather station	$4,066	$1,355	$5,421
City of Rose City	Ogemaw	1346.70	Upgrade undersized culvert	$150,000	$52,325	$202,325
Sebewaing River Drainage Board	Huron	1346.57	Construct Sebewaing River emergency floodway	$261,750	$109,590	$371,340
Shelby Twp.	Macomb	1346.532	Install four warning sirens	$48,375	$20,305	$68,680
South Branch Cass River Intercounty Drainage District	Sanilac	1346.544	Install automated weather station	$4,066	$1,355	$5,421
South Branch, Mill Creek Drainage District	St. Clair	1346.542	Install automated weather station	$4,066	$1,355	$5,421
City of Southgate	Oakland	1346.15	Construct sanitary relief sewer to reduce flooding	$100,211	$33,404	$133,614
Spring Lake Twp.	Ottawa	1346.531	Install two warning sirens	$27,375	$10,157	$37,532

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
City of Standish	Arenac	1346.63	Install box culvert	$82,875	$57,424	$140,299
Statewide Services for the Hearing Impaired	Genesee	1346.514	Deaf elderly / deaf disabled early warning system	$29,704	$2,952	$32,656
City of Sturgis	St. Joseph	1346.64	Stormwater diversion project	$245,381	$81,794	$327,175
Village of Sunfield	Eaton	1346.74	Storm sewer upgrade	$225,000	$95,086	$320,086
Tuscola County Drain Commission	Tuscola	1346.18	Flood mitigation measures in the Moore Drain, City of Vassar	$1,785,000	$1,125,253	$2,910,253
City of Utica	Macomb	1346.525	Install warning siren	$11,625	$5,175	$16,800
City of Utica	Macomb	1346.85	Elevation of 10 homes	$134,465	$44,822	$179,286
Van Buren Charter Twp.	Wayne	1346.19	Install backup electrical generators at nine sanitary sewer lift stations	$244,670	$81,557	$326,227
Van Buren Charter Twp.	Wayne	1346.21	Flood mitigation on North I-94 Service Drive	$82,979	$27,660	$110,639
Van Buren Charter Twp.	Wayne	1346.22	Install stormwater drains	$226,687	$75,562	$302,249
Van Buren County Drain Commission	Van Buren	1346.55	Construct stormwater detention basin and outlet structure	$4,260	$1,420	$5,680
Van Buren County Drain Commission	Van Buren	1346.69	Construct detention basin in South Haven	$312,375	$162,237	$474,612
Washington Twp.	Macomb	1346.527	Install three warning sirens	$40,875	$25,475	$66,350

Hazard Mitigation Grant Program: Disaster #1346, Urban Flooding, 9/10-11/00 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Washtenaw County Community College	Washtenaw	1346.533	Install warning siren	$12,900	$4,300	$17,200
Waterford Twp.	Oakland	1346.508	Engineering and feasibility study for lift station improvements	$17,250	$22,733	$39,983
Waterford Twp.	Oakland	1346.509	Education and public awareness program to reduce storm-related flooding	$5,686	$1,895	$7,582
City of Wayne	Wayne	1346.4	Backup electrical power supply for Stellwagen Sanitary Sewer Pump Station	$40,418	$13,473	$53,891
Wayne County	Wayne	1346.20	Upgrade controls at Pine Street Pumping Station	$85,650	$34,805	$120,455
Wayne County Department of Environment	Wayne	1346.25	Backflow preventers and sump pumps to relieve downriver area basement flooding	$267,414	$107,486	$374,900
City of Williamston	Ingham	1346.73	Bank stabilization / erosion control on Red Cedar River	$28,594	$9,531	$38,126
City of Wyandotte	Wayne	1346.12	Purchase and install 2,300 restricted catch basin covers to reduce sewer backups	$162,070	$54,023	$216,093
			Total for Disaster #1346:	**$24,123,962**	**$10,436,489**	**$34,560,449**

Hazard Mitigation Grant Program: Disaster #1413, Flooding, 4/10-30/02

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Charlevoix County Road Commission	Charlevoix	1413.6	Culvert upgrade - Porter Creek Crossing at Anderson and Behling Roads	$21,841	$15,206	$37,047
Emmet County Road Commission	Emmet	1413.1	Replace a culvert with a bridge at Mitchell Road over Minnehaha Creek	$56,436	$86,519	$142,955
Houghton County Road Commission	Houghton	1413.7	Culvert upgrade – Elm River at Old Rink Road	$24,759	$13,151	$37,910
City of Ironwood	Gogebic	1413.4	Insulate a water tower	$72,820	$57,214	$130,034
Lac Vieux Desert Tribal Reservation	(Native American Tribe)	1413.8	Underground conduit extension to mitigate stormwater flooding	$46,735	$17,444	$64,179
Michigan Department of Transportation	Marquette	1413.2	Culvert replacement/upgrade and grade lift on M-35	$149,280	$56,700	$205,980
Michigan Department of Transportation	Houghton	1413.3	Raise Roadway and equalize culvert on M-203	$235,936	$86,662	$322,598
Saginaw County Public Works Commissioner	Saginaw	1413.5	Construct a stormwater relief drain	$89,554	$260,303	$349,857
			Total for Disaster #1413	**$697,361**	**$593,199**	**$1,290,560**

Hazard Mitigation Grant Program: Disaster #1527, Severe Storms and Flooding, 5/20/04–6/8/04

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Barry County	Barry	A1527.13	Elevation of 13 homes	$180,583	$61,771	$242,354
Bridgeton Township	Newaygo	A1527.11	Elevation of 1 home	$12,000	$6,638	$18,638
Dearborn Heights, City of	Wayne	A1527.2	Sump pump and backflow valve installation at residential locations	$76,401	$35,264	$111,665
Genesee County Drain Commissioner	Genesee	A1527.8	Site acquisition and demolition	$82,800	$31,597	$114,397
Georgetown Township	Ottawa	A1527.3	Installation of 4 early warning sirens	$58,500	$19,500	$78,000
Kent County	Kent	A1527.10	Acquisition of 3 homes	$430,221	$143,406	$573,627
Ray Township	Macomb	A1527.4	Installation of 1 early warning siren	$17,250	$8,970	$26,220
Robinson Township	Ottawa	A1527.5	Installation of 2 early warning sirens	$27,900	$9,300	$37,200
Rutland Township	Barry	A1527.17	Acquisition of 1 home	$67,830	$22,610	$90,441
Salem Township	Allegan	A1527.6	Installation of 2 early warning sirens	$26,250	$8,750	$35,000
St. Clair County Road Commission	St. Clair	A1527.15	Removal of twin arch pipes and installation of large box culvert to increase flow capacity	$87,876	$29,292	$117,168
Wayne Township	Cass	A1527.7	Installation of 1 early warning siren	$19,665	$6,555	$26,220
			Total for Disaster #1527	**$1,087,275**	**$383,654**	**$1,470,929**

Hazard Mitigation Grant Program: Disaster #1777, Severe Storms and Flooding, 6/6/08–6/13/08

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Ann Arbor, City of	Washtenaw	A1777.12	Demolition of city building from floodway	$25,632	$8,544	$34,176
Blendon Township	Ottawa	A1777.1	Installation of 2 early warning sirens	$31,111	$10,370	$41,481
Bloomfield Township	Oakland	A1777.7	Local mitigation plan development	$10,822	$3,607	$14,430
Caledonia Township	Kent	A1777.2	Installation of 2 early warning sirens	$29,850	$15,721	$45,571
Caledonia, Village of	Kent	A1777.3	Installation of 1 early warning siren	$14,925	$7,337	$22,262
Commerce Township	Oakland	A1777.4	Installation of 4 early warning sirens	$59,376	$19,792	$79,168
Eastern Michigan University	Washtenaw	A1777.10	Local mitigation plan development	$12,010	$23,259	$35,269
Grand Haven, City of	Ottawa	A1777.5	Installation of 1 early warning siren	$14,025	$4,675	$18,700
Lansing, City of	Ingham	A1777.11	Acquisition-Demo (20 properties)	$752,897	250,965	$1,003,862
Plainfield Charter Twp.	Kent	A1777.9	Acquisition-Demo (13 properties)	$1,124,325	374,775	$1,499,100
Pokagon Band of Potawatomi Indians	Cass	A1777.8	Tribal mitigation plan development	$15,000	$5,000	$20,000
Springfield Township	Oakland	A1777.6	Installation of 3 early warning sirens	$44,532	$14,844	$59,376
			Total for Disaster #1777	**$2,134,505**	**$738,889**	**$2,889,804**

Hazard Mitigation Grant Program: Disaster #4121, Flooding, 4/16/13–5/14/13

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Plainfield Charter Township	Kent	P4121.1	Acquisition-Demo (1 property)	$708,653	$236,218	$944,871
			Total for Disaster #4121	**$708,653**	**$236,218**	**$944,871**

Hazard Mitigation Grant Program: Disaster #4195, Urban Flooding, 8/11/14–8/13/14

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Sanford, Village of	Midland	P4195.1	Acquisition of senior center	$195,852	$65,288	$261,140
Newaygo County	Newaygo	P4195.10	Flood warning inundation mapping	$127,682	$42,561	$170,243
Allegan, City of	Allegan	P4195.13	Erosion control, bank stabilization	$4,015,156	$1,338,385	$5,353,541
Oakland County	Oakland	P4195.14	Plan - HM County plan update	$152,045	$51,920	$203,965
Sanilac County	Sanilac	P4195.15	Plan - Local plan update	$35,818	$12,000	$47,818
Ann Arbor, City of	Washtenaw	P4195.16	Allen Creek Railroad berm flood reduction - phase II	$3,712,332	$1,237,444	$4,949,776
Clinton County Drain Commissioner	Clinton	P4195.17	Stormwater Mitigation	$590,976	$196,992	$787,968
Dearborn, City of	Wayne	P4195.18	Stormwater Sewer Separation	$4,540,654	$2,534,674	$7,075,328
Salem Township	Allegan	P4195.19	Safe Rooms	$856,418	$285,472	$1,141,890
Ann Arbor, City of	Washtenaw	P4195.2	Acquisition of 1 home	$2,667	$100,000	$102,667
Estral Beach, Village of	Monroe	P4195.20	Elevate 8 homes	$596,515	$198,838	$795,353
Dearborn, City of	Wayne	P4195.24	Stormwater shutoff gates and overflow structure	$1,302,573	$434,191	$1,736,764
Detroit, City of	Wayne	P4195.25	Generators at DPD Precincts 1, 3, and 7	$275,730	$148,470	$424,200
Lawton, Village of	Van Buren	P4195.26	Generator for Village Hall (PD and FD)	$79,300	$42,700	$122,000
Linden, City of	Genesee	P4195.27	Generator for City Hall (PD and FD)	$18,968	$10,213	$29,181
Mackinac County	Mackinac	P4195.28	Generator for PD and FD	$105,968	$57,059	$163,027

Hazard Mitigation Grant Program: Disaster #4195, Urban Flooding, 8/11/14–8/13/14 (cont.)

Applicant	County	Application #	Project	Federal Investment	Local Investment	Total Investment
Richmond Township	Macomb	P4195.29	Generator for EMS-EOC	$32,234	$34,200	$66,434
Benzie County	Benzie	P4195.3	Acquisition of 1 home	$71,931	$31,984	$103,915
Royal Oak, City of	Oakland	P4195.30	Generator of PD	$47,087	$25,354	$72,441
MDNR	Grand Traverse	P4195.31	Community Safe Rooms at State Parks	$596,242	$198,747	$794,988
MDNR	Roscommon	P4195.31	Community Safe Rooms at State Parks	$596,242	$198,747	$794,988
MDNR	St. Clair	P4195.31	Community Safe Rooms at State Parks	$596,242	$198,747	$794,988
MDNR	Wayne	P4195.31	Community Safe Rooms at State Parks	$596,242	$198,747	$794,988
Lansing, City of	Ingham	P4195.32	Acquisition of 8 homes in the floodplain.	$262,420	$87,473	$349,893
Clinton Township	Macomb	P4195.33	Elevate utilities and seal manholes	$173,274	$57,758	$231,032
Dearborn Heights, City of	Wayne	P4195.4	Acquisition of 14 properties	$2,138,661	$714,735	$2,853,396
Estral Beach, Village of	Monroe	P4195.5	Elevate 14 homes	$976,917	$325,639	$1,302,556
Caledonia, Village of	Kent	P4195.6	Warning Siren	$16,725	$5,875	$22,600
Livonia, City of	Wayne	P4195.7	Four Warning Sirens	$61,200	$20,775	$81,975
Salem Township	Allegan	P4195.8	Warning Siren	$15,616	$5,275	$20,891
Genesee County	Genesee	P4195.9	Warning sirens - County-wide (20 sirens)	$378,725	$133,375	$512,100
			Total for Disaster #4195	**$23,168,410**	**$8,993,638**	**$32,162,048**
			Totals for Disasters: 1028, 1128, 1181, 1226, 1237, 1346, 1413, 1527, 1777, 4121, and 4195:	**$59,696,951**	**$25,089,010**	**$84,785,960**

Summary of Flood Mitigation Assistance Program (FMAP) Projects Funded in Michigan: 1996-2015

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
New Baltimore, City of	Macomb	1996/97	Flood mitigation project in support of flood hazard mitigation plan.	$15,000	$5,613	$20,613
Clinton Township	Macomb	1996/97	Flood mitigation project in support of flood hazard mitigation plan.	$36,375	$21,687	$58,062
Midland, City of	Midland	1996/97	Development of a Flood Mitigation plan	$4,098	$1,366	$5,464
Vassar, City of	Tuscola	1996/97	Development of a Flood Mitigation plan	$9,678	$3,226	$12,904
Vassar, City of	Tuscola	1996/97	Used to develop a Flood Mitigation plan	$15,890	$5,297	$21,187
Vassar, City of	Tuscola	1998	Flood acquisition/relocation project in support of flood hazard mitigation plan.	$126,118	$42,039	$168,157
Macomb County	Macomb	1998	Development of a Flood Mitigation plan	$7,850	$4,150	$12,000
Michigan DEQ	Macomb	1998	Identify high-risk flood zones in unmapped areas of Macomb County and update hydrology.	$16,030	$5,343	$21,373
Dearborn Heights, City of	Wayne	1999	Development of a Flood Mitigation Plan	$6,740	$2,247	$8,986
Dearborn Heights, City of	Wayne	1999	Development of a Flood Mitigation Plan	$15,310	$5,103	$20,413
Allegan County	Allegan	2000	Development of a Flood Mitigation Plan	$14,200	$4,733	$18,933
Allegan County	Allegan	2000	Development of a Flood Mitigation Plan	$15,050	$5,017	$20,067
Vassar, City of	Tuscola	2000	Flood mitigation project in support of flood hazard mitigation plan – elev.	$80,787	$26,929	$107,716
Marquette County	Marquette	2001	Development of a Flood Mitigation Plan	$13,900	$4,633	$18,533
Marquette County	Marquette	2001	Development of a Flood Mitigation Plan	$14,750	$4,917	$19,667
Frenchtown Township	Monroe	2002	Development of a Flood Mitigation Plan	$10,275	$7,318	$17,593
Frenchtown Township	Monroe	2002	Development of a Flood Mitigation Plan	$9,413	$6,704	$16,117
Ann Arbor, City of	Washtenaw	2003	Development of a Flood Mitigation Plan	$12,600	$4,207	$16,807
Ann Arbor, City of	Washtenaw	2003	Development of a Flood Mitigation Plan	$11,450	$3,817	$15,267
Bridgeton Township	Newaygo	2004	Development of a Flood Mitigation Plan	$12,500	$4,167	$16,667
Bridgeton Township	Newaygo	2004	Development of a Flood Mitigation Plan	$13,120	$4,373	$17,493

Summary of Flood Mitigation Assistance Program (FMAP) Projects Funded in Michigan: 1996-2015 (cont.)

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
Kalamazoo	Kalamazoo	2005	Only planning grant was awarded. No TA money. Project is for the development of a flood mitigation plan.	$13,900	$6,980	$20,880
Plainfield Township	Kent	2005	Development of a Flood Mitigation Plan	$13,700	$18,312	$32,012
Wakefield, City of	Gogebic	2005	Development of a flood mitigation plan. - Plan writing portion only	$13,700	$4,567	$18,267
Wakefield, City of	Gogebic	2005	Development of a flood mitigation plan. - Technical portion (i.e. geo-location of structures, development of map layers)	$14,439	$4,814	$19,253
Bloomfield Township	Oakland	2006	Development of a Flood Mitigation Plan	$15,899	$5,653	$21,199
Ottawa County	Ottawa	2008	Development of flood plan annex to all hazards plan	$1,058	$367	$25,333
Plainfield Township	Kent	2008	Elevation of 6 homes	$8,158	$3,332	$11,490
Plainfield Township	Kent	2009	Acquisition and demolition of 2 residential structures in the floodplain of the Grand River.	$104,131	$34,710	$138,841
Midland, City of	Midland	2013	Acquisition and demolition of 4D Building Supply	$687,300	$0	$687,300
Genesee Township	Genesee	2015	Acquisition of one (SRL) property	$78,350	$0	$78,350
			FMA Totals For 1996-2015:	**$1,411,767**	**$251,621**	**$1,686,944**

Summary of Flood Mitigation Assistance

Three types of grants have been available under the FMAP: **Planning; Technical Assistance; Project**. **Planning Grants** aid states and local communities in developing flood mitigation plans. **Technical Assistance Grants** (no longer available) enabled states to provide technical assistance to applicants in applying for FMAP funds or in implementing approved projects. **Project Grants** help fund eligible flood mitigation projects that reduce the risk of flood damage to NFIP-insurable structures. The table above will not necessarily identify one of each type of grant for each fiscal year. In some fiscal years, allocations were returned to FEMA if viable grant applications were not submitted by local entities. In Fiscal Year 2009, the FMAP became a nationally competitive grant program (with no state specific allocations) that could fund mitigation projects or flood mitigation plans.

Summary of Pre-Disaster Mitigation Program (PDMP) Projects Funded in Michigan: 2002-2017

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
Canton Township	Wayne	2002	Development of an all-hazard mitigation plan	$30,239	$14,627	$44,867
Detroit	Wayne	2002	Development of an all-hazard mitigation plan	$55,843	$23,357	$79,200
Lincoln Park	Wayne	2002	Development of an all-hazard mitigation plan	$30,195	$12,630	$42,825
Livonia	Wayne	2002	Development of an all-hazard mitigation plan	$22,186	$9,280	$31,465
Romulus	Wayne	2002	Development of an all-hazard mitigation plan	$11,728	$4,905	$16,633
Wayne County	Wayne	2002	Development of an all-hazard mitigation plan	$140,935	$156,948	$297,883
Barry County	Barry	2003	Development of an all-hazard mitigation plan	$7,711	$2,571	$10,282
Berrien County	Berrien	2003	Development of an all-hazard mitigation plan	$21,195	$7,437	$28,632
Saginaw County	Saginaw	2003	Development of an all-hazard mitigation plan	$30,021	$15,063	$45,084
St. Clair County	St. Clair	2003	Development of an all-hazard mitigation plan	$47,591	$16,699	$64,290
Van Buren County	Van Buren	2003	Development of an all-hazard mitigation plan	$21,000	$13,102	$34,102
Michigan Technological University (MTU)	Houghton	2005	Development of an all-hazard mitigation plan	$56,250	$18,750	$75,000
Robinson Township (Acquisition Project #1)	Ottawa	2005	Acquisition of 19 structures and 11 vacant parcels out of the Grand River floodplain	$703,552	$234,517	$938,070
Robinson Township (Acquisition Project #2)	Ottawa	2005	Acquisition of 21 structures and 9 vacant parcels out of the Grand River floodplain	$664,506	$221,502	$886,007
Ada Township	Kent	2006	Acquisition and demolition of 1 structure	$63,824	$21,275	$85,099
Detroit, City of	Wayne	2008	Installation of 10 generators at fire stations - Burial of overhead power lines	$839,112	$279,704	$1,118,816
Lansing, City of	Ingham	2008	Acquisition of 29 residential properties	$534,052	$209,291	$743,343
Ann Arbor, City of	Washtenaw	2009	Acquisition of 1 home and 1 vacant parcel	$169,966	$56,655	$226,622
Marquette County	Marquette	2009	Dune Stabilization along state highway	$98,969	$34,935	$133,905
Marquette County	Marquette	2009	Culvert upgrade	$76,470	$25,490	$101,960

Summary of Pre-Disaster Mitigation Program (PDMP) Projects Funded in Michigan: 2002-2017 (page 2)

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
University of Michigan - Flint	Genesee	2009	Development of an all-hazard mitigation plan.	$45,048	$15,333	$60,381
Wayne County	Wayne	2009	Installation of 18 outdoor warning sirens	$256,238	$85,413	$341,650
Gogebic County	Gogebic	2010	Update of a county hazard mitigation plan	$29,959	$10,165	$40,124
Houghton County	Baraga	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Houghton County	Houghton	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Houghton County	Iron	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Houghton County	Keweenaw	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Houghton County	Ontonagon	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Oakland County	Oakland	2010	Update of a county hazard mitigation plan	$58,742	$20,785	$79,527
Chippewa County	Chippewa	2011	Update of a county hazard mitigation plan	$7,674	$3,081	$10,755
Chippewa County	Luce	2011	Update of a county hazard mitigation plan	$7,674	$3,081	$10,755
Chippewa County	Mackinac	2011	Update of a county hazard mitigation plan	$7,674	$3,081	$10,755
Delta County	Alger	2011	Update of a county hazard mitigation plan	$12,562	$4,691	$17,253
Delta County	Delta	2011	Update of a county hazard mitigation plan	$12,562	$4,691	$17,253
Delta County	Menominee	2011	Update of a county hazard mitigation plan	$12,562	$4,691	$17,253
Delta County	Schoolcraft	2011	Update of a county hazard mitigation plan	$12,562	$4,691	$17,253
Detroit, City of	Wayne	2011	Update of a county hazard mitigation plan	$47,775	$16,036	$63,811
Ingham County	Clinton	2011	Update of a county hazard mitigation plan	$27,221	$10,277	$37,498
Ingham County	Eaton	2011	Update of a county hazard mitigation plan	$27,221	$10,277	$37,498
Ingham County	Ingham	2011	Update of a county hazard mitigation plan	$27,221	$10,277	$37,498
Kent County	Kent	2011	Acquisition of 9 homes in the floodplain	$784,881	$261,627	$1,046,508
Marquette County	Marquette	2011	Update of a county hazard mitigation plan	$29,115	$13,974	$43,089
Oceana County	Lake	2011	Update of a county hazard mitigation plan	$50,000	$16,825	$66,825

Summary of Pre-Disaster Mitigation Program (PDMP) Projects Funded in Michigan: 2002-2017 (page 3)

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
Oceana County	Mason	2011	Update of a county hazard mitigation plan	$50,000	$16,825	$66,825
Oceana County	Muskegon	2011	Update of a county hazard mitigation plan	$50,000	$16,825	$66,825
Oceana County	Newaygo	2011	Update of a county hazard mitigation plan	$50,000	$16,825	$66,825
Houghton County	Houghton	2010	Update of a county hazard mitigation plan	$6,014	$2,166	$8,180
Oceana County	Oceana	2011	Update of a county hazard mitigation plan	$50,000	$16,825	$66,825
Otsego County	Otsego	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Presque Isle	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Alcona	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Alpena	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Crawford	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Montmorency	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Otsego County	Oscoda	2011	Update of a county hazard mitigation plan	$12,081	$4,807	$16,888
Plainfield Township	Kent	2011	Acquisition of 3 homes in the floodplain.	$155,691	$51,897	$207,588
Allegan County	Allegan	2012	Update of a county hazard mitigation plan	$17,028	$5,676	$22,704
Emmet County	Charlevoix	2012	Update of a county hazard mitigation plan	$10,765	$3,588	$14,354
Emmet County	Cheboygan	2012	Update of a county hazard mitigation plan	$10,765	$3,588	$14,354
Emmet County	Emmet	2012	Update of a county hazard mitigation plan	$10,765	$3,588	$14,354
GLS Region V	Genesee	2012	Update of a county hazard mitigation plan	$29,927	$9,976	$39,903
GLS Region V	Lapeer	2012	Update of a county hazard mitigation plan	$29,927	$9,976	$39,903
Mount Clemens	Macomb	2012	Stormwater Improvement Project	$62,500	$28,185	$90,685
Roscommon County	Clare	2012	Update of a county hazard mitigation plan	$22,176	$9,122	$31,298
Roscommon County	Gladwin	2012	Update of a county hazard mitigation plan	$22,176	$9,122	$31,298
Roscommon County	Iosco	2012	Update of a county hazard mitigation plan	$22,176	$9,122	$31,298

Summary of Pre-Disaster Mitigation Program (PDMP) Projects Funded in Michigan: 2002-2017 (page 4)

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
Roscommon County	Isabella	2012	Update of a county hazard mitigation plan	$22,176	$9,122	$31,298
Roscommon County	Roscommon	2012	Update of a county hazard mitigation plan	$22,176	$9,122	$31,298
Shiawassee County	Shiawassee	2012	Update of a county hazard mitigation plan	$102,038	$34,013	$136,050
St. Clair County	St. Clair	2012	Update of a county hazard mitigation plan	$14,381	$4,794	$19,175
Estral Beach, Village of	Monroe	2013	Hazard mitigation plan development	$9,806	$3,919	$13,725
Lansing, City of	Ingham	2013	Acquisition of 19 residential properties from the floodplain	$83,855	$27,952	$111,807
Tuscola County	Tuscola	2013	Update of a county hazard mitigation plan	$16,923	$8,086	$25,009
Calhoun County	Calhoun	2014	Update of a county hazard mitigation plan	$50,000	$16,956	$66,956
Ogemaw County	Ogemaw	2014	Update of a county hazard mitigation plan	$41,414	$18,237	$59,651
Saginaw County	Saginaw	2014	Update of a county hazard mitigation plan	$21,000	$7,000	$28,000
Arenac County	Arenac	2015	Update of a county hazard mitigation plan	$41,000	$14,218	$55,218
Bloomfield Township	Oakland	2015	Update of a county hazard mitigation plan	$10,000	$3,366	$13,366
Royal Oak	Oakland	2015	Update of a county hazard mitigation plan	$74,784	$24,934	$99,718
U of M	Washtenaw	2015	Hazard mitigation plan development	$112,500	$37,500	$150,000
Ann Arbor, City of	Washtenaw	2016	Update of a county hazard mitigation plan	$107,044	$35,681	$142,725
Dearborn Heights	Wayne	2016	Acquisition of 12 flood-prone homes	$1,033,059	$344,353	$1,377,412
Estral Beach, Village of	Monroe	2016	Elevation of 3 homes	$204,875	$68,293	$273,168
Gratiot County	Gratiot	2016	Update of a county hazard mitigation plan	$35,769	$12,112	$47,881
Lapeer County	Lapeer	2016	Construct 8 safe rooms at boy scout camp	$725,658	$241,886	$967,544
Muskegon County	Muskegon	2016	Construct 11 safe rooms at boy scout camp	$997,780	$332,593	$1,330,373
Presque Isle County	Presque Isle	2016	Culvert upgrade	$560,135	$188,612	$748,746
Bay County	Bay	2017	Update of a county hazard mitigation plan	$43,214	$14,405	$57,618
EUPRPDC	Chippewa	2017	Update of a county hazard mitigation plan	$10,000	$3,333	$13,333
EUPRPDC	Luce	2017	Update of a county hazard mitigation plan	$10,000	$3,333	$13,333

Summary of Pre-Disaster Mitigation Program (PDMP) Projects Funded in Michigan: 2002-2017 (page 5)

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
EUPRPDC	Mackinac	2017	Update of a county hazard mitigation plan	$10,000	$3,333	$13,333
Huron County	Huron	2017	Update of a county hazard mitigation plan	$27,656	$9,219	$36,875
Kalamazoo County	Kalamazoo	2017	Update of a county hazard mitigation plan	$22,838	$7,613	$30,450
MDNR	Grand Traverse	2017	Construction of 1 safe room at Interlochen State Park and one at Traverse City State Park	$743,208	$251,069	$994,277
MDNR	Mason	2017	Construction of 1 safe room at Ludington State Park	$371,604	$125,535	$497,139
NEMCOG	Alcona	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Alpena	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Crawford	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Montmorency	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Oscoda	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Otsego	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
NEMCOG	Presque Isle	2017	Update of a county hazard mitigation plan	$9,000	$3,002	$12,002
Salem Township	Allegan	2017	Construction of a safe room	$2,822,846	$961,233	$3,784,079
Wayne County	Wayne	2017	Update of Wayne County HM plan	$83,759	$27,921	$111,680
			TOTALS TO DATE: FY 2002-2017	**$14,285,066**	**$5,004,105**	**$19,289,171**

Two types of grants are available under the PDMP: **Planning** and **Project**. **Planning Grants** provide assistance to states and local communities in developing all-hazard mitigation plans. **Project Grants** help fund eligible mitigation projects that eliminate or reduce damages to public or private property from natural hazards.

Summary of Repetitive Flood Claims Program (RFCP) Projects Funded in Michigan: 2006 and 2012

Applicant	County	Fiscal Year	Project	Federal Investment	Local Investment	Total Investment
Mecosta Township	Mecosta	2006	Acquisition and demolition of one structure	$109,965	$0	$109,965
Estral Beach, Village of	Monroe	2012	Elevation of three homes in the floodplain	$114,998	$0	$114,998
			TOTALS TO DATE: FY 2006 and 2012	**$224,959**	**$0**	**$224,959**

Only one type of grant is available under the RFCP – **project grants**: There is no local share under the RFCP as the program is 100% federally funded.

MITIGATION PROJECT FUNDING MADE AVAILABLE IN MICHIGAN SINCE 1994, BY COUNTY (AS OF JANUARY 2019)

COUNTY	PROJECT TOTAL	FEDERAL SHARE
Alcona	$358,662	$224,581
Alger	$49,557	$36,624
Allegan	$10,804,718	$8,086,954
Alpena	$627,210	$411,669
Antrim	$469,887	$303,039
Arenac	$303,139	$195,100
Baraga	$112,668	$81,852
Barry	$343,076	$256,124
Bay	$3,244,737	$2,578,999
Benzie	$126,290	$88,712
Berrien	$28,632	$21,195
Calhoun	$104,456	$78,125
Cass	$121,116	$89,136
Charlevoix	$469,308	$329,002
Cheboygan	$64,010	$47,672
Chippewa	$624,143	$468,413
Clare	$2,263,973	$1,698,846
Clinton	$873,506	$655,184
Crawford	$62,637	$46,056
Delta	$62,133	$46,056
Dickinson	$117,006	$87,359
Eaton	$405,623	$289,208
Emmet	$179,684	$83,983
Genesee	$5,720,039	$4,302,903
Gladwin	$63,379	$48,401
Gogebic	$713,348	$407,771
Grand Traverse	$1,888,630	$1,413,973
Gratiot	$493,944	$339,986
Hillsdale	$55,407	$26,634
Houghton	$760,708	$560,694
Huron	$663,392	$430,966
Ingham	$1,792,709	$1,321,132
Ionia	$425,228	$324,100
Iosco	$218,075	$115,912
Iron	$243,791	$174,340
Isabella	$1,568,077	$1,170,544
Jackson	$163,044	$103,431
Kalamazoo	$218,304	$161,926
Kalkaska	$22,375	$16,781
Kent	$7,310,511	$5,269,782
Keweenaw	$184,618	$138,097
Lake	$134,767	$100,000
Lapeer	$1,055,993	$791,726
Leelanau	$44,350	$30,656
Lenawee	$202,855	$137,220
Livingston	$674,605	$459,067
Luce	$57,491	$43,424
Mackinac	$494,272	$333,142

Macomb	$2,838,700	$1,695,652
Manistee	$22,375	$16,781
Marquette	$2,166,234	$1,334,220
Mason	$631,906	$471,604
Mecosta	$123,094	$123,094
Menominee	$49,557	$36,624
Midland	$1,704,215	$1,440,576
Missaukee	$22,375	$16,781
Monroe	$6,258,169	$4,755,396
Montcalm	$12,727	$12,727
Montmorency	$60,670	$44,581
Muskegon	$1,781,097	$1,335,703
Newaygo	$329,868	$245,302
Oakland	$4,594,043	$3,101,583
Oceana	$106,827	$80,000
Ogemaw	$294,056	$217,639
Ontonagon	$98,777	$73,977
Osceola	$40,668	$32,727
Oscoda	$60,670	$44,581
Otsego	$62,776	$46,156
Ottawa	$4,371,821	$3,117,035
Presque Isle	$809,416	$604,715
Roscommon	$858,368	$644,643
Saginaw	$4,167,642	$2,736,640
Sanilac	$729,896	$458,251
Schoolcraft	$49,557	$36,624
Shiawassee	$179,175	$134,113
St. Clair	$1,286,974	$953,557
St. Joseph	$327,175	$245,381
Statewide	$4,571,418	$3,739,893
Tuscola	$4,138,550	$2,680,040
Van Buren	$636,393	$416,935
Washtenaw	$5,899,496	$4,335,841
Wayne	$19,036,463	$13,298,426
Wexford	$868,806	$651,605
State of Michigan Totals:	**$116,176,040**	**$83,605,905**

- The totals in this table represent 424 separate grants. Three-hundred-eighty-one (381) of the projects are complete and the totals included in the table are based actual project costs. Forty-three (43) of the grants are awarded but not yet complete as of January 2019. For these grants, projected totals were used based on grant application budgets.
- For grants that benefited multiple counties, the project totals were evenly distributed to the counties they benefitted.
- There are a total of 26 grants that yielded benefits statewide. Those grants are totaled under the category of "Statewide".
- The project grant totals represented in this table are from grants awarded to the State of Michigan from the Federal Emergency Management Agency (FEMA). The grants were awarded from four separate FEMA grant programs. FEMA hazard mitigation grant programs are collectively known as Hazard Mitigation Assistance (HMA). The four grant programs represented in this table are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) program, the Pre-Disaster Mitigation (PDM) program, and the Repetitive Flood Claims (RFC) program. The RFC program no longer exists. All grants, other than totaled in the "Statewide" category, were passed through from the State of Michigan to local units of government, tribes, or state agencies.

Summary of Public Assistance, Section 406 Mitigation

FEMA has the authority to provide Public Assistance (PA) funding for cost-effective hazard mitigation measures for facilities damaged by a declared incident.

Generally, eligible mitigation measures are those the Applicant performs on the damaged portion(s) of the facility. If the Applicant proposes mitigation measures that are distinct and separate from the damaged portion(s) of the facility, FEMA evaluates the proposal and determines eligibility on a case-by-case basis considering how the mitigation measure protects the damaged portion(s) of the facility and whether the mitigation measure is reasonable based on the extent of the damage. Some examples include:

- Constructing floodwalls around damaged facilities
- Installing new drainage facilities (including culverts) along a damaged road
- Dry floodproofing both damaged and undamaged buildings that contain components of a system that are functionally interdependent

Michigan Disaster Declaration 4121

On June 18, 2013, the President declared a major disaster (DR-4121) for 16 Michigan counties: Allegan, Baraga, Barry, Gogebic, Houghton, Ionia, Kent, Keweenaw, Marquette, Midland, Muskegon, Newaygo, Ontonagon, Osceola, Ottawa, and Saginaw, making Public Assistance, including Section 406 Hazard Mitigation, funding available. Approximately $4.8 million in total Public Assistance grant dollars were obligated by FEMA with approximately $281,000 in PA mitigation proposed. Proposed 406 mitigation projects for DR-4121 primarily consisted of slope/embankment protection materials, e.g., rip rap, and culvert upsizing and replacement.

Michigan Disaster Declaration 4195

On September 25, 2014, the President declared a major disaster (DR-4195) for Macomb, Oakland, and Wayne counties, making Public Assistance, including Section 406 Hazard Mitigation, funding available. Approximately $15.2 million in total Public Assistance grant dollars were obligated by FEMA with approximately $1.3 million in PA mitigation proposed. Proposed 406 mitigation projects for DR-4195 primarily consisted of flood prevention measures including floor/roof drains, backwater valve, and flood gate installation.

Because most of the Section 406 Mitigation allocations in Michigan are often small and because these funds are only available for hazard mitigation measures for facilities damaged by a declared incident, subrecipients do not always use the proposed funds. However, those completed projects where Section 406 Mitigation funds have been used, such as the installation of floor and roof drains, backwater valves, flood gates, culverts, and the use of slope and embankment protection materials will reduce the potential for future damage to a facility from a disaster event and break the cycle of disaster/rebuild/disaster.

***Note: PA Program Information taken from FEMA Public Assistance Program and Policy Guide, FP 104-009-2, April 2018.**

Appendix 12: Compendium of Previous MHMP Objectives

This appendix contains objectives that had been removed from previous editions of this plan, either because they were competed or due to other reasons such as non-feasibility, the consolidation of objectives, or gradual de-prioritization by key agencies over time in favor of higher priorities. In previous editions of this plan, this list of objectives had been organized chronologically (by date of the plan in which it had appeared). In this 2019 edition, the list has been reorganized so that all items are organized by goal and objective number. The goals have remained fairly similar since the initial 2005 plan, and therefore this reorganization more clearly shows how related objectives had changed or been replaced over the years. It also helped the MCCERCC Hazard Mitigation Committee to more readily assess this long list to consider whether any of the earlier strategies should reappear in the new 2019 plan update.

Note: Numerous MHMP objectives in this appendix had previously been stated to be environmentally sound, technically feasible, and (except where noted below) to have a benefit-cost review either not applicable or expected to "pass" such a review. Therefore, repetitive language that had referred to these criteria has been removed within the following descriptions. Various other comments and explanation have similarly been edited down so that this appendix retains only the most relevant information.

Some complexity has arisen from changes that had accumulated between previous editions of this plan, so this Appendix includes new overview tables showing how various MHMP objectives within each of this plan's four goals have been carried over, amended, combined, or removed from subsequent editions. For each brief description in the left part of each table, the corresponding number for that objective has been presented within the right side of the table, as it had been listed within each subsequent edition of this plan.

Goal 1: Promote Life Safety

Brief description	2005	2008	2011	2014	2019
Increase awareness of hazard dangers and mitigation solutions.	1.1	1.1	1.1	1.1	1.1
Promote multi-hazard emergency plans in public and private institutions.	1.2	1.2	1.2	1.2	1.2
Promote early warning systems and capability.	1.3	1.3	1.3	1.3	1.3
Develop a "Safety House" to provide training and information.	1.4	2.2	D		
Promote "safe rooms" within homes, businesses, and facilities.	1.5	1.4	1.4	1.4	1.4
Amend the State Fire Safety Code re: places of public assembly.	1.6	D			
Promote anchoring requirements for facility components within flood zones.	1.7	1.5	D		
Promote state disclosure provisions for property transfer within flood zones.	1.8	1.7	D		
Promote a system of real-time stream gauges statewide, for flood warning.	1.9	1.6	1.6	1.5	1.5
Promote the structural anchoring of pre-manufactured homes.	1.10	1.8	D		
Update the Michigan Hazard Analysis.	1.11	1.9	D		1.7
Promote the concept of a "safety gift" list.	1.12	1.10	D		
Promote the local development of hazard analyses and mitigation plans.	1.13	1.11	1.11	1.6	1.6

Objective 1.4 in the 2005 plan was reclassified from Goal 1 to Goal 2, and renumbered as Objective 2.2 in the 2008 plan update. In the table, a D means that the item was marked or designated as deleted or discontinued within the newly updated edition of the plan. (Most of those were crossed out or moved from the active list of strategies into the "Compendium of Addressed Objectives," but some numbering errors were noticed, which have been corrected here in this updated Appendix.) Elements that have been shaded within this table had some significant amendment made to their language within the plan update year that received the shading.

The following objectives for Goal 1 had been removed from later editions of the plan, as described within the updated "Comments/Explanation" text that follows each description. This updated text explains either the current status of objectives that had fully or essentially been completed, or the reasons that some objectives were changed or removed within later editions of this plan.

Objective 1.6 (in 2005 MHMP): Amend the State Fire Safety Code and code enforcement program to include all places of public assembly and congregation.
Implementation Method:

- Study the feasibility of amending the Code.
- Amend the Code (if feasible).
- Develop and fund a uniform statewide code enforcement program.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was removed from the plan in 2008 since that plan only addressed natural hazards. After the plan had again included technological and human-related hazards in 2011, the objective could have been reinstated, but code revisions have not been one of the tasks borne by key agency personnel involved in the plan update since that time.

Objective 1.7 (in 2005 MHMP) and 1.5 (in 2008 MHMP): Establish and enhance anchoring requirements for oil, gasoline, and propane tanks, and paint, chemical barrels in known flood hazard areas.
Implementation Method:

- Study the feasibility of amending State Administrative Rules to include comprehensive anchoring requirements for all land uses in known flood hazard areas.
- Amend the Administrative Rules (if feasible).

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was removed from the 2011 plan because it was not considered feasible within current and projected future resource environments. These concerns still remain. The anchoring of tanks and barrels is relatively cheap, and under flood conditions may prevent the complete loss of the substances they contain, as well as a reduction in potential liability from damages that may be caused by loose tanks and barrels as they float away. When the costs of environmental contamination, cleanup, and liability are compared with the relatively cheap costs of anchoring, the cost-effectiveness of this measure seems apparent. However, the actual mechanisms by which to arrange for state-level administration the objective are not apparent at this time.

Objective 1.8 (in 2005 MHMP) and 1.7 (in 2008 MHMP): Establish / enhance state disclosure provisions for flood prone areas (require the status of all buildings located in floodplains be disclosed as a condition of financing from a financial institution).
Implementation Method:

- Study the feasibility of legislation to strengthen disclosure provisions under state law (Seller Disclosure Act, 92 PA 1993, as amended).
- Consider within that legislation a provision to prohibit construction of public buildings within the floodplain except those required to meet specific needs within the floodplain.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was removed in 2011, when it was described as no longer being considered feasible. Although considered to be a regulatory proposal, substantial effort would still be needed to develop and implement the idea. Its benefits would involve promoting an awareness of (and therefore mitigation of) flood risks, which could no longer simply be passed, *caveat emptor*, to a different (and unsuspecting) property owner. Although there would be administrative costs associated with such regulations, real estate buyers would be more likely to purchase property at a price that better reflects its true value and thus realize substantial savings and benefits. The 1994 Flood Insurance Reform Act requires banks to ensure that flood insurance policies are in place on all structures that have a federally backed mortgage and are located within a FEMA-mapped 1%-annual-chance floodplain. This is not necessarily well-enforced, however, doesn't need to apply to other financing arrangements, the and thus may be a reason why the number of flood insurance has declined in Michigan and other states. In addition, if an area is not mapped for floodplains, then no disclosure of flood liability can be required. The Michigan real estate Seller's

Disclosure form does include elements related to flood damages. The current version of the disclosure form does permit an answer of "unknown" to these questions, however, which is an option that perhaps should be removed. There have been multiple changes (and reversed changes) to the flood insurance program in recent years, and other objectives in this plan address Michigan's flood insurance and flood mitigation needs.

Objective 1.10 (in 2005 MHMP) and 1.8 (in 2008 MHMP): Study the feasibility of requiring all manufactured homes to be tied down (structurally anchored), not just those in designated floodplains, to prevent wind and water rollovers.

Implementation Method:

- Work with the MDLEG Manufactured Housing Commission to study the feasibility of such a proposal.
- Assist in promulgating rules to require universal tie downs (if feasible).

Completed or Removed? REMOVED

Date Addressed: N/A

Funding Source: State Funding (General Fund)

Comments/Explanation: (2019 status) It was noted in a previous plan that new manufactured homes are already required to have an anchoring system installed at the time of their construction. Older and existing manufactured housing units are not required to be anchored. In addition to winds and floods, this objective could support in-place sheltering needs that may apply to other hazards, such as a radiological or chemical release. Bolstering the integrity of residential units, and the capacity of the state to house its residents, plus any evacuees from a national emergency event (i.e. Hurricanes Katrina and Rita in 2005) appear to also be useful benefits. Every residential unit left intact after a disaster means fewer residents that may need sheltering, and may also result in an additional capacity to house those who have been displaced from their own homes. Areas struck by winds could potentially see considerable benefits from structural anchoring. However, this objective was removed in 2011 as it was not considered appropriate for available and projected resources. The current situation in 2019 doesn't feel much more inviting for this type of program, and so its status remains as "tabled." Part of the feasibility issue involves a consideration of overall costs (to private owners, park operators, insurance agencies, and any other involved stakeholders) compared to the expected benefits of reduced property damages.

Objective 1.11 (in 2005 MHMP) and 1.9 (in 2008 MHMP): Revise the Michigan Hazard Analysis to address the years 2006-2008.

Implementation Method:

- Collect, compile, analyze and synthesize hazard data for the period 2006-2008. Incorporate hazard data from local hazard analyses and risk assessments and mitigation plans as appropriate.
- Revise the document format and content as required to reflect the state's current hazard base, state or national or international conditions, and changes in state and federal laws, regulations, policies, programs, and funding.
- Develop and distribute the revised document.
- Incorporate findings into the 2011 revision to the Michigan Hazard Mitigation Plan. (Note: revised plan must be federally approved by March 28, 2011.)
- Note: Implementation of this project is contingent upon additional state planning staff for the MSP/EMHSD.

Completed or Removed? COMPLETED. RESTORED to the 2019 MHMP as Objective 1.7.

Date Addressed: 2010

Funding Source: EMPG, HMGP, PDMP, State Funding (General Fund)

Comments/Explanation: (2019 status) The Michigan Hazard Analysis describes all significant hazards known to affect Michigan, from an emergency management perspective. The Michigan Hazard Analysis document, last published separately in 2012 but a component within the MHMP, has had its natural hazard sections updated as an attachment to this Michigan Hazard Mitigation Plan. However, this interim edition of the hazard analysis will not yet include updated chapters for technological and human-related hazards. It contains only the natural hazards that are required by FEMA to be analyzed for state planning purposes. The document should be further updated in 2019 and 2020 to include the additional hazards expected under EMAP standards. Some of these hazards are Michigan's most serious risks, such as pandemic illness and infrastructure failures. The regular updating of Michigan's hazard mitigation documents has clearly been cost-effective not only because of the usefulness of these documents to emergency management programs throughout the state, but because of the substantial amount of federal funding whose availability is contingent upon maintaining these documents to the required standards. The staff time of key workers

in State government, plus those external parties who review and provide input into the process, is offset by federal support for such planning efforts, and by saving other agencies the substantial resources (and redundancy) that would be involved were they to all independently investigate and analyze the subjects from scratch, on their own. This objective has therefore been updated and restored to the 2019 plan, renumbered as Objective 1.7.

Objective 1.12 (in 2005 MHMP) and 1.10 (in 2008 MHMP): Develop and widely publish a recommended listing of "safety and preparedness gifts" that could be purchased for Christmas, birthdays, and other special occasions, to improve personal and family safety and preparedness in a disaster or emergency.
Implementation Method:

- Establish a committee of emergency management and human service agencies to develop a list based on current family preparedness guidance.
- Identify private sector partners that might be interested in assisting with mass dissemination of the list.

Completed or Removed? COMPLETED
Date Addressed: 2010
Funding Source: HMGP, PDMP, Private Funding
Comments/Explanation: (2019 status) This objective has effectively been addressed by programs such as the MSP/EMHSD "Do One Thing" and "Be Prepared Be Safe" preparedness initiatives. The STEP program and school-oriented contents have been considered far more effective in promoting awareness, and so the original format of this objective is no longer particularly appropriate. Goal 1 is being better served by other objectives within this plan, so this particular wording will not be revived or favored in this 2019 edition.

Goal 2: Reduce Property Damage

Brief description	2005	2008	2011	2014	2019
Integrate hazard mitigation into local comprehensive planning processes.	2.1	D			
Increase EMC and planners' knowledge of hazard mitigation through land use.	2.2	2.1	2.1	2.1	2.1
Develop a "Safety House" to provide training and information.	1.4	2.2	D		
Hazard mitigation measures to protect state facilities from terrorism/sabotage.	2.3	D			
State Construction Code amendments to achieve hazard mitigation.	2.4	D			
Amend State Floodplain Regulatory Authority (SFRA) re: floodplain permits.	2.5	2.3	D		
Amend SFRA re: "grandfather clause" for structures within floodway.	2.6				
Integrating hazard mitigation into the design of public infrastructure.	2.7	2.4	D		
Integrating hazard mitigation into the construction-design review process.	2.8	D			
Further assessment of flood vulnerabilities in state owned/operated facilities.		2.5	2.5	2.2	2.2
Flood data compilation and integration in Geographic Information Systems.	2.9	2.6	2.6	2.3	2.3
Amend NREPA to regulate development downstream from dams.	2.10	2.7	D		
Assess how to map all floodplains to FEMA and MDEQ standards.	2.11	D			
Assess the feasibility and effectiveness of statewide watershed management.	2.12	2.8	D		
Study Michigan's land cover and soils to determine their hydrological effects.	2.13	2.9	D		
Promote minimum setback requirements from agricultural drainage ditches.	2.14	2.10	D		
Promote the detailed directional mapping of drains and their flows.	2.15	2.11	D		
Promote design, construction, and maintenance guidelines for dikes & levees.	2.16	2.12	D		
Promote resilient state codes/standards for water/sewer systems.	2.17	2.13	D		
Promote hazard-resistance within water system master plans.	2.18	2.14	D		
Promote formal "let run" water procedures to reduce freeze-related damages.	2.19	2.15	D		
Promote CDBG-funded reductions in freeze-related water/sewer damage.	2.20	D			
Assess engineering standards and practices to reduce freeze-related damages.	2.21	2.16	D		
Promote hazard mitigation planning in all local emergency mgmt. programs.	2.22	D			
Increase state authority to review subdivision plans for manufactured housing.	2.23	2.17	D		
Promote wind-resistant construction techniques.	2.24	2.18	D		
Increase the advance warning available for extreme or extended cold spells.	2.25	2.19	D		
Promote a community grading system for wildfire resilience.	2.26	2.20	R		
Promote the FIREWISE program throughout the state.			2.20	2.6	2.5
Restrict or require stricter standards on public facilities within hazard areas.	2.27	2.23	D		
Remove or relocate structures within designated floodway areas.	2.28	2.21	2.21	2.4	2.4
Remove, elevate, or relocate the most repetitively flood-damaged structures.	2.29	2.22	2.22	2.5	
Strengthen code/design standards for college/university construction.	2.30	2.24	D		
Promote and assist with flood mitigation projects in vulnerable areas.				2.7	2.6
Promote and assist with wildfire mitigation projects statewide.				2.8	2.7
Identify and fund hazard mitigation actions for facilities and infrastructure.	4.19	4.15	4.15	2.9	2.8
Promote and assist with severe wind mitigation projects statewide.				2.10	2.9
Promote and assist with severe winter weather mitigation projects statewide.				2.11	2.10

Objectives 2.5 and 2.6 in the 2005 plan were merged together into Objective 2.3 in the 2008 plan. Objective 2.20 in the 2008 plan was replaced by a new objective with the same number in the 2011 plan. The 2014 plan re-classified an item from Goal 4 into Goal 2, as Objective 2.9. In the table, a D means that the item was marked or designated as deleted or discontinued within the newly updated edition of the plan. (Most of those were crossed out or moved from the active list of strategies into the "Compendium of Addressed Objectives," but some numbering errors were noticed, which have been corrected here in this updated Appendix.) In the table, an R means that an objective was replaced by another one that was assigned the same number within the updated plan for that year. Elements that have been shaded within this table had some significant amendment made to their language within the plan update year that received the shading.

Objective 2.1 (in 2005 MHMP): Integrate hazard mitigation into the comprehensive planning process at the local and regional levels.

Implementation Method: Establish contact with the State Legislative Committee involved in preparing the "Coordinated Planning Act" to encourage the following:

- Incorporate hazard mitigation into the comprehensive planning process at the local and regional levels by making it a required plan element.
- Incorporate hazard area classifications into standard zoning classifications used in Michigan.
- Permit county overlay zoning of designated hazardous river and stream corridors, hazardous transportation corridors, and intercommunity hazardous areas.
- Require that County Drain Commissioners be included in the review and approval or disapproval of all land use change proposals – to include condominiums, development site plans, and mobile home parks (in addition to the existing review requirement for land subdivisions.
- Require cross jurisdictional hydrologic planning between legal entities within watershed units.

Completed or Removed? SUBSTANTIALLY COMPLETED

Date Addressed: 2006

Funding Source: State Funding (General Fund)

Comments/Explanation: (2019 status) On July 1, 2006, Michigan's three zoning enabling acts (one each for cities and villages, townships, and counties) were officially repealed and combined into one new statute, the Michigan Zoning Enabling Act (2006 PA 110). The Zoning Enabling Act appears to provide sufficient flexibility and regulatory framework to allow communities to effectively use comprehensive planning and zoning to reduce their natural hazard risk and vulnerability. In addition, the work during the 2000s to build awareness of general hazard mitigation needs among urban and regional planners has clearly paid off. The American Planning Association and Michigan Association of Planning have incorporated hazard mitigation into their conference sessions and themes, their guidance materials and training opportunities, and into the specialized sections available to members within the APA.

Objective 1.4 (in 2005 MHMP) and 2.2 (in 2008 MHMP): Develop, construct, and operate (in conjunction with other appropriate entities) a Michigan "Safety House" demonstration model to provide a training and information focal point for builders, building officials, code enforcement officers, engineers, community planners, public works agencies, drain commissioners, and the public on safe, sustainable and disaster resistant building materials and construction techniques.

Implementation Method:

- Revise existing MSP/EMHSD concept paper for use as an educational and "selling" tool for potential partners in the venture.
- Identify and approach potential venture partners to gain support and commitment for the concept.
- Determine size and scope of demonstration model (i.e., full-size structure vs. smaller scale demonstration model) per the options discussed in the concept paper.
- Determine construction and operational costs.
- If feasible, develop a plan of action for constructing the model.
- If a full-size structure is built, develop a plan of action for maintenance and operation of the facility.

Completed or Removed? REMOVED

Date Addressed: N/A

Funding Source: HMGP, PDMP, Private Funding

Comments/Explanation: (2019 status) The idea was never demonstrated to be more cost-effective than alternative methods of presenting the same information. The "disaster resistant" concept is relevant for all types of hazards, but the rise of web-based interactivity might mean that something directed toward that medium would be more appropriate today. A simulated model, or actual "best practice" examples relayed through a GIS "Story Maps" format, could help to demonstrate the feasibility and benefits of disaster-resistant construction, without necessarily proceeding with a physical model that would be subject to wear, maintenance, and additional transportation and staff expenses after it is developed. MSP/EMHSD had developed the original concept paper for this during FY 01. This objective, in this form, will remain tabled for the foreseeable future, but might be reconceived into some other form.

Objective 2.3 (in 2005 MHMP): Implement appropriate mitigation measures to protect state owned / operated critical facilities and infrastructure from acts of sabotage and terrorism.
Implementation Method: Possible mitigation measures include, but are not limited to:

- Developing risk / vulnerability assessments of potential sabotage / terrorism threats.
- Developing plans, strategies and procedures for mitigating identified vulnerabilities.
- Enhancing personnel capabilities through site safety training, better equipment, improved information dissemination, increased numbers of personnel, etc.
- Hardening of facilities to include design, construction and structural enhancements to prevent damage and the potential for injury or loss of life (i.e., stronger / fire resistant materials; use of shatterproof / glazed glass; better egress routes; reduced points of entry; increased "buffer" zones; etc.)
- Physical security enhancements to include fencing, barriers, locking doors, lighting, cameras / monitors, motion detectors, alarms, computer firewalls, redundant security / communication systems, etc.
- Security screening enhancements to include bio-threat detectors, metal detectors, x-ray machines, plastic explosive detectors, electronic ID card systems, optical / fingerprint scanners, etc.

Completed or Removed? REMOVED
Date Addressed: ONGOING
Funding Source: HSGP State Funding (General Fund)
Comments/Explanation: (2019 status) This is an ongoing effort, under the umbrella of the Michigan Homeland Security Strategy and in conjunction with the Michigan Homeland Security Preparedness Committee, Michigan Homeland Security Advisory Council, Michigan Homeland Protection Board, the MSP/EMHSD, and appropriate state agencies. With this homeland security structure in place, this prevention and protection objective no longer needs to be specified within the MHMP or under the purview of the MCCERCC.

Objective 2.4 (in 2005 MHMP): Amend the State Construction Code to include, where appropriate, hazard mitigation measures designed to enhance wind, flooding, snow load and fire protection provisions.
Implementation Method: Establish a new statewide building code based on the national consolidated code.
Completed or Removed? COMPLETED
Date Addressed: 2000
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) A statewide code was established and implemented under 1999 PA 245. The code has adequate provisions for wind, flooding, snow loads, and fire protection.

Objective 2.6 (in 2005 MHMP): Amend Part 31 of the State Floodplain Regulatory Authority to address the "grandfather" clause that allows continued floodway occupation as long as the size of the structure is not increased.
Implementation Method: Amend the Part 31 Rules.
Completed or Removed? REMOVED
Date Addressed: ONGOING
Funding Source: EMPG, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) This 2005 objective was merged with 2005 Objective 2.5 to form Objective 2.3 within the 2008 plan, and included all desired modifications to the Part 31 Rules.

Objective 2.8 (in 2005 MHMP): Incorporate hazard mitigation factors into the design review process for construction or major modification of all state owned/operated critical facilities.
Implementation Method:

- As part of the MHMP revision process, identify state owned / operated critical facilities occupying floodplains, floodways, subsidence areas, high risk erosion zones, earthquake zones and other known, location-specific natural and technological hazard areas.
- As part of the MHMP revision process, estimate potential losses to state owned / operated critical facilities for all relevant natural, technological and human-caused hazards.
- Based on the results of the MHMP Risk Assessment process, conduct detailed follow-up studies of vulnerable facilities to identify the most appropriate mitigation measures for each facility, given its level of vulnerability, potential losses, facility design and function, etc. Specifically address the following identified concerns:

- Determine the first-floor elevations of facilities in identified floodplains and other potential flood prone areas. Determine if facilities should be flood proofed, elevated, or relocated, or if drainage should be improved, as the most appropriate mitigation option.
- More precisely identify facilities that are vulnerable to subsidence by conducting site-specific geological surveys to determine the presence of abandoned and unmapped underground mines.

- Based on the results of these detailed studies, select the most appropriate mitigation measures and strategies for each facility in order to minimize future disaster damage.
- Implement identified measures and strategies where possible, based on available resources.
- Through the MDTMB representative on the MHMCC, encourage state agency personnel involved in the design review process for future construction or major modification of state facilities to advocate for hazard mitigation measures whenever practical.
- Revise and enhance the State Flood Hazard Mitigation Plan (Executive Order 1977-4) to prevent, where possible, the locating of state facilities in floodplains, floodways, or other known hazardous areas.

Completed or Removed? SUBSTANTIALLY COMPLETED
Date Addressed: 2005
Funding Source: EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) Executive Directive 2001-5 was signed on September 11, 2001, to develop a statewide, interagency flood mitigation strategy to assure compliance with Executive Order 1977-4. Please see **Appendix 15**. State owned/operated critical facilities have been identified and analyzed as part of the MHMP since 2004. Detailed follow-up studies of vulnerable state owned/operated critical facilities are performed as needed. No state owned/operated critical facilities are located within high-risk erosion zones, and the potential losses to state owned/operated facilities from earthquake were determined to be negligible.

Objective 2.11 (in 2005 MHMP): Study methods to map all floodplains in Michigan to current FEMA and MDEQ standards.
Implementation Method:

- Maximize MDEQ participation in FEMA's Map Modernization Program.
- Maximize local participation in the Cooperating Technical Partner (CTP) Program with the MDEQ.

Completed or Removed? COMPLETED
Date Addressed: 2007
Funding Source: FEMA MMP, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) The Map Modernization Program has effectively been replaced with RiskMAP, with MDEQ and other Michigan agencies is fully engaged as partners. These efforts should yield updated floodplain maps statewide within the next few years.

Objective 2.20 (in 2005 MHMP): Encourage and provide technical assistance to communities to use CDBG funds for implementing water and sewer freeze resistance measures.
Implementation Method:

- Work with the Michigan CDBG Program to determine which types of projects would be eligible for funding consideration under the Rebuild Michigan and other similar programs.
- Provide that information to communities statewide via informational letter, web posting, or other appropriate method.
- Establish a monitoring system with the CDBG Program to determine the number of freeze related projects that have been funded.

Completed or Removed? COMPLETED
Date Addressed: 1996
Funding Source: CDBG, EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) Reliable water and sewer infrastructure is vital to community economic development and job creation and retention. By 2008, CDBG funds had been used to implement 12 water and sewer infrastructure freeze protection projects within the declared area for Federal Disaster 1028. The total CDBG investment in these ground freeze mitigation projects was $5.7+ million. Other forms of infrastructure improvement are now being implemented within Michigan.

Objective 2.22 (in 2005 MHMP): Develop hazard mitigation plans (in coordination with local comprehensive plans if possible) in all local emergency management program jurisdictions.
Implementation Method:
- Develop and distribute planning guidance.
- Provide technical assistance as needed.
- Collect and compile pertinent data related to the planning effort.
- Provide direct assistance in writing plans as needed.
- Review and certify completed plans.
- Submit plans to FEMA for final certification.

Completed or Removed? SUBSTANTIALLY COMPLETED
Date Addressed: 2008
Funding Source: HMGP, FMAP, PDMP, EMPG
Comments/Explanation: (2019 status) Please refer to Appendix 3 for information on how ongoing support has been provided on this topic during the time since the 2014 plan was completed.

Objective 2.5 (in 2005 MHMP) and 2.3 (in 2008 MHMP): Amend Part 31 of the State Floodplain Regulatory Authority to address 1) concerns pertaining to permits for filling or construction within the floodplain of inland lakes, and 2) the "grandfather" clause that allows continued floodway occupation as long as the size of the structure is not increased.
Implementation Method:
- Study the feasibility of amending the Part 31 Rules.
- Amend the Part 31 Rules (if feasible).

Completed or Removed? COMPLETED
Date Addressed: N/A – ONGOING
Funding Source: EMPG, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was considered complete by 2011, having been effectively addressed by the rewriting of Part 31 administrative rules. Codes and insurance policy became more important. The grandfather clause temporarily disappeared from national flood insurance policy under federal flood insurance revisions, but was restored a couple years later. Some useful reference information can be found here: https://www.fema.gov/flood-insurance-reform-law.

Objective 2.7 (in 2005 MHMP) and 2.4 (in 2008 MHMP): Study methods to incorporate hazard mitigation considerations into the design of new and substantially improved public infrastructure to ensure disaster-resistance and structural integrity.
Implementation Method:
- Conduct a comprehensive study of federal and state regulatory mechanisms related to the design, engineering and construction of public infrastructure.
- Study the feasibility of amending state codes, standards, rules and permitting processes for public infrastructure to incorporate or enhance disaster-resistant practices.
- Amend codes, standards, rules, and permitting processes (if feasible).
- Develop and adopt minimum standards for drain design and construction as part of the effort to revise the State Drain Code.

Completed or Removed? CONSOLIDATED
Date Addressed: N/A – ONGOING
Funding Source: HMGP, State Funding (General Fund)
Comments/Explanation: (2019 status) The 2011 MHMP stated that this objective was being consolidated with other MHMP items, such as Objective 1.1. Substantial consideration has already been given in recent years to the "hardening" of critical facilities and infrastructure against terrorism and sabotage. Additional work followed the Flint Water Emergency, to address the issue of lead contamination.

Objective 2.10 (in 2005 MHMP) and 2.7 (in 2008 MHMP): Amend Part 315 of the Natural Resources and Environmental Protection Act to regulate development downstream of a dam through analysis of the dam's "hydraulic shadow."

Implementation Method:

- Study the feasibility of amending Part 315 of the Act.
- Amend Part 315 of the Act (if feasible).

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) In 2011, this item was removed after progress had slowed and was then considered unfeasible due to "lack of staff, competing work priorities, and political and fiscal realities." The idea was to amend the Dam Safety Act to identify that the "hydraulic shadow" below each dam, and that development in that area is at risk in case of a dam failure. A local zoning authority can prohibit building in the hydraulic shadow, but that does not always occur. An alternative to the legislative amendment could be a vigorous educational campaign targeted at local zoning administrators and other community officials.

Objective 2.12 (in 2005 MHMP) and 2.8 (in 2008 MHMP): Study the implications of instituting statewide watershed management to enhance local and state flood management efforts in Michigan.
Implementation Method:

- This issue is being considered as part of the overall effort to amend the state planning enabling legislation (the "Coordinated Planning Act").
- Consider conducting a separate study of this issue, in conjunction with the Michigan Association of Regions, the Michigan Association of Planning, and other appropriate professional groups.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: HMGP, FMAP, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) By 2011, it had been noted that progress had slowed and the objective was no longer considered feasible. Recent RiskMAP efforts are occurring on a watershed basis, however, involving state and federal partnering agencies. Watershed management includes the alleviation of multiple types of secondary effects from flooding.

Objective 2.13 (in 2005 MHMP) and 2.9 (in 2008 MHMP): Conduct a study of Michigan's land character and its influence on storm water runoff – to facilitate the development of a land coverage formula for Michigan based on soil character.
Implementation Method: Digitize soil surveys of all Michigan counties to show and determine soil erosion potential and soil water holding capacity. (From this effort, a formula can be developed to calculate the maximum recommended land coverage for impervious surfaces. Soil characteristics, slopes and vegetation types will be considered in the development of this methodology.)
Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: HMGP, PDMP, State Funding (General Fund)
Comments/Explanation: (2019 status) This project was initiated with two HMGP projects under Federal Disasters 1128 and 1181 ($442,853 in project investment to date). Soil surveys for a total of 11 east central Michigan counties were digitized under this effort by the Michigan Department of Agriculture and Rural Development (MDARD). Additional work for other areas of the state had to be postponed until time and resources allowed. This is another state-level study that was considered unfeasible by 2011 and removed from the plan. This item is directed primarily toward flood prevention (and may also be useful for the handling of droughts). The size of this task becomes substantially easier to manage as the extent and quality of statewide digital data sets continues to develop. In the meantime, USGS stream modeling activities have provided useful information about the flood and drought hazards. Comprehensive LiDAR coverage is expected within the next few years. At a point when topographic, hydrologic, and other data can be readily integrated using a Geographic Information System, the staff time and resources needed to accomplish this type of task (in tight budget times) should become affordable enough to provide confidence that the net benefits realized from the effort will be substantial enough to offset the costs of the project. At such a point, this objective might be reconsidered.

Objective 2.14 (in 2005 MHMP) and 2.10 (in 2008 MHMP): Promote the establishment of minimum setback requirements for agricultural drainage ditches.
Implementation Method:

- Develop and distribute guidance (through the Michigan Cooperative Extension Service and/or related organizations) on "best practices" for greenbelts along agricultural drainage ditches.
- Study the feasibility of legislation requiring a state setback standard.
- Study the feasibility of legislation allowing for acquisition of buffer strips, or easement rights through tax abatement or other financial mechanism.
- Seek legislation for both (if feasible).

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: HMGP, EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) This item was focused on flood prevention, taking a statewide and regulatory approach to help spread the benefits and costs. When the regulations tend primarily just to improve the quality of future decisions, rather than to require the correction of past mistakes, this objective can be considered more manageable in its ambitions. By 2011, this objective was still removed from the MHMP along with other abstracted statewide information-based efforts. As statewide geodata becomes available and has been integrated, a return to this objective should become feasible again.

Objective 2.15 (in 2005 MHMP) and 2.11 (in 2008 MHMP): Develop and distribute detailed maps showing drains and their flow direction, to assist in disaster response actions associated with liquid pollutants.
Implementation Method:

- Digitize drainage channels of all Michigan counties to show drain routes, characteristics and flow direction.
- Work with county road commissions to have drain routes and flow direction included on official county road maps.
- Work with county planning departments and regional planning commissions to have drain routes and flow direction included on county land use and zoning maps.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: HMGP, State Funding (General Fund)
Comments/Explanation: (2019 status) This was another statewide study that had been removed from the MHMP by 2011. However, this objective describes activities that recently have been undertaken by USGS. This item is relevant to technological hazards involving hazardous materials, and may also relevant to human-related hazards involving public health emergencies, contamination, or deliberate sabotage/terrorism. Digital data has advanced to the point where the task has become feasible, but not necessarily for a Michigan state-level agency to complete. Support for existing USGS efforts will be maintained, but this objective otherwise remains outside of the active items within this plan. Once fully digitized, drain routes and hydrology could be included on county road maps and county land use and zoning maps to assist local responders during liquid pollutant emergencies. The efforts are also relevant to floods.

Objective 2.16 (in 2005 MHMP) and 2.12 (in 2008 MHMP): Develop and establish design, construction, and maintenance guidelines for dikes and levees protecting agricultural land.
Implementation Method: Develop and distribute (through the Michigan Cooperative Extension Service and/or related organizations) guidelines that incorporate current engineering and maintenance "best practices" for agricultural dikes and levees.
Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) Another statewide study that had been removed from the 2011 MHMP, this item is focused upon flood control infrastructure. This objective might be expanded to include the protection of critical infrastructure. The costs would primarily involve staff time, but the key restriction would be the expertise and agency commitment involved in researching, producing, and promoting the adoption of these guidelines. Once developed, web-publication of these guidelines would be quite inexpensive, but likely to result in safety improvements in at least some of the state's many agricultural areas. This objective will still remain tabled until a more evident

match appears between its implementation and the level of interest and resources currently available for it within the most relevant state agencies.

Objective 2.17 (in 2005 MHMP) and 2.13 (in 2008 MHMP): Increase awareness of community officials about state codes and standards for water and sewer systems, and the permit processes for system alterations, to prevent frost damage to new and existing infrastructure.
Implementation Method:

- Issue MDEQ guidance to local communities on a regular basis, with special emphasis placed on ground freeze mitigation.
- Include the guidance in the MSP/EMHSD Statewide Mitigation Marketing and Public Education Project under Federal Disaster 1346, which is targeted at seven professional groups that influence mitigation decisions at the local level. (Public works officials are one of the seven targeted groups.)
- Fully integrate ground frost damage prevention measures into all system master plans and the permitting process for system improvements and alterations.

Completed or Removed? COMPLETED/CONSOLIDATED
Date Addressed: N/A – ONGOING
Funding Source: HMGP, PDMP, State Funding (General Fund)
Comments/Explanation: (2019 status) By 2011, Bullet 2 was considered to be sufficiently covered by Objective 1.1 (public education), and bullets 1 and 3 both fall under ongoing MDEQ efforts to ensure the structural and operational integrity of water and sewer systems. Infrastructure strengthening has been implemented since the damaging freeze of 1994 (Federal Disaster 1028-DR-MI) and different kinds of infrastructure issues have been prioritized since those improvements. For these reasons, this objective was removed from further consideration.

Objective 2.18 (in 2005 MHMP) and 2.14 (in 2008 MHMP): Develop water system master plans that adequately address ground freeze protection for those communities that don't presently have such plans.
Implementation Method:

- Work with the MDEQ to determine which communities in Michigan do not have water system master plans that adequately address ground freeze protection.
- Determine the most appropriate method(s) for providing technical assistance to complete a master plan.
- Study the feasibility of using HMGP and/or PDMP planning funds to provide technical assistance for completing master plans that feature freeze resistance as a plan component.

Completed or Removed? COMPLETED
Date Addressed: N/A – ONGOING
Funding Source: HMGP, PDMP, State Funding (General Fund)
Comments/Explanation: (2019 status) Bullets 1 and 2 are part of ongoing system monitoring and regulation efforts by the MDEQ to ensure the structural and operational integrity of water and sewer systems against natural, technological and human-caused hazards. This is an ongoing, established process that had been strengthened in emphasis since the "freeze disaster" of 1994 (Federal Disaster 1028-DR-MI), and is adequate to meet the State's needs in this area. Bullet 3 is not feasible because of fund work eligibility restrictions and because other funding sources exist for this type of assistance. For these reasons, this objective had been removed from further consideration in 2011. Different forms of infrastructure priorities have developed since then, although in general it remains true that a water system master plan can help communities develop and implement both short and long-range preventive measures for ground frost damage and other vulnerabilities.

Objective 2.19 (in 2005 MHMP) and 2.15 (in 2008 MHMP): Establish formal "let run" policies and procedures to keep water moving through a community's system to prevent freezing during periods of extended or extreme cold weather.
Implementation Method:

- Issue MDEQ guidance to local communities on a regular basis, with special emphasis during extended periods of extreme cold temperatures.
- Include the guidance in the MSP/EMHSD Statewide Mitigation Marketing and Public Education Project under Federal Disaster 1346, which is targeted at seven professional groups that influence mitigation decisions at the local level. (Public works officials are one of the seven targeted groups.)

- Fully integrate let-run policies and procedures into all system master plans.

Completed or Removed? COMPLETED/CONSOLIDATED
Date Addressed: N/A – ONGOING
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) Bullets 1 and 3 are part of ongoing system monitoring and regulation efforts by the MDEQ to ensure the structural and operational integrity of water and sewer systems against natural, technological and human-caused hazards, an ongoing, established process that had been strengthened after Michigan's 1994 infrastructure "freeze disaster" (Federal Disaster 1028-DR-MI), and is adequate to meet the State's needs. Bullet 2 is being addressed by Objective 1.1 (mitigation marketing / education campaign for target groups). For these reasons, this objective had been removed from the MHMP in 2011. Different forms of infrastructure vulnerability have instead been prioritized since that time. Many communities already make use of the "let run" principle—although some water is used with this practice (and thus causes an expense), the damages caused by frozen pipes can be disastrous, and so the expense of this preventive practice has been determined to be justifiable. Community let-run actions are initiated and terminated locally, and although they may not be uniform or consistent, they seem to have been sufficiently effective.

Objective 2.21 (in 2005 MHMP) and 2.16 (in 2008 MHMP): Determine if the State's cold weather engineering practices and standards are sufficient to mitigate water and sewer infrastructure freeze failure.
Implementation Method:

- Research and determine cold weather engineering "best practices" for water and sewer infrastructure (if different from current MDEQ practices and standards).
- Determine additional costs of following the higher engineering standards and practices.
- If the higher standards and practices are feasible, work with MDEQ to incorporate those standards and practices into current State codes, standards, and practices for design, construction, and alteration of public water and sewer systems.

Completed or Removed? COMPLETED
Date Addressed: N/A – ONGOING
Funding Source: EMPG, HMGP, PDMP, State Funding (General Fund and State Revolving Funds for public water and sewer infrastructure improvements)
Comments/Explanation: (2019 status) By 2011, this objective was considered complete, and removed from the MHMP actions list. Each of the three implementation actions are part of ongoing system monitoring and regulation efforts by the MDEQ to ensure the structural and operational integrity of water and sewer systems against natural, technological and human-caused hazards. This is an ongoing, established process that had been strengthened after Michigan's 1994 infrastructure "freeze disaster" (Federal Disaster 1028-DR-MI), and is adequate to meet the State's needs in this area.

Objective 2.23 (in 2005 MHMP) and 2.17 (in 2008 MHMP): Determine the feasibility of increasing the authority of the MDLEG Manufactured Housing and Land Development Division to allow for amendment or rejection of proposed manufactured housing subdivision plats that are located in, adjacent to, or would be adversely impacted by, technological hazard areas.
Implementation Method:

- Study the feasibility (and desirability) of increasing the MDLEG authority to amend or reject manufactured housing subdivision plats that are at risk (potential/actual) from technological hazard areas.
- If feasible and desirable, develop a statewide standard and universal application of regulations in the development of manufactured housing subdivisions.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) The idea of reviewing proposed manufactured housing subdivision plats for a vulnerability to hazards other than floods (already overseen by MDEQ) may merit further study, but had been judged to be politically unfeasible by 2011, when it was removed from the MHMP list of actions. Generally, subdivision development is a local zoning issue in Michigan. A statewide standard and universal application of regulations in the

development of manufactured housing subdivisions might be desirable, but could be considered unacceptable in its actual implementation.

Objective 2.24 (in 2005 MHMP) and 2.18 (in 2008 MHMP): Promote wind resistant construction techniques to builders and the public, to prevent / minimize major structural damage due to severe winds.
Implementation Method:

- Conduct a public information campaign aimed at increasing the use of structural fasteners in new construction and retrofitting of existing structures. The campaign could be part of an existing hazard awareness campaign (i.e., Severe Weather Awareness Week) or a separate effort.
- Develop a slogan that promotes the use of structural fasteners in residential and commercial construction.
- If the Michigan "Safety House" demonstration model project is implemented, wind resistant construction techniques will be highlighted in that demonstration model. (Refer to 2008 MHMP Objective 2.2 for details.)

Completed or Removed? COMPLETED
Date Addressed: N/A – ONGOING
Funding Source: EMPG, HMGP, PDMP, State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was judged to have been met by 2011, through regional and national advocacy and education campaigns conducted by fastener manufacturers, building supply retailers, nongovernmental organizations, and various governmental agencies—including FEMA. FEMA's web site provided excellent information on wind-resistant construction techniques, and included links to other informative sites. Although a Michigan-specific campaign was not established, these other efforts provided sufficient advocacy and guidance for builders and citizens wishing to increase structural integrity through the increased and consistent use of structural fasteners. Bullet 3 was judged to be unfeasible because the Michigan "Safety House" had itself been removed from further consideration.

Objective 2.25 (in 2005 MHMP) and 2.19 (in 2008 MHMP): Develop a methodology for identifying and alerting communities of periods of extended or severe cold temperatures that could lead to widespread water and sewer system freeze-ups.
Implementation Method:

- Research the combinations of temperature, snow cover, soil conditions, pipe depth, water temperature (etc.) required to create water and sewer infrastructure freeze conditions.
- Determine the number of days per year that infrastructure freeze conditions could be expected for each region of the state.
- Establish a standardized warning classification system for the level of risk expected (i.e., freeze watch, freeze warning), similar to those used for severe weather.
- Develop a warning notification system that can be utilized in all Michigan communities.

Completed or Removed? COMPLETED/REMOVED
Date Addressed: N/A – ONGOING
Funding Source: HMGP, PDMP, EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) By 2011, this objective was judged to have been essentially met by ongoing system monitoring and regulation activities by the MDEQ to ensure the structural and operational integrity of water and sewer systems against natural, technological and human-caused hazards. That process had been strengthened since Michigan's 1994 infrastructure "freeze disaster" (Federal Disaster 1028-DR-MI), and is adequate to meet the State's current needs in this area. Although a Michigan-specific classification system was not developed, ongoing and ever-improving freeze forecasts by NOAA/NWS provide sufficient early notification to community officials of the potential for infrastructure freeze-ups due to cold temperatures and/or ground frost depth.

Objective 2.27 (in 2005 MHMP) and 2.23 (in 2008 MHMP): Mandate that schools, hospitals, fire stations, and other critical public facilities (paid for fully or partially by state funds) not be constructed in known hazard areas unless sufficient mitigation measures are implemented to reduce potential injuries, loss of life, property damage, and loss of function or essential services.
Implementation Method:

- Define what constitutes a "hazard area" and "sufficient mitigation measures" to ensure clarity and comprehensiveness in the application of the mitigation strategy.

- Define what a "critical public facility" is and develop a statewide standard and universal application of regulations in the construction and siting of such facilities.
- Ensure that provisions are put in place to eliminate any possibility of violations to the "Headlee Amendment" of the Michigan Constitution.
- Study the feasibility of enacting legislation to ensure that this impact reduction measure is institutionalized in all program areas and for all types of applicable facilities.
- Seek legislation (if feasible).
- Develop new administrative rules as required.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was intended to be able to have a preventive effect without entailing significant costs for its implementation, being primarily rooted in examining the procedures followed in capital facilities planning (primarily done at the local level), so that consideration must be given to the existence and location of identified floodplain areas or other known areas of higher-risk. However, it became difficult to pinpoint what types of facilities would necessarily be included, and what level of risk would mandate restrictions. It was considered unlikely that the Michigan Planning Enabling Act (2008 PA 33), passed after years of debate and deliberation by planning officials, elected officials and a number of other professional discipline stakeholders, would be amended in this manner. The completion of at least 100 local hazard mitigation plans, covering the vast majority of Michigan's land area from a local perspective, is a new resource that might allow this objective to be further assessed, but more on a voluntary basis, in which case it could be said that the activity has already received consideration within local plans. Awareness may already be sufficient that each local facility is already assessed on a case by case basis. This objective was removed from the plan in 2011. At present, there are no strict requirements for the location of emergency facilities, other than local zoning laws, many of which restrict building within floodplains.

Objective 2.30 (in 2005 MHMP) and 2.24 (in 2008 MHMP): Require colleges / universities to adhere to the provisions of the State Construction Code and third-party inspections.
Implementation Method:

- Establish a dialogue with the MDLEG on the feasibility of including these structures in the Code provisions.
- If feasible, assist the MDLEG in revising legislation and promulgating rules to include college facilities in the Code provisions.

Completed or Removed? COMPLETED
Date Addressed: 2002 / ONGOING
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) The enactment of the Construction of School Buildings Act (2002 PA 628) and the Stille-DeRossett-Hale Single State Construction Code Act (1999 PA 245) effectively addresses this objective. In addition, college and university facilities used for instructional purposes are also required to comply with the fire safety Administrative Rules promulgated by the State Fire Safety Board under the Michigan Fire Prevention Act, 1941 PA 207, as amended. Collectively, these regulatory mechanisms address the construction and occupant safety concerns at college and university facilities, as identified in this objective. Therefore, the objective had been assessed as complete by 2011 and removed from further consideration. Colleges and universities typically have the capacity to realize this objective without undue hardship. The density of residential arrangements (and other functions) on academic campuses requires things to run smoothly, and also means that an emphasis on code compliance and inspections is not an unreasonable or inappropriate requirement. The costs of the types of accidents or injury that might result from non-compliance could easily be estimated to exceed the costs of non-compliance. Colleges and universities clearly have a lot at stake in maintaining efficient and safe operational arrangements for their activities, and each institution's reputation is also quite important to maintain. Therefore, there is already great cause for each institution to voluntarily wish to comply with or exceed code and inspection standards.

Goal 3: Build Alliances

Brief description	2005	2008	2011	2014	2019
Consolidate hazard awareness campaigns into one overarching promotion.	3.1	3.1	D		
Promote urban forestry programs to mitigate storm, wind, and fire impacts.	3.2	3.2	3.2	3.1	3.1
Increase local participation in the National Flood Insurance Program (NFIP).	3.3	3.3	3.3	3.2	3.2
Improve the NFIP policy base to better reflect varied flood risks in Michigan.	3.4				D
Coordinate proposed recreation land purchases with at-risk flood areas.	3.5	3.4	D		
Assess the enhancement of wind-resistant standards in MSHDA structures.	3.6	3.5	D		
Reduce hazardous materials threats through SERC hazard mitigation actions.	3.7	D			
Maintain and strengthen mitigation partnerships: SJ, SEMCs, MCCERCC, etc.					3.3
Identify and promote new partnerships to achieve hazard mitigation.					3.4

Objectives 3.3 and 3.4 in the 2005 plan were merged into Objective 3.3 in the 2008 plan. In the table, a D means that the item was marked or designated as deleted or discontinued within the newly updated edition of the plan. (Most of those were crossed out or moved from the active list of strategies into the "Compendium of Addressed Objectives," but some numbering errors were noticed, which have been corrected here in this updated Appendix.) Elements that have been shaded within this table had some significant amendment made to their language within the plan update year that received the shading.

Objective 3.4 (in 2005 MHMP): Increase the statewide NFIP policy base to more accurately reflect the flood hazard threat in Michigan.
Implementation Method: All implementation methods listed under Objective 3.3 are also valid under this Objective.
Completed or Removed? CONSOLIDATED
Date Addressed: N/A – ONGOING ACTIVITY
Funding Source: EMPG, HMGP, FMAP, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) This objective had been combined with 2005 Objective 3.3 within the 2008 plan.) Generally, the MDEQ targets its NFIP promotional activities at those communities that have the greatest flood risk. These flood-prone communities are a higher priority for promotional activities than are communities with less of a flood risk.

Objective 3.7 (in 2005 MHMP): Identify and implement mitigation measures that could reduce or eliminate the threats to life and property from hazardous material fixed site and transportation accidents.
Implementation Method:

- Study possible methods and mechanisms for expediting the completion of SARA Title III off-site response plans required for each Section 302 site.
- Develop strategies to integrate local emergency management planning and SARA Title III hazardous material response planning into local comprehensive planning efforts. (See Goal 2 – Reduce Property Damage – for additional information on this activity.)
- Consider integrating local hazardous material planning efforts (via the LEPCs) into the "Michigan Safety First Community" initiative described in Objective 3.1.
- Develop strategies for assisting LEPCs in proactively examining 302 sites to reduce chemical inventories (where feasible) and the resultant risks to human life and property.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) Federal HMEP and HSGP funding has been used to facilitate the completion of numerous SARA Title III Section 302 plans. Although many of those completed plans will need to be updated over the next several years, these activities show that the topic is handled in an ongoing manner.

Objective 3.1 (in the 2005 and 2008 MHMPs): Integrate existing hazard awareness campaigns into one safety promotion campaign that addresses hazard vulnerability reduction, crime prevention, fire safety, traffic safety, school safety, etc.

Implementation Method: Study the feasibility of establishing a "Michigan Safety First Community" designation that local communities could work toward by undertaking appropriate public safety and hazard mitigation measures.
Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: EMPG, HMGP, PDMP, State Funding (General Fund), Private Funding (partners to be determined)
Comments/Explanation: (2019 status) This objective had been removed from the MHMP in 2011 as impractical. The "Michigan Safety First Community" designation could possibly have a graduated incentives program (i.e., tax breaks, insurance rate reductions, less regulatory burden, etc.) as communities implemented required actions in support of the designation. A detailed concept paper on the "Michigan Safety First Community" designation was developed by the MSP/EMHSD during FY 01, and included implementation options for this initiative, which failed to gather steam.

Objective 3.5 (in 2005 MHMP) and 3.4 (in 2008 MHMP): Coordinate proposed recreation land purchases with identified flood mitigation needs across the state.
Implementation Method:

- Hold regular coordination meetings with the MDNR Parks and Recreation Division to review each agency's short and long-term needs and proposed land purchases.
- When possible, purchase land that has both recreation and flood mitigation value.
- Develop strategies to integrate this objective into local planning efforts (e.g., hazard mitigation, comprehensive / land use, parks / recreation, etc.) to ensure it is considered in both long and short-term land use / development decisions.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: HMGP, EMPG, FMAP, PDMP, RFCP, SRLP, Parks and Recreation Funding (federal, state, local)
Comments/Explanation: (2019 status) Areas under consideration for purchase as open space or parks and recreation land may also serve the dual benefit of mitigating flood hazards by prohibiting residential or commercial development or providing space for storm water or seasonal runoff retention or detention. Conversely, areas under consideration for purchase for flood mitigation purposes may also have significant value for open space or recreation. From the state government perspective, this action had seemed to entail few additional costs involving the development of procedures to make use of available flood information when engaged in recreational planning and related resource development and land acquisition/management decisions. From the local perspective, the costs of this activity (mainly in terms of time and staff efforts) might have been broadly incorporated into the larger goal of integrating hazard mitigation practices into urban and regional planning activities. By 2011, however, it was decided that this objective was unfeasible. Because of different funding cycle time frames and purchase objectives, it is difficult to coordinate purchase activities with the MDEQ. In addition, virtually all land acquisition projects undertaken for flood mitigation purposes are completed through local government-sponsored project applications. Many hazard mitigation grant-funded flood acquisition and relocation projects have in fact purchased land that was then converted to permanent recreational open space. This purchase strategy is well-founded in local hazard mitigation plans and is strongly advocated by the MSP/EMHSD in its guidance and technical assistance provided to local mitigation plan developers and potential grant applicants. State-level staffing resources are inadequate to allow much additional time to be devoted to the proactive identification, statewide, of potential land purchases for flood mitigation purposes. In addition, the State of Michigan generally lacks matching funds to proactively purchase land itself for flood mitigation purposes, although the MDEQ occasionally purchases land that includes floodplains, at least partially useable for recreational purposes using dedicated (restricted) funding sources. This objective is more appropriate for implementation at the local government level, and therefore had been removed from consideration in 2011.

Objective 3.6 (in 2005 MHMP) and 3.5 (in 2008 MHMP): Study the feasibility of requiring Michigan State Housing Development Authority (MSHDA)-financed structures to incorporate wind engineering techniques designed to reduce or eliminate future wind damage.
Implementation Method:

- Conduct a joint study (MSP/EMHSD and MSHDA) to determine if enhanced wind engineering measures would be feasible in MSHDA projects. The study should address both practical and financial considerations.
- If the study results are affirmative, revise MSHDA documents and procedures as necessary to address the enhanced construction requirements.

Completed or Removed? COMPLETED
Date Addressed: N/A – ONGOING
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) A multi-county pilot wind engineering project was conducted with the MSHDA in 1999-2000 using $150,000 in U.S. Department of Housing and Urban Development (HUD) "Disaster Recovery Initiative" funding associated with the 1998 severe storms and flooding which struck the Midwest (and which resulted in Federal Disasters 1226-DR-MI and 1237-DR-MI in Michigan). Although this project was successful, the staff time required to coordinate, monitor and report activities was considerable and would be difficult to sustain on a regular basis. However, since that pilot project MSHDA has taken a more proactive role in promoting wind engineering in its projects. Wind engineering techniques are incorporated in MSHDA-financed structures when it is cost-acceptable to do so or when required by the State's Single Construction Code. MSHDA has taken this proactive mitigation posture voluntarily. Therefore, this objective was removed from MHMP consideration in 2011.

Goal 4: Provide Leadership

Brief description	2005	2008	2011	2014	2019
Promote hazard mitigation awareness and education throughout the populace.	4.1	4.1	4.1	4.1	4.1
Improve interagency communications on hazard mitigation strategies.	4.2	4.2	4.2	4.2	4.2
Establish an efficient and fair process for hazard mitigation project funding.	4.3	D			
Promote hazard mitigation activities that address multiple objectives.	4.4	D			
Regularly update the Michigan Hazard Mitigation Plan.	4.5	4.3	4.3	4.3	4.3
Monitor proposed Michigan legislation for hazard mitigation relevance.	4.6	4.4	4.4	4.4	4.4
Arrange for a State Hazard Mitigation Fund that can receive contributions.	4.7	4.5	D		
Enhance the organizational capacity to address and fund hazard mitigation.	4.8	D			
Enable MCCERCC to apply private sector donations to hazard mitigation.		4.6	4.6	4.5	
Work to establish a Statewide Hazard Mitigation Program within Michigan.					4.5
Promote flood mitigation within road and drainage construction standards.	4.9	4.7	D		
Re-establish 1980s low-interest loan programs for shoreline flood mitigation.	4.10	4.8	D		
Officially recognize worthy hazard mitigation initiatives within Michigan.	4.11	4.10	4.10	4.7	4.1
Develop a tax-incentive program to promote private hazard mitigation actions.	4.12	4.11	D		
Evaluate sewer systems and their flood vulnerability and damage.	4.13	4.9	4.9	2.7	
Increase the proportion of full-time, paid, professional firefighter personnel.	4.14	D			
Promote flood mitigation through a Michigan floodproofing handbook.	4.15	4.13	D		
Build awareness of taxpayer cost savings that result from hazard mitigation.	4.16	4.12	4.12	4.8	4.1
Apply best practices from MDEQ's Floodplain Service Program.	4.17	D			
Assess the effects of state-level subsidence insurance or mitigation loans.	4.18	4.14	D		
Identify and fund hazard mitigation actions for facilities and infrastructure.	4.19	4.15	4.15	2.9	
Improve coordination between government, NGOs, and the public.					4.6
Assist local governments in overcoming grant application obstacles.					4.7

Objective 4.6 in the 2014 plan was described as having been merged into Objective 2.7 in that same plan. In the table, a D means that the item was marked or designated as deleted or discontinued within the newly updated edition of the plan. (Most of those were crossed out or moved from the active list of strategies into the "Compendium of Addressed Objectives," but some numbering errors were noticed, which have been corrected here in this updated Appendix.) Elements that have been shaded within this table had some significant amendment made to their language within the plan update year that received the shading.

Objective 4.3 (in 2005 MHMP): Develop efficient, effective, fair and impartial hazard mitigation project identification, solicitation, review, prioritization and selection processes.
Implementation Method:

- Develop a project identification and solicitation system that can be tailored to meet the needs of each disaster situation, and that results in the submittal of an adequate number of high quality mitigation projects.
- Develop a hazard mitigation resource table or manual so that all potential and appropriate funding programs are considered when prioritizing projects.
- Develop a project prioritization system that includes current and relevant review criteria and clear-cut scoring options.

Completed or Removed? COMPLETED
Date Addressed: 2008
Funding Source: EMPG, HMGP, FMAP, State Funding (General Fund)
Comments/Explanation: (2019 status) As described in **Appendix 10**, the MCCERCC and MSP/EMHSD have developed fair and impartial project identification, solicitation, review, prioritization and selection processes related to the HMGP, FMAP, and PDMP. The "Funding Sources for Hazard Mitigation" guidance document (MSP/EMHSD Publication 207A, and originally a supplement to the Michigan Hazard Mitigation Plan) was eventually incorporated into the MHMP itself (also in **Appendix 10**, which describes funding sources and also the means to find and apply for others). This objective was removed from the MHMP after the latter accomplishment.

Objective 4.4 (in 2005 MHMP): Promote multi-objective results on all hazard mitigation projects and initiatives.
Implementation Method: Make multi-objective results one of the criteria used in the prioritization of projects for funding under the HMGP, PDMP, FMAP, RFCP, and SRLP.
Completed or Removed? COMPLETED
Date Addressed: 2008
Funding Source: HMGP, EMPG, FMAP, PDMP, State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was considered complete by 2008. The achievement of multiple objectives is now institutionalized under the review criterion "Consistent with Other Initiatives?" in the prioritization of projects for funding under the HMGP, PDMP, and FMAP (see **Appendix 10**). Note: the earlier language includes references to the Repetitive Flood Claims Program and the Severe Repetitive Loss Program, but these should now be considered to be a specialized part of the Flood Mitigation Assistance Program (FMAP).

Objective 4.8 (in 2005 MHMP): Develop a staffing pattern for adequately addressing state and local hazard mitigation functions, and pursue funding of needed mitigation positions.
Implementation Method:
- Prepare and submit staffing plans for funding under HMGP State Management Costs, as disasters occur.
- Prepare and submit staffing plans for funding under PDMP State Management Costs, as annual funding cycles occur.
- Develop and maintain mitigation position descriptions that accurately reflect the nature, scope and magnitude of work required in each position.
- Identify (and pursue, as appropriate) other funding sources that could be used to fund hazard mitigation positions.

Completed or Removed? COMPLETED (but requires ongoing maintenance to sustain capability)
Date Addressed: N/A – ONGOING
Funding Source: HMGP and PDMP Management Costs, EMPG, FMAP, State Funding (General Fund), Private Funding (partners to be determined)
Comments/Explanation: (2019 status) The MSP/EMHSD had successfully used HMGP State Management Cost funding in the past to staff needed positions related to grants management, planning and administrative support. Those positions were initially limited term positions but have all been converted to permanent positions, providing the long-term continuity required to adequately address and sustain hazard mitigation functions on a permanent basis. It is imperative that stable, continuous funding sources be regularly identified to provide for the continuation of these hazard mitigation positions. Otherwise, staff may be re-assigned to other functions within the division. Apart from that ongoing activity, this task was considered to be accomplished by the 2008 edition of this plan.

Objective 4.14 (in 2005 MHMP): Increase the proportion of full-time, paid professional firefighters within the state fire service.
Implementation Method:
- Consider legislation creating a state fire fund to provide supplemental funding to hire and train full-time firefighters.
- Study the feasibility of establishing more full-time public safety officer positions within Michigan local jurisdictions.

Completed or Removed? REMOVED (Not within the purview of this plan)
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This objective was removed from the 2008 MHMP because it was considered to go a bit too far astray from the required natural hazards mitigation components that the plan must cover. The issue of full-time fire service staffing is relevant to wildfire hazards, but issues of staffing and training have been interpreted as more of a preparedness measure than hazard mitigation, proper. There is also some overlap in capability between public safety officers which combine EMT, police officers, and firefighter experiences, and there is also a question of whether most emergency-level wildfires are handled through a different framework than most structural fires. This topic might again be considered for inclusion in this plan, when further discussions have clarified how its effects might apply to the wildfire hazard as distinct from structural fire and other emergency response activities.

Objective 4.17 (in 2005 MHMP): Study the floodplain service program of MDEQ to determine appropriate staffing levels, given current and projected service requests.
Implementation Method:
- MDEQ budgetary process.
- Federal CAP budgetary process.

Completed or Removed? COMPLETED (but requires ongoing maintenance to sustain capability)
Date Addressed: N/A – ONGOING
Funding Source: CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) Current and projected service requirements related to floodplain management are considered as part of the normal MDEQ and CAP budgetary processes. Requirements for additional staff will be addressed within those two separate yet related processes. Therefore, this objective was considered complete within the 2008 edition of this plan.

Objective 4.7 (in 2005 MHMP) and 4.5 (in 2008 MHMP): Study the feasibility of developing a State Hazard Mitigation Fund to provide seed money to local communities and state agencies wishing to undertake mitigation initiatives.
Implementation Method:
- Study the feasibility of establishing a permanent fund for mitigation purposes.
- Establish fund mechanisms and parameters in conjunction with the Michigan Department of Technology, Management and Budget (MDTMB).
- Per Objective 4.6, develop protocols for soliciting and accepting donations from the private sector (businesses, philanthropic organizations, individuals, etc.).
- As appropriate, seek funding from the Michigan Legislature.
- Identify and seek funding from potential private sector donors.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund), Private Funding (partners to be determined)
Comments/Explanation: (2019 status) This objective originally accompanied a related one (referenced as Objective 4.6 within the 2008 plan), but that companion objective was recently re-worked as Objective 4.5 in this current 2019 plan. This objective had been removed from the 2011 MHMP when budgetary limitations felt prohibitive, but has essentially been reworked to form a new objective in this 2019 plan.

Objective 4.9 (in 2005 MHMP) and 4.7 (in 2008 MHMP): Develop a construction and maintenance manual for road and drainage construction and maintenance personnel (to minimize future flood damages).
Implementation Method:
- Review the hazard mitigation strategy document developed for 1128-DR-MI to determine the core issues identified by the interagency mitigation team.
- Establish a subcommittee of subject matter experts to develop the manual.
- Develop and distribute the manual.
- Conduct training workshops on using the manual (targeting drain commissioners, road maintenance personnel, contractors, and farmers).
- Consider integrating the manual into the CD produced under Objective 1.1 (statewide mitigation marketing and education campaign) since drain commissioners and road maintenance personnel are included in the target groups for that project.

Completed or Removed? COMPLETED
Date Addressed: 2010
Funding Source: HMGP, FMAP, PDMP, EMPG, State Funding (General Fund)
Comments/Explanation: (2019 status) This item was considered complete within the 2011 edition of this plan. Excellent guidance documents have been produced by MDEQ on the topic of floodplain management ("Floodplain Management for Local Officials," "Floodplain Management in Michigan: Quick Guide," and "Flood Hazard Mitigation Handbook," for example). There have also been construction guidance documents developed by MDOT for its staff, and this objective has effectively been accomplished. Some wording (bullet 5) is out-of-date, as the CD-

ROM medium is no longer in favor. Documents are typically available online now. This item was removed from this plan in 2011.

Objective 4.10 (in 2005 MHMP) and 4.8 (in 2008 MHMP): Re-establish the low interest loan programs used in the mid-1980s to elevate and set back flood and erosion prone structures along the Great Lakes shoreline. Study the feasibility of establishing a similar program for riverine flood prone structures for elevation, flood proofing, or acquisition and relocation.

Implementation Method:

- Conduct a feasibility study of both options.
- If feasible, present the concept to the Governor's staff for approval.
- Seek a legislative sponsor for legislation to establish the program.
- Provide follow up as needed through the legislative process.

Completed or Removed? REMOVED

Date Addressed: N/A

Funding Source: State Funding (General Fund)

Comments/Explanation: (2019 status) This item focuses on the shoreline erosion/flood hazard, but was removed from the 2011 MHMP as unfeasible within the budgetary framework and priorities of that time. No known progress has been made on the feasibility study. However, some activities have proceeded upon the assessment of high-risk areas and at-risk structures along the shorelines. The loans themselves would involve individualized assessments of cost-effectiveness, but no known progress has been made on that program. In the mid-1980s, zero-interest loans had been made available to erosion and flood-impacted homeowners as well as to flood-impacted agricultural producers. Under this program, the State took its invested funds out of investment and delivered those funds to local banks. The banks then loaned those funds at no interest to owners of flood or erosion-impacted structures and flood-impacted agricultural producers. When the loan principal was paid back, without interest, the bank returned the money to state government. In this case, the interest the government normally might have earned on these funds, had they been invested, was lost, as a means of contributing to the welfare of affected property owners. Due to the severe drought in Michigan during the summer of 2001, the agricultural community asked for a reinstatement of the zero-interest loan program—a measure passed into law on February 27, 2002. However, some have noted that the mid-1980s program was provided in the context of double-digit inflation, 20-percent unemployment rates, and 18-percent interest rates. If the mid-1980s economic conditions were the driving force behind the program, and the flood disasters that occurred in 1985 and 1986 were merely the catalyzing agents that brought focus to the issue, then its current feasibility might be minimal. Based upon these assessments, the idea was dropped from this plan.

Objective 4.12 (in 2005 MHMP) and 4.11 (in 2008 MHMP): Study the feasibility of developing a state tax incentive program to encourage home and business owners to undertake mitigation measures that are consistent with local hazard mitigation plans.

Implementation Method:

- Research Michigan's solar energy tax credit program, as well as programs in place in other states, to determine the revenue and programmatic implications of implementing such a program.
- If feasible, present the concept to the Governor's staff for approval.
- Seek a legislative sponsor for legislation to establish the program.
- Provide follow up as needed through the legislative process.

Completed or Removed? REMOVED

Date Addressed: N/A

Funding Source: State Funding (General Fund)

Comments/Explanation: (2019 status) In the 2011 MHMP, this objective was assessed as too unlikely to be implemented, and was removed from the list of current actions. Hazard vulnerabilities can cost the government a great deal of money in response and recovery costs, so where investments in hazard mitigation have been found to reduce such costs, a tax-incentive program could have provided a mechanism to encourage more widespread activities than grants have been able to. Many details would need to be worked out, however, regarding the administrative oversight and verification of the activities that had earned the tax incentive. This objective was formed from a consideration of the state solar energy tax credit program instituted in the 1980s, but considered too unfeasible within the budgetary

restrictions of the past decade. Tax incentives send a strong signal to encourage hazard mitigation, and the program might eventually become a feasible one to again add to Michigan's current MHMP action list.

Objective 4.15 (in 2005 MHMP) and 4.13 (in 2008 MHMP): Develop a Michigan-specific flood proofing handbook and make it available to home and business owners in flood prone areas.
Implementation Method:

- Establish a subcommittee of subject matter experts to develop the handbook.
- Develop and distribute the handbook.
- Conduct training workshops on using the handbook (targeting home and business owners).

Completed or Removed? COMPLETED
Date Addressed: 2010
Funding Source: HMGP, EMPG, FMAP, PDMP, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) This item was considered complete by 2011. The MDEQ has published at least three excellent flood mitigation handbooks for local government officials, and these documents also have applicability to home and business owners. The titles of those documents are "Flood Hazard Mitigation Handbook," "Floodplain Management for Local Officials," and "Floodplain Management in Michigan: Quick Guide." These state-specific guidance documents, coupled with the excellent flood proofing guidance documents published by FEMA and available online, effectively address this objective.

Objective 4.18 (in 2005 MHMP) and 4.14 (in 2008 MHMP): Study the feasibility of establishing a state-level insurance or low interest loan program to help repair, relocate, or fund mitigation measures for homes and businesses in subsidence prone areas or damaged by a subsidence incident.
Implementation Method:

- Study the state-level programs already in place in Illinois, Kentucky, Ohio, Pennsylvania and West Virginia to determine commonalties and parallels with Michigan's subsidence situation.
- In conjunction with the MDEQ Geological and Land Management Division, prepare a position paper that outlines the scope and magnitude of the problem, probable costs associated with such a program, and alternatives that could be pursued to establish and implement such a program.
- If feasible, present the findings to the Governor's staff for approval.
- Seek a legislative sponsor for legislation to establish the program.
- Provide for follow up as needed through the legislative process.

Completed or Removed? REMOVED
Date Addressed: N/A
Funding Source: State Funding (General Fund)
Comments/Explanation: (2019 status) This item focuses upon the subsidence hazard, and was another item that in 2011 was considered unfeasible and removed from the MHMP's active list of objectives. The main costs of such a feasibility study would involve the time and resources used by personnel who have sufficient expertise—to design a research approach and then accumulate and evaluate appropriate information. Since there are few programs that are directly aimed at the mitigation of private risks from ground subsidence in Michigan, it was doubtful that such a study could readily be implemented.

Objective 4.6 (in 2008 and 2011 MHMPs) and 4.5 (in 2014 MHMP): Evaluate flood damage to and caused by failure of sewage handling systems.
Implementation Method:

- Convene a subcommittee of subject matter experts from applicable agencies to review this issue in recent flood events and develop solutions to identified problems.
- Implement the solutions where feasible.

Completed or Removed? REMOVED: Merged into Objective 2.7
Date Addressed: 2013
Funding Source: EMPG, CAP, State Funding (General Fund)
Comments/Explanation: (2019 status) The 2014 MHMP noted that this objective had been merged into Objective 2.7 in that plan. Please refer to Objective 2.6 in the current plan. Note: The 409 Plan for Federal Disaster 774, October

1986, recommended creating a multi-disciplinary task force to evaluate this issue, which resurfaced in subsequent flood disasters as well.

Objective 4.11 (in 2005 MHMP), 4.10 (in the 2008 and 2011 MHMPs), and 4.7 (in 2014 MHMP): Identify and formally recognize local, tribal, regional, state, or private projects and initiatives that have successfully incorporated hazard mitigation concepts and/or exemplify sound hazard vulnerability reduction strategies.
Implementation Method: **MERGE INTO OBJECTIVE 4.1**

- MSP/EMHSD will maintain a "Best Practices" document that recognizes hazard mitigation activities in Michigan.

Committee Priority: HIGH
Completion Target: 2016
Funding: EMPG, State Funding (General Fund)
Comments: (2019 status) This objective is currently considered to be covered by Objective 4.1 in the current plan. With regard to bullet 1, by 2014 the MCCERCC had studied the feasibility of establishing a formal award program for excellent in hazard mitigation and decided that it would be better to team with the Michigan Emergency Management Association (MEMA) to recognize outstanding mitigation efforts through its established mitigation award program. With regard to bullet 2, the MSP/EMHSD and the MCCERCC had successfully developed a new publication, "Hazard Mitigation Best Practices: Michigan Success Stories," which identified and recognized outstanding accomplishments in reducing loss of life, property and environmental damage associated with natural hazards in Michigan. This document, MSP/EMHSD Publication 106a (in recognition of its close tie to the MHMP – Publication 106), may be periodically updated, or converted into a more current format such as a GIS Story Maps site. Bullet 2 remains a valid and ongoing action item, but is no longer clearly distinct from the more general Objective 4.1.

Objective 4.16 (in 2005 MHMP), 4.12 (in the 2008 and 2011 MHMPs), and 4.8 (in 2014 MHMP): Highlight cost savings and other benefits to taxpayers due to mitigation measures that helped reduce future disaster damages.
Implementation Method: **MERGE INTO OBJECTIVE 4.1**

- Regularly write and publish mitigation "success stories / best practices" highlighting the benefits of completed mitigation projects at the state, tribal, and local levels.
- Post the success stories / best practices document on the MSP/EMHSD web site (MCCERCC web page) and submit them to FEMA V for inclusion on the FEMA mitigation web site, as appropriate.
- Include mitigation success stories / best practices in other MCCERCC reports, as appropriate.

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG, State Funding (General Fund)
Comments: (2019 status) As with the previous listing, this objective had by 2014 been considered more appropriate to merge into the more general Objective 4.1, and removed from the list of active MHMP items in order to keep that list as straightforward as possible. The MSP/EMHSD had completed an initial "Best Practices" publication, which was made widely available in multiple formats, including online posting. Some updated version of it is likely in the future, but perhaps in a more interactive online format such as that recently proposed in discussions: GIS Story Maps.

Changes in the MHMP Action Plan from 2014 to 2019

NOTE: The following pages show all the significant changes that have been made between the 2014 Michigan Hazard Mitigation Plan, and this updated 2019 plan. The 2014 plan had itself included a comparison with the previous 2011 plan, by showing various text that had been marked with strikeouts. However, to avoid confusing recently deleted text with that which had effectively been removed five years before, this section does not include the 2014 material had had been marked for deletion through the use of strikeouts. Instead, all strikeouts here refer to text that was considered current in 2014 but that has been changed or removed within this new edition's hazard mitigation strategy. Explanatory "NOTES" have been conspicuously labeled as such, to explain each significant change made to this content between 2014 and 2019. This initial note therefore documents that the first change from the 2014 involved the removal of all 2011 text that had been struck out but still left visible within the 2014 plan. In addition, Objective 4.6, which in 2014 was labeled as "merged into Objective 2.7," has also not been included here. This section does not document or explain minor changes in spelling or wording that were considered not to affect the meaning of the phrases or sentences involved. It must also be noted that this section documents only the changes to the main content of the Objectives and Implementation Methods, and not changes to the lengthy explanatory "Comments" which have been substantially replaced with new text in this 2019 edition (see Chapter 9). In addition, every objective has had its "completion target" year updated, and these updates were considered self-explanatory as they stem from the date of the plan and the assigned committee priority time-frame for each objective's implementation.

Goal 1

Promote Life Safety: Minimize disaster-related injuries and loss of life through public education, hazard analysis, and early warning.

Objective 1.1: Increase public / private sector awareness of hazard related dangers and mitigation solutions.
Implementation Method:
- State agencies will distribute information about hazard mitigation through training sessions, the internet, professional networks, and other readily available means.

Committee Priority: HIGH (ongoing)
Completion Target: 2016
Funding: HMA
NOTE: Slight changes were made to the wording of the objective, adding in the concept of "resiliency principles."

Objective 1.2: Encourage and promote multi-hazard emergency plans in all public and private institutions, to include provisions for mitigating applicable hazards.
Implementation Method:
- Provide planning guidance, technical assistance, and continuous follow-up to applicable facilities, as required.

Committee Priority: HIGH (ongoing)
Completion Target: 2016
Funding: State Funding (General Fund), HMA, EMPG, etc.
NOTE: No significant changes were made to this objective.

Objective 1.3: Promote local early warning systems and capability.
Implementation Method:
- Use information from local hazard mitigation plans to assess gaps in warning system coverage.
- Assist with funding warning systems and warning sirens in local jurisdictions, through the administration of FEMA Hazard Mitigation Assistance grant funds.

Committee Priority: MEDIUM
Completion Target: 2019
Funding: EMPG, HMA, HSGP
NOTE: No significant changes were made to this objective.

Objective 1.4: Promote the concept of "safe rooms" within homes, businesses, and local/state governmental facilities to prevent and minimize injury and loss of life in tornadoes and severe winds.

Implementation Method:

- Print and make available FEMA's "safe room" construction plans; also permanently post the plans on the MSP/EMHSD web page.
- Work with the Michigan Committee on Severe Weather Awareness to promote safe rooms as a viable option for severe storms protection.
- As circumstances allow, develop prototype "safe rooms" within public buildings to serve as demonstration projects.
- Develop new (or enhance existing) safe space public information materials for mobile home residents.

Committee Priority: MEDIUM

Completion Target: 2019

Funding: HMA, EMPG

NOTE: The first Implementation Method bullet was deleted. The phrasing did not describe FEMA's current technical guide (FEMA P-361), which is readily available online, and the current design and posting standards of the MSP/EMHSD Publications Page reserve its use for original MSP/EMHSD publications. A new bullet was added at the bottom to refer to the potential applicability of grants to support safe room installation.

Objective 1.5: Support and utilize a system of real-time rainfall and river flow gauges throughout Michigan as part of an overall flood warning system.

Implementation Method:

- Support for multi-agency system of stream gauges and inter-gauge interpolation for local, state and federal users.
- Incorporate stream gauge system and data into State hazard analysis and resource protection activities.
- Encourage local and regional agencies to consider or make use of stream gauge data in their own activities.
- Maintain weather web site to display precipitation information so that agriculture and fire weather notice and actions may be undertaken in a timely manner.

Committee Priority: MEDIUM

Completion Target: 2019

Funding: Federal Funding (current effort led by U.S. Geological Survey; partnering agencies in Michigan)

NOTE: The MCCERCC Hazard Mitigation Committee agreed to change the priority of this objective from MEDIUM to HIGH, in light of advances and ongoing efforts seen in conjunction with partners such as the USGS and USACE.

Objective 1.6: Develop comprehensive hazard analyses / risk assessments (as part of a hazard mitigation plan development process) in all local emergency management program jurisdictions to address all pertinent natural, technological and human-related hazards.

Implementation Method:

- Multi-year hazard analysis development process initiated in FY 2000 and is implemented by municipal and county governments and their partnering agencies, making use of local grant agreements (annual work plans for EMPG-funded emergency management programs) and dedicated hazard mitigation planning staff in MSP/EMHSD.
- Create hazard area data sets using the locally compiled and reported hazard data.
- Overlay the hazard area data on the critical facilities inventory and relevant population data to identify and further define and quantify risk and vulnerabilities.

Committee Priority: HIGH/ONGOING

Completion Target: 2016

Funding: EMPG, HMA

NOTE: As a part of clarifying changes in the wording of the first bullet's text, a reference to "available planning grants" was added.

NOTE: The 2019 plan added back an objective from the 2005 and 2008 plans, as Objective 1.7. This objective referred to updating the Michigan Hazard Analysis, which is again being formatted as its own attached document, after having been included in the main document of the three previous editions of the MHMP.

Goal 2

Reduce Property Damage: Incorporate hazard mitigation considerations into land use planning / management, land development processes, and disaster resistant structures.

NOTE: Goal 2 was slightly adjusted to include a reference to "resource management," thus clarifying and expanding upon the previously implicit reference to land management within the original wording.

Objective 2.1: Increase knowledge of urban/regional planners and emergency managers about sound land use and development practices that can help reduce long-term hazard risks and vulnerabilities.

Implementation Method:

- Partner with accreditation organizations for undergraduate and graduate city, urban, and regional planning programs at Michigan colleges and universities, to encourage integration of hazard mitigation principles and practices into comprehensive planning courses, and/or the development of a course (or courses) that discuss same.
- Partner with the American Institute of Certified Planners (AICP) and the American Planning Association to include questions pertaining to hazard mitigation on the exam for AICP certification.

Committee Priority: HIGH (Ongoing)
Completion Target: 2016
Funding: EMPG
NOTE: The first bullet had some clarifying amendments made to its text.

Objective 2.2: Further define identified flood vulnerabilities in state owned/operated critical facilities.

Implementation Method:

- Conduct detailed follow-up studies of vulnerable state owned/operated critical facilities to help to determine the types of "brick and mortar" projects that would be required to permanently reduce identified facility vulnerabilities to flooding.
- Follow up with the Michigan Department of Technology, Management and Budget (MDTMB) regarding the implementation of study recommendations in affected facilities (as time, circumstances, and resources permit).

Committee Priority: MEDIUM
Completion Target: 2019 (Phased Implementation)
Funding: HMA, FEMA HMTAP, RiskMap, USGS, etc.
NOTE: Based upon discussion with MDTMB personnel, several changes were made to the wording of this objective, including the addition of a reference to "Facility and Insurance Budgets" as a funding mechanism. The description better reflects actual practices (implemented as needed for individual facilities).

Objective 2.3: Identify critical floodplain storage areas within the state and enter the data into appropriate Geographic Information Systems to enhance future land use planning and development decision making.

Implementation Method:

- Conduct a study of critical floodplain storage areas and digitize the results.
- Make the results available to all appropriate land use planning and regulatory agencies in the state.

Committee Priority: LOW
Completion Target: 2024 (Phased Implementation)
Funding: HMA, CAP, FEMA HMTAP, State Funding (General Fund)
NOTE: This objective was re-worded to emphasize the GIS component of flood-risk information, which has been extremely active, and to de-emphasize the idea of a statewide project to identify "critical floodplain storage areas," which was judged as remaining rather unclear and an awkward match for actual activities, with tend to occur as needed for particular projects such as those regularly undertaken by MDOT. The priority for this objective was reclassified as HIGH. A third bullet was added, reflecting a need for greater coordination between stakeholders, before and during major development projects.

Objective 2.4: Acquire/remove or relocate residential and commercial structures currently occupying floodways of Michigan rivers and streams.
Implementation Method:
- Identify structures in floodways.
- Acquire/remove or relocate at-risk structures.

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA
NOTE: This was changed to refer to floodplains instead of floodways. The HMA program does not have information about floodway status, but only floodplain status. In addition, this objective was merged with Objective 2.5 (below).

Objective 2.5: Relocate, elevate, or acquire the worst repetitive-loss structures in Michigan.
Implementation Method:
- Identify repetitive loss structures.
- Acquire/remove, relocate, or elevate repetitive loss structures.

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA
NOTE: This objective was merged with Objective 2.4 (above), since an earlier distinction between floodway priorities had been removed to better reflect current HMA programs, which are oriented toward floodplains more generally.

Objective 2.6: Encourage Community Wildfire Protection Plans and establish and sustain additional FIREWISE communities, statewide.
Implementation Method:
- The MDNR will assist communities in developing Community Wildfire Protection Plans (CWPP).
- Communities with completed CWPPs are to be encouraged, as appropriate, to obtain FIREWISE designations to address their wildfire risks/vulnerabilities (where local willingness exists to establish and sustain the program).
- As MDNR staff resources allow, work with the identified communities to focus local activities to meet FIREWISE program requirements, fire-related elements of their CWPPs, "fire adapted community" standards, etc.
- Formally recognize outstanding CWPPs, examples of FIREWISE community participation, "fire adapted communities," and other wildfire-related achievements, as a "best practice" for other Michigan communities to emulate.
- Expand wildfire mitigation to include related efforts, such as the "fire adapted communities" standard, referenced in the new guidance document available at http://www.fs.fed.us/openspace/fote/reports/GTR-299.pdf.

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG, State Funding (General Fund)
NOTE: Based upon MDNR feedback, text in the first bullet was amended to specify "as funding allows." The USDA Forest Service was added to the funding description, along with "local match." The MCCERCC Hazard Mitigation Committee had pondered whether to merge two wildfire objectives together, but MDNR feedback resulted in the separate objectives being retained.

Objective 2.7: Promote and assist with flood mitigation projects in all vulnerable areas, statewide.
Implementation Method:
- The MDEQ will continue their flood mapping coordination work, dam safety programs, NFIP outreach, and other activities to alleviate general flood risks (beyond the specific floodplain and repetitive loss sites identified in Objective 2.4).
- MSP/EMHSD will continue to provide technical assistance with, and promotion of, hazard mitigation planning that identifies potential at-risk sites for flood mitigation activities.
- MSP/EMHSD will continue to administer grant programs that allow federally subsidized flood mitigation activities to occur.
- Develop ways to evaluate flood damage to and caused by the failure of sewage handling systems.

Committee Priority: HIGH

Completion Target: 2016
Funding: HMA, EMPG, State Funding (General Fund)
NOTE: No significant changes were made to this objective.

Objective 2.8: Promote and assist with wildfire mitigation projects statewide.
Implementation Method:
- MDNR will make use of grants from the USDA Forest Service to help fund local communities in their development of Community Wildfire Protection Plans.
- Since wildfires can be very damaging in large areas of Michigan, scan local plans for hazard mitigation projects to support with technical assistance and/or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG, USDA Forest Service
NOTE: Based upon feedback from MDNR, this objective was kept distinct from the FIREWISE-related one, and a new bullet was added to describe an additional implementation method.

Objective 2.9: Identify and fund appropriate mitigation measures for vulnerable public and private facilities and infrastructure.
Implementation Method:
- Continue to identify, solicit, fund and implement cost-effective, environmentally sound, and technically feasible mitigation projects under the HMA, EMPG, and other pertinent programs.
- Per Objective 1.3, fund early warning systems under the HMGP 5% state discretionary set-aside provision and other pertinent programs.
- Per Objective 1.4, fund "safe rooms" within vulnerable public and private structures.
- Per Objective 2.2, further define identified flood vulnerabilities in state owned/operated critical facilities.
- Per Objective 2.4, acquire/remove, relocate, or elevate structures located within Michigan floodplains, or that have suffered from repetitive flood losses.

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG, State Funding (General Fund), Private Funding (Partners TBD), FEMA HMTAP.
NOTE: No significant changes were made to this objective.

Objective 2.10: Promote and assist with severe wind mitigation projects statewide.
Implementation Method:
- Since tornadoes and severe winds are very damaging events in Michigan, scan local plans for hazard mitigation projects to support with technical assistance and/or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG
NOTE: No significant changes were made to this objective.

Objective 2.11: Promote and assist with winter weather mitigation projects statewide.
Implementation Method:
- Since severe winter weather is very damaging in Michigan, scan local plans for hazard mitigation projects to support with technical assistance and/or federal hazard mitigation funds (if applicable).

Committee Priority: HIGH
Completion Target: 2016
Funding: HMA, EMPG
NOTE: No significant changes were made to this objective.

Goal 3

Build Alliances: Forge partnerships with other public safety agencies and organizations to enhance and improve the safety and wellbeing of all Michigan communities.

Objective 3.1: Promote urban forestry and vegetation management programs and initiatives to develop more resilient woodlands, streetscapes, and landscapes in communities throughout Michigan.
Implementation Method:

- Coordination and technical support to local urban forestry programs (professional guidance, training, and education; tree selection, planting, and maintenance; local tree ordinance development; public awareness and education; street and park tree management and planning; community climate adaptation planning; utility vegetation management, awareness, and safety; recognition/certification).
- Conduct periodic educational programs on creating and maintaining a storm-resistant urban forest, targeted at urban forestry programs and local public works agencies.

Committee Priority: HIGH
Completion Target: 2016
Funding: EMPG, HMA, State Funding (General Fund), Private Funding
NOTE: Elements of the wording in this objective were adjusted for clarity, and also appended so that urban forestry was identified as specifically relevant to the hazards of severe winds, fires, ice storms, lightning, and invasive species, rather than just a general reference being "storm-resistant."

Objective 3.2: Promote floodplain management activities throughout Michigan, increase statewide participation in the National Flood Insurance Program, and ensure that the NFIP policy base accurately reflects the flood hazard threat in Michigan.
Implementation Method:

- Conduct Community Assistance Contacts (CACs) and Community Assistance Visits (CAVs) to promote the NFIP.
- Where feasible, promote participation in the NFIP (as a viable and prudent flood mitigation measure) in all MSP/EMHSD and MDEQ hazard mitigation guidance documents.
- Promote the NFIP at applicable governmental conferences and trade shows.
- Fully participate in all FEMA sponsored promotional events and activities for NFIP recruitment.
- Participation in Map Modernization activities and agency coordination around RiskMap efforts.

Committee Priority: HIGH (Ongoing)
Completion Target: 2016
Funding: EMPG, HMA, CAP, State Funding (General Fund)
NOTE: The final phrase in the stated objective was removed after being discussed by the MCCERCC Hazard Mitigation Committee, in which the clarity of the phrase was questioned and its relevance to the 2019 plan seemed outdated as a result of the extensive NFIP educational and outreach efforts by FEMA and its RiskMAP partners, MDEQ, MSP/EMHSD, and related agencies. The final bullet was rewritten to emphasize the current RisKMAP activities, removing the outdated reference to "Map Modernization." An additional bullet was appended to the Implementation Method, describing post-disaster community outreach activities.

NOTE: Additional objectives were added, numbered as 3.3 and 3.4, to describe the strengthening of existing partnerships and efforts to identify and establish new partnership opportunities.

Goal 4

Provide Leadership: Provide leadership, direction, coordination, guidance, and advocacy for hazard mitigation in Michigan.

Objective 4.1: Educate and inform local and state officials, political leaders, the public, and involved professional disciplines about hazard mitigation concepts, programs, processes, and considerations.
Implementation Method:
- Conduct educational seminars where feasible and appropriate.
- Develop, update, and distribute written guidance targeted to specific groups.
- Post relevant information on web pages of the MSP/EMHSD and other agencies.
- Update EMHSD Pub. 207: "Local Hazard Mitigation Planning Workbook."

Committee Priority: HIGH (Ongoing)
Completion Target: 2016
Funding: EMPG, HMA, State Funding (General Fund)
NOTE: The objective was amended to include references to policy-makers and resilience. Objectives 4.7 and 4.8 were determined to be similar enough that they had their own implementation methods added to this objective, resulting in 4 additional bullet points within this list.

Objective 4.2: Promote better information flow on hazard mitigation among agencies, between levels of government, and between public and private entities.
Implementation Method:
- Invite other state agencies and private industry to share their concerns, expertise, and ideas with the MCCERCC.
- Regularly publicize the MCCERCC's activities and actions using all appropriate means.
- Promote greater overlap between state and local planning activities.

Committee Priority: HIGH
Completion Target: 2016
Funding: EMPG, HMA, State Funding (General Fund)
NOTE: No significant changes were made to this objective.

Objective 4.3: Continuously revise and enhance the Michigan Hazard Mitigation Plan (MHMP) to ensure it remains current, accurate, relevant, implementable, and in compliance with the federal Disaster Mitigation Act of 2000 and the Emergency Management Accreditation Program (EMAP).
Implementation Method:
- Update the Michigan Hazard Analysis (EMHSD Pub. 103) during or before 2016, as a foundation for updating the MHMP and so as to maintain contact with partnering agencies and assist in more evenly distributing the coordination and feedback process across all parts of the three years available for MHMP update. (The hazard analysis forms approximately half of the content of the MHMP.)
- Integrate relevant data and findings from completed local hazard mitigation plans into the Risk Assessment and other appropriate plan sections.
- Keep the documents posted on the MSP/EMHSD web site, with appropriate staff contact information, so as to be continuously available for public review and feedback.
- Maintain contact with all partnering agencies, and collect information about plan monitoring, project implementation, new conditions, emerging hazards, climatological changes, emergency incidents, and other topics relevant to all types of hazards that could affect Michigan.
- Revise the Michigan Hazard Mitigation Plan to address the appropriate revision period.
- As feasible, establish enhanced collection and analysis systems for the following types of data:
  - Loss estimations for all relevant state owned/operated facilities.
  - Structure counts in floodplains, with particular emphasis on commercial structures.
  - Use of satellite and aerial photographs (now readily available online) for risk assessment purposes.
- Develop the information management capacity to utilize the HAZUS-MH risk assessment tool or to match its capabilities through other means.

Committee Priority: HIGH
Completion Target: 2016 (for hazard analysis, with full plan update due in March 2017)
Funding: EMPG, HMA, State Funding (General Fund)
NOTE: The specific reference to the Michigan Hazard Analysis update by 2016 was removed, forming instead an updated objective of its own (1.7). The completion target was similarly amended to reflect a changed schedule for the Michigan Hazard Analysis, MHMP (for FEMA approval), and upcoming EMAP re-accreditation process.

Objective 4.4: Continuously monitor proposed legislation in Michigan for possible hazard mitigation opportunities and/or implications.
Implementation Method:
- Establish and maintain reporting relationships with state agency legislative liaisons so that mitigation-related aspects of proposed legislation are identified and reported to the MCCERCC.
- Establish and maintain a capability within the MSP/EMHSD to continuously monitor proposed legislation for hazard mitigation implications (using the key word notification mechanism of the Michigan Legislature web site or by other means).
- Establish and maintain reporting relationships with all applicable emergency management and first responder organizations so that mitigation aspects of proposed legislation are identified and reported to the MCCERCC.
- Establish liaison with the Michigan Legislative Service Bureau so that the following are identified and reported to the MCCERCC (to the extent possible): 1) mitigation-related aspects of legislation; and 2) the enactment, revision, and recession of Administrative Rules with mitigation implications.

Committee Priority: MEDIUM
Completion Target: 2019
Funding: EMPG, State Funding (General Fund)
NOTE: Based upon discussion by the MCCERCC Hazard Mitigation Committee, this objective was revised to make clearer what steps are still needed. The 2014 descriptions had made it sound as if a full legislation-monitoring system was already in place throughout all relevant state agencies. The final bullet point was appended with a third sub-element referring to potential opportunities for legislation to be affected in ways that support the principles of resilience and hazard mitigation.

Objective 4.5: Develop protocols for MCCERCC to solicit, accept, use/expend, and account for private sector donations for hazard mitigation purposes.
Implementation Method:
- Work with the Michigan Department of Technology, Management and Budget (MDTMB) and Michigan Department of State Police (MSP) Management Services to determine the guidelines and parameters for such activities to ensure compliance with state laws, rules and regulations.
- If determined to be feasible and allowable, develop standard protocols for soliciting, accepting, expending, using, managing, reporting on, and accounting for donations (financial and/or in-kind).
- Institutionalize the protocols in the MCCERCC Bylaws to ensure their continued and consistent use.
- As required, develop standardized forms to be used in the conduct of all required transactions (or identify existing forms that can be used).
- Report on the use and final disposition of donations in the MCCERCC Annual Plan document.

Committee Priority: MEDIUM
Completion Target: 2019
Funding: EMPG, State Funding (General Fund)
NOTE: This objective was substantially revised to emphasize a new, state-funded hazard mitigation grant program, and to de-emphasize the donations-management aspect, while also removing references to MCCERCC. The precise form of the proposed program is still being determined, and the revisions made to this element are phrased in more general terms that can refer to whatever specific form of program may arise through future legislative action. The priority of this objective was reclassified as HIGH, and the reference to "General Fund" was removed.

NOTE: Objective 4.6 had been listed as officially merged into Objective 2.7, within the 2014 plan. A new Objective 4.6 was added in 2019, about improving coordination between all components of the whole community.

Objective 4.7: Identify and formally recognize local, tribal, regional, state, or private projects and initiatives that have successfully incorporated hazard mitigation concepts and/or exemplify sound hazard vulnerability reduction strategies.

Implementation Method:

- MSP/EMHSD will maintain a "Best Practices" document that recognizes hazard mitigation activities in Michigan.

Committee Priority: HIGH

Completion Target: 2016

Funding: EMPG, State Funding (General Fund)

NOTE: For the 2019 update, this objective was merged into Objective 4.8 (below), and then both were incorporated into the Implementation Method descriptions within Objective 4.1.

In the 2019 update, a new Objective was added with the number 4.7, regarding the identification of strategies for overcoming community obstacles when applying for hazard mitigation grants.

Objective 4.8: Highlight cost savings and other benefits to taxpayers due to mitigation measures that helped reduce future disaster damages.

Implementation Method:

- Regularly write and publish mitigation "success stories / best practices" highlighting the benefits of completed mitigation projects at the state, tribal, and local levels.
- Post the success stories / best practices document on the MSP/EMHSD web site (MCCERCC web page) and submit them to FEMA V for inclusion on the FEMA mitigation web site, as appropriate.
- Include mitigation success stories / best practices in other MCCERCC reports, as appropriate.

Committee Priority: HIGH

Completion Target: 2016

Funding: HMA, EMPG, State Funding (General Fund)

NOTE: For the 2019 update, this objective was merged with Objective 4.7, and then both were incorporated into the Implementation Method descriptions within Objective 4.1.

To see the results of these changes, please refer to Chapter 9 within the main MHMP document.

Appendix 13: Lists of Hazard Mitigation Ideas

PART ONE: General Ideas from the 2019 Michigan Hazard Analysis

I. Natural Hazards

A. WEATHER HAZARDS

Thunderstorm Hazards (General)

- Increased coverage and use of NOAA Weather Radio, and 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 (where appropriate).

Hail-specific (in addition to the General Thunderstorm Hazards list)

- Increased coverage and use of NOAA Weather Radio.
- Public early warning systems and networks.
- Tree trimming and maintenance to prevent limb breakage and to 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. (NOTE: Where appropriate: Burial may sometimes cause additional problems and costs in cases where eventual cable breakages are harder to locate and more expensive to repair.)
- Moving vehicles into garages or other covered areas.
- Purchase of insurance that includes coverage for hail damage.
- Using structural bracing, window shutters, laminated glass in window panes, and impact-resistant roof shingles to minimize damage to public and private structures.

Lightning-specific (in addition to the General Thunderstorm Hazards list)

- Increased coverage and use of NOAA Weather Radio.
- Public early warning systems and networks.
- Tree trimming and maintenance to prevent limb breakage and to 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. (NOTE: Where appropriate: Burial may sometimes cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing any such problems.)
- Using surge protectors on critical electronic equipment.
- Installing lightning protection devices on the community's communications infrastructure and critical structures. More widespread use of lightning protection devices might also occur.

Tornadoes (in addition to the General Thunderstorm Hazards list)

- Increased coverage and use of NOAA Weather Radio, or comparable device-based notifications.
- 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. (NOTE: Where appropriate. Burial may cause additional problems and costs when breakage or malfunction occurs, due to the increased difficulty in locating and repairing the problem.)
- 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.
- 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.

Severe Winds (in addition to the General Thunderstorm Hazards list)
- Increased coverage and use of NOAA Weather Radio, or comparable device-based notifications.
- 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. (NOTE: Where appropriate. Burial may cause additional problems and costs when breakage or malfunction occurs, due to the increased difficulty in locating and repairing the problem.)
- 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.
- 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, and other vulnerable public or event locations.

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.
- Provide and publicize designated heating and cooling centers within the community, where persons in need may go to obtain relief from outdoor temperatures.

Winter Weather Hazards (General)
- Increased coverage and use of NOAA Weather Radio.
- 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, where appropriate.
- Establishing heating centers/shelters for vulnerable populations.

Ice and Sleet Storms (in addition to the General Winter Weather Hazards list)
- Increased coverage and use of NOAA Weather Radio.
- 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. (NOTE: Where appropriate. Burial may cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing the problem.)
- Establishing heating centers/shelters for vulnerable populations.
- Home and public building design and maintenance to prevent roof and wall damage from "ice dams."

Snowstorms (in addition to the General Winter Weather Hazards list)
- Increased coverage and use of NOAA Weather Radio.

- 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. (NOTE: Where appropriate. Burial may cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing the problem.)
- Establishing heating centers/shelters for vulnerable populations.
- Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and storage, etc.
- Agricultural activities to reduce impacts on crops and livestock.
- Pre-arranging for shelters for stranded motorists/travelers, and others.
- Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.

Fog

- Increased coverage and use of NOAA Weather Radio.
- De-icing measures (for freezing fog), as would be used for other ice-related hazards.

B. HYDROLOGICAL HAZARDS

Fluvial (Riverine) Flooding

- Floodplain 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.
- Purchase or transfer of development rights – to discourage development in floodplain areas.
- “Floating” architectural designs for structures in flood-prone areas.
- 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 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.).
- Protection (or restoration) of wetlands and natural water retention areas.
- Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
- Joining the National Flood Insurance Program (NFIP).
- Obtaining flood insurance. (Requires community participation in the NFIP.)
- Participation in the Community Rating System (CRS).

Urban Flooding

- Stormwater management—Adequate design, installation, maintenance, and monitoring of municipal storm sewer systems. Ordinances or amendments to assist in stormwater management (e.g. forbidding illicit discharges). Planning for and regulating areas prone to flooding (acceptable uses and development restrictions through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, purchased

or transferred development rights, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.

- Homeowner's and rental insurance that includes coverage of damages and cleanup of sewer backflow impacts.
- 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, or the expansion of infrastructure to higher 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.
- Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
- Increased coverage and use of NOAA Weather Radio.
- 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.
- 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 the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Wetlands protection regulations and policies.
- Use of check valves, sump pumps and backflow preventers in homes and buildings.
- 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.
- 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.).
- Protection (or restoration) of wetlands and natural water retention areas.
- Landslide mitigation ideas: Do not build houses, buildings, parks, or playgrounds close to steep slopes; install flexible pipe fittings to avoid gas and water line breakage.

Shoreline Flooding and Erosion

- 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.
- Joining the National Flood Insurance Program, obtaining insurance, and 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.
- 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 permanently relocated outside of flood-prone areas and erosion areas.
- 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.
- Increased coverage and use of NOAA Weather Radio.
- Locating structures and infrastructure landward of the established setbacks.

Dam Failures

- Regular inspection and maintenance of dams.
- Garnering community support for a funding mechanism to assist dam owners in the removal or repair of dams in disrepair.
- Regulate development in the dam's hydraulic shadow (where flooding would occur if a severe dam failure occurred).
- Ensuring that dams meet or exceed the design criteria required by law.
- Public warning systems.
- Obtaining insurance.
- Increased coverage and use of NOAA Weather Radio
- Increased funding for dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.
- Constructing emergency access roads to dams, where needed.
- Pump and flood gate installation/automation.

Drought

- Storage of water for use in drought events (especially for human needs during periods of extreme temperatures, and for responding to structural fire and wildfire events).
- Legislative acts, local ordinances, and other measures to prioritize or control water use.
- Encouragement of water-saving measures by consumers (including landscaping, irrigation, farming, and low-priority lawn maintenance and non-essential auto washing).
- Anticipation of potential drought conditions, and the preparation of drought contingency plans.
- Designs, for recreational and other water-related structures and land uses, that take into account the full range of water levels (of lakes, streams, and groundwater).
- Designs and plans for water delivery systems that include a consideration of drought events.
- Obtaining agricultural insurance.

C. ECOLOGICAL HAZARDS

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 houses; 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.
- 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 lands with a history of flammable substances stored, spilled, or dumped on them).
- Public notification of fire weather and fire warnings.
- 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 made into wood chips 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 for properties 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 with their 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 (from blown embers, etc.)
- 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 building structures on hilltop locations, where they will be at greater risk from wildfires (in addition, hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure).
- 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).
- Have adequate water supplies for emergency fire-fighting (in accordance with NFPA standards).
- Obtaining insurance.

Invasive Species

- Restrictions on the import and transport of species carriers.
- Adjustments to hunting, fishing, and other policies and regulations related to wildlife populations.
- Use of barriers to prevent invasive species travel.
- Use of competing species or other population control techniques.

D. GEOLOGICAL HAZARDS

Earthquakes – (the biggest Michigan threats would be to pipelines, buildings that are poorly designed or constructed, and the 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."

Subsidence

- Identifying and mapping old mining areas and geologically unstable terrain, and limiting or preventing development in high-risk areas.
- 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.

Space Weather

- Awareness campaigns for industries and systems involving satellite communications, GPS, or radio communications that could be disrupted by space weather events. In addition to the use of GPS for navigation, aviation, and military applications, that technology is also important for offshore drilling operations, precision farming, transportation, and mapping and surveying. Therefore, it is very important to protect these systems.
- Operating procedures that include back-up systems allowing complex systems (e.g. air traffic control) to continue to function when key technological systems (e.g. GPS, radio communications, satellites) malfunction. For example, some "legacy" systems might be retained as a back-up, new GPS signals and codes could be used to remove ranging errors, and protective and back-up components could be installed in vulnerable systems.
- The use of special procedures, equipment, and redundancies by utility systems (e.g. electrical power and pipeline systems) to minimize the potential for geomagnetic effects to cause inappropriate shutdowns, impaired or lost functionality, and system damage. For example: the provision of reserve system capacity may offset the effects of geomagnetic storms; or the temporary disconnection of vulnerable components for their own protection.
- Additional back-up satellites, for communications and navigation, may be needed to limit the damaging effects of a major solar storm, which may put current satellite equipment out of action and require their rapid replacements. The importance and cost of satellite systems may not be well-known to the general public. As of 2009, the existing fleet of 250 commercial satellites constituted a total investment of about $75 billion, and involved an annual revenue stream estimated at over $250 billion.

Celestial Impacts

- Advance planning for catastrophic scenarios. For example, the U.S. Air Force used an asteroid strike for its December 2008 Interagency Deliberate Planning Exercise. The after-action report for that exercise was posted online at https://cneos.jpl.nasa.gov/doc/Natural_Impact_After_Action_Report.pdf. An asteroid detected at a distance equivalent to that of the Earth's Moon could still give 8 hours of advance warning for the evacuation of coastal areas (to mitigate loss of life from a projected sea impact).
- Continued surveillance and analysis of Near-Earth Objects, and support for agencies that are engaged in such work. For example, since 1975, the Department of Defense has amassed extensive data about meteors entering the atmosphere, finding that hundreds per year explode in the atmosphere with explosive energy of at least 1 kiloton.
- Existing technologies could allow the diversion of a large asteroid or comet, if a sufficient lead time is available. Objects on a collision-course, with an impact date from 10 to 100 years in the future, might be diverted or reduced by the use of conventional rockets and explosives. (Such action would be coordinated in the United States by the Departments of Defense and Energy, and would likely include international partners.) Explosives would require knowledge of an object's composition to be effective. Laser targeting could be used to change an object's velocity, although weeks or months may be required to obtain a large enough effect. With a sufficient amount of warning time (on the order of years), other mitigation techniques could include attaching a solar sail to the object,

an interception/landing mission, and/or use of the "Yarkovsky effect" in which asteroid temperatures could be changed to affect its orbit.

- Various space missions have occurred to gather more information about asteroids and comets, and more are planned for the future. Some past missions have included Vega 1, Vega 2, Giotto, Suisei, and Sakigake (1986 flybys of Halley's Comet); Galileo (1995 observations of the Shoemaker-Levy comet impact); Near-Earth Asteroid Rendezvous (NEAR—asteroid investigations from 1997 to 2001); Deep Space 1 (comet rendezvous in 2001), Stardust (comet material collected and returned for analysis in 2006); Hayabusa (aka MUSES-C – asteroid landing and probing from 2005 to 2010); Rosetta (asteroid flybys from 2008 to 2010, and comet intercept mission scheduled for 2014-2015); and Deep Impact/EPOXI (comet rendezvous in 2005 and flyby in 2010). Additional missions can be expected to provide even more information.

II. Technological Hazards

A. INDUSTRIAL HAZARDS

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).
- 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 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.
- Safe installation, maintenance, and use of electrical outlets and wiring.
- Measures to reduce urban blight and associated arson (possibly including Crime Prevention through Environmental Design).
- 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.)
- Discourage 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.

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).
- Pest-control measures for mosquitoes and other nuisances around scrap tire yards.

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

- Compliance with/enforcement of Resource Conservation and Recovery Act (RCRA) standards.
- Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
- 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.
- 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).
- Compliance with all industrial, fire, and safety regulations.
- Insurance coverage.
- Enhanced security and anti-terrorist/sabotage/civil disturbance measures.

Hazardous Material Transportation Incidents

- 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, maintenance 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.
- 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.
- Locating schools, nursing homes, and other special facilities away from major hazardous material transportation routes.

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 and widespread use of the "MISS DIG" utility damage prevention service (800-482-7171).
- Proper pipeline design, construction, maintenance and inspection.

Nuclear Power Plant Emergencies

- Arrangements for 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).

Oil and Natural Gas Well Accidents

- 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.
- Adherence to all regulations and best industry practices, especially for relatively new techniques of hydraulic fracturing, in order to preserve Michigan's environmental quality and public confidence in the industry.

B. INFRASTRUCTURE HAZARDS

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 beneficial and appropriate, to resist damage from severe winds, lightning, ice, and other hazards.

- Redundancies in utility and communications systems, especially "lifeline" systems; to increase resilience (even if at the cost of some efficiency).
- Separation and/or expansion of sewer system to handle anticipated stormwater volumes.
- Use of generators for backup power at critical facilities.
- "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).
- Physical protection of 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).

Energy Emergencies

- Redundancies and alternatives in the energy supply system; provision of backup supply systems.
- The capacity to use more than one type of fuel to sustain necessary operations and functions.
- Use of alternative sources of energy (e.g. solar, wind sources) for key functions.
- Architectural designs that reduce the need for outside energy inputs.

Transportation Accidents

- 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.
- Use of ITS (intelligent transportation systems) technology.
- Airport maintenance, security, and safety programs.

III. Human-Related Hazards

Civil Disturbances

- 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.
- Structure and property insurance in risky areas, combined with anti-arson practices.
- Design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, etc. that take into consideration emergency and security needs.

Nuclear Attack

- Designated fallout shelters and public warning systems.
- 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.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including enemy attack).

Public Health Emergencies

- Immunization programs to vaccinate against communicable diseases.
- Improving ventilation techniques in areas, facilities, or vehicles that are prone to crowding, or that may involve exposure to contagion or noxious atmospheres.
- Radon detection and abatement activities, 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.
- Free or reduced-expense community clinics and school health services.
- Brownfield and urban blight clean-up activities.
- Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
- Separation of storm and sanitary sewer systems.

Terrorism and Similar Criminal Activities

- Using laminated glass and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- 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.

Major Catastrophic Incidents

- Major warfare, such as World War II.
- Great Blackouts, such as those of 1965 and 2003.
- Anticipated or threatened infrastructure breakdowns (such as “Y2k”).
- Major terrorist incidents or threats, such as 9/11 and the subsequent anthrax events.
- Catastrophic hurricane impacts, as seen in 2005 with hurricanes Katrina and Rita (with many displaced evacuees and a state emergency declaration in Michigan.)

PART TWO: Hazard Mitigation Projects Described in Local Plans (Listed by MSP/EMHSD District) Emphasizing HMA-fundable project ideas

District/Region 1

Delta Township (in Eaton County)

- Page 3.1.V.6 – 3.1.V.8, dry/wet flood proofing of structures; construction of elevated or alternative roads that are unaffected by flooding; government acquisition, relocation, or condemnation of structures within flood plain or floodway areas; structural projects to channel water away from people and property, or to increase drainage or absorption capacities; installing storm drainage systems, including the separation of storm and sanitary sewage systems; and installing back-up generators for pumping and lift stations in sanitary sewer systems.
- Page 3.1.XIII.5 and 3.1.XIV.3, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 3.2.II.4, brownfield cleanup activities.
- Page 3.2.IV.3, proper location, design, and maintenance of water and sewer systems.
- Page 3.2.IV.3 and 3.2.X.3, burying electrical and phone lines, where possible.
- Page 3.2.IX.3, proper installation and maintenance of heating systems, and electrical outlets and wiring.
- Page 3.2.X.3, use of generators for backup power at critical facilities.
- Page 3.2.X.3, replacement or renovation of aging structures or equipment.
- Page 3.3.IV.5, In urban areas demolish derelict structures to prevent rodent infestation.
- Page 4.1.5, this has the 7 general mitigation strategies considered throughout the plan.
- Page 5.11, enhance infrastructure through design and construction to prevent future flood damage.
- Page 5.12, acquisition of repetitive loss structures and/or relocation of structures/reuse of property
- Page 5.15, retrofit and modify bridges in order to maintain their functionality
- Page 5.25, construct safe rooms/spaces in all new institutional buildings

Gratiot County

- Page 63, the City of St. Louis' water system may need to be replaced.
- Page 81, bridge replacement at three locations to better handle high water events and improve traffic safety.
- Page 81, new piles (breaker walls) and riprap at the Mill Pond Dam spillway in St. Louis to provide a more stable bank for the St. Louis Light Plant.
- Page 81, demolition and removal of the Total Petroleum Facility has greatly reduced the potential for a catastrophic event in Alma.
- Page 88, encourage the construction of shelters at City and County Parks.
- Page 89, upgrade the warning systems in Breckenridge, Ashely and Perrinton.
- Page 90, separate the City of Alma's sanitary and storm sewer system to prevent overflow during severe weather events which can cause local flooding and public health issues.
- Page 91, expand the county drain capacity along US 127 in Ithaca to help protect existing and future businesses in a potential commercial and industrial development area.
- Page 92, reconstruct bridges and culverts to eliminate obstructions to the floodway.

Hillsdale County

- Page 45 and 46, NFIP related info about structures in flood zones.
- Page 124, separation and/or expansion of sewer systems to handle anticipated storm water volumes.
- Page 124, use of generators for backup power at critical facilities.
- Page 124, replacement or renovation of aging structures and equipment.
- Page 124, acquire portable generators for use at school buildings as possible emergency shelters.
- Page 125, install early warning siren systems where warranted.

- Page 128, provide back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 128, demolish and clear vacant condemned structures to prevent rodent infestations.

Jackson County
- Page 59, 60, 63, 64, 149, and 150, flood mitigation information.
- Page 143, might construct a County Sheriff/ City Police Department building.
- Page 143, could construct a new emergency management center.
- Page 144, critical facilities: hospitals, schools, jails and prisons, nursing homes, emergency communication facilities, care facilities and similar institutions require the use of backup generators for electrical power in the event of a power failure.
- Page 146, vacant condemned structures should be demolished, and properties cleared of debris to prevent rodent infestation.
- Page 149, install warning sirens.
- Page 149, could construct shelters at mobile home parks.
- Page 150, construct four bridges crossing the North Branch of the Kalamazoo River in the Village of Concord.

City of Lansing (in Ingham County)
- Page 15, floodplain acquisition.
- Page 18, levee/floodwall or other protective actions at Ingham Regional Medical Center Greenlawn Campus.
- Page 18, Repair/ Replace Dakin Street bridge to allow emergency egress from Potter Park zoo in flood conditions.
- Page 18, acquisition of structures in the floodway or high-risk structures in the flood fringe.
- Page 18, permanently lower (open) gates at North Lansing Dam to drop river level 4' in city, or remove dam entirely to restore river to its natural course.

Lenawee County
- Page 49, 51, 132, and 141, flood mitigation information.
- Page 132, increase warning siren coverage and weather radio.
- Page 139, availability of emergency generators, especially when needed for critical emergency services.
- Page 140 and 142, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 141, retrofit older buildings with sprinkler systems.

Livingston County
- Page 164 and 183, encourage the placement of additional public warning sirens in county communities.
- Page 166, MDOT constructed a $32 million Latson Road Interchange that opened in 2013.
- Page 166, major safety and operational improvements are being made to the I-96/US-23 interchange in Brighton Township.
- Page 180, purchase hazard prone lands through public acquisition.
- Page 181, purchase generators to provide a backup power source for public health and safety facilities such as water and sewer treatment plants.
- Page 184, install local lightning detection systems.
- Page 185, relocation of homes in flood-prone areas.
- Page 187, dam repair or replacement.
- Page 187, retrofits of transportation infrastructure – in areas prone to flooding, roads and bridges may need to be reinforced to withstand flooding stresses.
- Page 187, separation of storm drainage systems from sanitary sewage systems.
- Page 187, dam warning systems should be in place to alert the public in a dam failure.
- Page 193 and 198, facilitate the acquisition of approximately 25 flood-prone properties in lowlands surrounding Limekiln Lake in Green Oak Township.

Michigan State University (in Ingham County)

- Page 138, Expand mass notification capabilities to external audiences.
- Page 138, Power to flood-prone buildings: The electrical substations located in eight critical buildings are prone to flooding in a major flood event.
- Page 139, transformers containing polychlorinated biphenyl (PCB) identified in 20 buildings and replace them after determining priority list.
- Page 148, public early warning systems and networks.
- Page 148, use appropriate wind engineering measures and construction techniques to strengthen public and private structures against severe wind damage.
- Page 148, construction of concrete safe rooms in homes and shelter areas in fairgrounds, shopping malls, or other vulnerable public areas.
- Page 149, dry/wet flood-proofing of structures
- Page 149, 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.
- Page 149, structural projects to channel water away from people and property to increase drainage or absorption capacities.
- Page 150, installing storm drainage systems, including the separation of storm and sanitary sewer systems.
- Page 150, back-up generators for pumping and lift stations in sanitary sewer systems and other measures to ensure that drainage infrastructure is not impeded.
- Page 152, install and maintain smoke detectors and fire extinguishers
- Page 153, use of generators for back-up power at critical facilities.

Shiawassee County

- Page 20, 109, 113, 117, 121, 144, 183, and 184, add/enhance more early warning sirens/alerts.
- Page 20, 95, and 96, the county has initiated the removal of the Shia Dam.
- Page 49 – 52, 115, 145, and 183, flood mitigation information.
- Page 95 and 96, the county has a Mistingay Creek Inter-County Drains project.
- Page 118 and 145, repair and/or remove dams where appropriate.
- Page 122, 146, 147, and 183, identify and employ generators for back-up power at critical facilities.
- Page 142, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 183 and 184, expand and/or improve storm drain capacity/ retention.
- Page 183, Owosso Township constructed a new Township and Fire Hall in 2016.
- Page 184, Owosso Public Schools made a request for a proposal for the construction of a new bus garage.

Tri-County Regional Plan for Clinton, Eaton, and Ingham Counties, and for Delta Township (in Eaton County)

- Page 81 and 85, public early warning systems and networks.
- Page 82 and 92, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 83, dry/wet flood proofing of structures.
- Page 83, 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.
- Page 83, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 83, 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.)
- Page 83, 88, and 89, installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation (or expansion) of storm and sanitary sewage systems.
- Page 84 and 88, back-up generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 85, increasing the function and capacity of sewage lift stations and treatment plants, including possible separation of combined storm/sanitary sewer systems, if appropriate.

- Page 85, construct emergency access roads to dams, where needed.
- Page 88, replacement or renovation of aging structures and equipment.
- Page 89, providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 89, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 89, brownfield and urban blight clean-up activities.

District/Region 2 North

Bloomfield Township (in Oakland County)
- Page 7/2, 8/1, install warning sirens.
- Page IV/2, Club Drive flood mitigation project.
- Page IV/2 – IV/3, Amy Drive flood mitigation project.
- Page V/2, water mains in flood plain.
- Page V/3, roads in flood plain.
- Page V/4, rehabilitation options and costs for sanitary sewer, water main, storm sewer, and roads.
- Page V/5, mitigation options for flood-prone properties.

Macomb County
- Pages 44-47, list of top 25 flood priorities throughout the county (also page 95-113, extra description on pages 114-148)
- Page 155, Armada Village's specific flood projects.
- Page 156, Armada Township, emergency siren system project.
- Page 156, Armada Township, trailer park shelter project.
- Page 157 and 158, Bruce Township's specific flood projects.
- Page 159, City of Center Line – specific flood projects.
- Pages 161-166, Chesterfield Township – numerous flood projects.
- Pages 167-170, Clinton Township – numerous flood projects, elevate utilities and seal manholes.
- Page 172, City of Eastpointe backup generator project.
- Page 172, City of Eastpointe outdoor warning system upgrades project.
- Page 173, City of Fraser – specific flood projects.
- Page 174, City of Fraser backup generator project.
- Pages 175-177, Harrison Township – numerous flood projects.
- Page 178, Harrison Township backup generator project.
- Page 179, Lenox Township emergency siren project.
- Pages 179-180, Lenox Township's specific flood projects.
- Page 182, Macomb Township's specific flood projects.
- Page 183, Macomb Township trailer park shelter project.
- Page 184, City of Mount Clemens water treatment facility improvement project.
- Page 184, City of Mount Clemens back-up generator project.
- Pages 185-186, Mt. Clemens pump station and flood monitoring.
- Pages 187-189, City of New Baltimore – multiple flood projects.
- Page 190, New Haven – flood mitigation at 10 homes.
- Page 190, Village of New Haven back-up generator project.
- Page 191, Village of New Haven severe weather shelters for mobile home community parks.
- Pages 192-194, Ray Township – multiple flood projects.
- Page 193, Ray Township emergency siren project.
- Page 195, City of Richmond trailer park shelter project.
- Page 196, Richmond Township emergency siren project.
- Page 198, City of Roseville, back-up hydrant project.

- Page 198, City of Roseville, back-up generator project.
- Page 199, City of Roseville, outdoor warning alert system-sirens.
- Page 200, City of St. Clair Shores – specific flood projects.
- Page 201, Shelby Township emergency siren upgrade.
- Page 201, Shelby Township's specific flood projects.
- Page 202, Shelby Township trailer park shelter project.
- Page 203, City of Sterling Heights' retention/drain upgrades.
- Page 204, City of Sterling Heights' emergency outdoor warning siren upgrade.
- Page 205, City of Sterling Heights' back-up generator project.
- Page 206, City of Sterling Heights' riverbank stabilization.
- Page 207, City of Utica – flood mitigation at homes.
- Page 208, City of Utica brownfield re-development zone.
- Page 208, City of Utica back-up generator project.
- Page 209, City of Warren – flood mitigation at homes.
- Page 210, Washington Township trailer park shelter.
- Page 210, Washington Township re-engineering of existing sewer system project.
- Page 211, Washington Township Emergency Operation Center project.

Oakland County

- Page 12, 194, 198 and 200, Install additional tornado sirens in the community.
- Page 13, 194, 198, 201 and 209, Obtain/maintain back-up generators for pumping and lift stations and treatment plants, including possible separation of combined sanitary/storm sewer systems, if appropriate.
- Page 13 and 209, detect and prevent/discourage illegal discharges from home footing drains, downspouts and sump pumps into storm water system.
- Page 13, 195 and 204, Obtain communication boosters for deficient areas in the Oakland County Wireless Integrated (OakWin) System (Oakland County's 800 mhz, county-wide, interoperable radio system).
- Page 13, 195 and 205, pre-arrange heating/cooling centers/shelters for vulnerable populations, stranded motorists, etc).
- Page 14, 195, 200 and 203, Continue to enhance and maintain early warning systems and networks.
- Page 14, 195, 198 and 201, Encourage communities to obtain and adequate supply of generators for temporary emergency power.
- Page 14, 195 and 201, Make sure warming and cooling centers have adequate backup power generators.
- Page 65, repetitive loss properties (in Birmingham, Troy, Waterford, Farmington Hills).
- Pages 76-78, sewer system improvements (especially Beverly Hills and Franklin, also Bloomfield Hills)
- Page 112, Beverly Hills, Bingham Farms, Birmingham – specific projects.
- Page 113, additional sirens needed in Brandon Township.
- Page 114, Clawson water and sewer line improvements.
- Page 115, Commerce Township – building located in floodplain.
- Page 115, improve dead spot communication of the Oakwin Radio System inside and outside of buildings in the City of Farmington Hills.
- Page 115, improve dead spot communications of the Oakwin Radio System in the City of Farmington.
- Page 116, Franklin – specific flood location to mitigate.
- Page 116, Groveland Township flood locations identified.
- Page 117, Hazel Park has 2 structures that could be removed.
- Page 117, Highland Township needs a tornado siren.
- Page 117, Holly Township needs additional warning sirens.
- Pages 117-118, Holly Township flood and wetlands locations, inadequate culverts.
- Page 119, Keego Harbor flood – project possibilities.
- Page 119, Lathrup Village needs a public shelter for emergencies.
- Page 120, Lathrup Village flood/sewer, and Village of Leonard sewer system.

- Page 120, Village of Leonard needs sprinklers installed in a historic building. Also, there is no sewer system to handle heavy rain fall or melting snow. There are no storm drains to handle storm water runoff and flooding.
- Page 120, Lyon Township needs additional tornado sirens.
- Page 121, Milford Township needs additional tornado sirens.
- Page 121, Novi Township needs road repair and replacement.
- Page 122, City of Novi, eliminate radio dead zones and provide continuous coverage of the OakWin System in all buildings located in the city.
- Page 122, Oakland Township – flooded roads.
- Page 123, Ortonville – insufficient warning of a tornado, or the resources to properly respond to emergencies caused by tornadoes is a concern. Also, many buildings in the city are of advanced age.
- Page 124, Oxford Township, an energy pipeline that runs through the township has required repairs at several locations.
- Page 125, City of Rochester has aging structures in the downtown historical area.
- Page 126, Rose Township – aging and inadequate culverts.
- Page 126, Royal Oak Township has numerous structures in the community that are especially vulnerable to fires and tornadoes.
- Page 126, City of Royal Oak needs additional emergency shelters.
- Page 128, Springfield Township – pumping station.
- Page 128, Sylvan Lake – flood areas where mitigation activities should be helpful. Also, deficiencies still exist with the OakWin System; therefore, there is a need for portable repeaters to be used in fire emergencies.
- Page 129, Walled Lake – A number of downtown buildings are inter-connected and very old, creating the risk of structural fires that could impact the entire downtown area.
- Page 129, Waterford Township flood info. Also, vacant buildings could have structural fires.
- Page 130, West Bloomfield Township has a need to widen Maple Road. Also, storm water management infrastructure improvements are needed. The OakWin System used by police and fire has some deficient areas that can cause difficulties with communication.
- Page 130, White Lake Township flood info.
- Page 130, Wixom, the OakWin System has some deficient areas with the City of Wixom that can cause difficulties with communication.
- Page 131, Avondale School district lacks generator power to operate the schools.
- Page 156, Addison Township – Coordinate with Oakland County to reduce dead zones in the OakWin System.
- Page 157, Auburn Hills – Re-engineer community roads that are susceptible to flooding around the Clinton River.
- Page 157, Auburn Hills needs to continue to seek funding for backup generator power for senior citizen housing facilities during power outages.
- Page 158, Village of Beverly Hills – Implement funding from Fire Grant to upgrade existing generators in the fire hall and police stations to provide power to entire buildings.
- Page 159, Bingham Farms (info relevant to potential mitigation activities?)
- NOTE: I had items listed but then crossed out here, possibly because they had already received funding as projects or perhaps because they were deemed ineligible by Matt or Joel? They were "Page 159, Birmingham floodgates, Bloomfield Hills flooded road" and "Page 165 Groveland Township roads flooded, Page 167 Holly Township flooded roads." I'm guessing there was a reason to remove them from my list, so I haven't typed the info out as part of this list.
- Page 159, City of Birmingham needs to install additional floodgates on older buildings located along the river.
- Page 159, Bloomfield Hills needs to address flooding problems along Opdyke Road. They also want to work together to coordination the installation of a new cell tower to increase coverage of the OakWin System.
- Page 160, Bloomfield Township flood plan references.
- Page 160, Bloomfield Township needs to install additional tornado sirens within the community.
- Page 161, Village of Bloomfield wants to address the problem of flooding in the western portion of the Village.
- Page 161, Brandon Township – Provide additional tornado sirens.
- Page 161, Brandon Township flood area.
- Page 161, Brandon Township needs to install a fire suppression well in downtown Ortonville to help with possible fire in the downtown area.

- Page 162, Clarkston – Continue to advocate for 100% emergency siren coverage for Oakland County.
- Page 162, Clawson – include DPW in the OakWin System.
- Page 162, Clawson – upgrade generators in the Clawson City Hall and Fire Hall, the two named command posts for emergencies.
- Page 162, Commerce Township needs to install additional tornado sirens.
- Page 163, Commerce Township wants to advocate for widening Union Lake and Haggerty Roads to five lanes for improved public safety and emergency vehicle access.
- Page 163, City of Farmington – radio dead zones are still present even after changing over to the county-wide system. The need for bi-directional antennas is a top priority.
- Page 163, Farmington Hills river flood area.
- Page 164, Farmington Hills – study the feasibility of installing additional entrances and exits to/from I-696 to improve emergency vehicle access to accident sites.
- Page 164, Farmington Hills needs boosters to the OakWin System to eliminate or reduce dead spots inside and outside of buildings.
- Page 164, Ferndale – obtain backup generators for the Police Headquarters and City Hall.
- Page 165, Franklin needs to purchase a generator for use/installation in local church or school shelter.
- Page 165, Groveland Township needs to install at least one additional tornado siren.
- Page 165, Groveland Township – raise and improve roads that are susceptible to flooding.
- Page 166, Highland Township needs to install one additional tornado siren in the northeast section of the Township.
- Page 167, Holly Township needs to install additional tornado sirens.
- Page 167, Holly Township – raise and improve sections of Township roads that are susceptible to flooding. Also, pave Falk and Rood Roads. Improve Grange Hall Road, Holly Road, and other roads in Holly Township.
- Page 167, Village of Holly needs to provide additional tornado sirens to serve all areas of the village.
- Page 168, City of Huntington Woods needs to improve the OakWin System to eliminate or reduce dead zones.
- Page 169, City of Keego Harbor, construct a community center that could serve as an emergency shelter.
- Page 169, City of Keego Harbor, supply the police station with an emergency generator.
- Page 169, City of Keego Harbor, flooding concerns.
- Page 169, City of Keego Harbor, boost signal of the OakWin System in certain areas.
- Page 170, Lathrup Village – Provide additional shelters for citizens to use in emergency situations.
- Page 170, Lathrup Village flooding from sewer back-ups on roads.
- Page 171, Leonard Village flood – sewers/drains.
- Page 171, Leonard Village needs boosters for the OakWin System.
- Page 171, Lyon Township – install additional tornado sirens for the mobile home park.
- Page 171, Lyon Township – find a suitable emergency shelter for residents.
- Page 172, Milford Township – redesign culverts in areas of frequent flooding along the Huron River.
- Page 172, Milford Township needs to install additional tornado sirens.
- Page 173, Northville flood area.
- Page 173, Novi Township needs to repair the Township's roads.
- Page 174, Oakland Township flood (general info).
- Page 174, City of Oak Park needs to replace the older back-up generators at the City's Public Safety Department.
- Page 175, City of Oak Park – Construction started of a new public safety/city hall building. Also, the City's community center is due for renovation.
- Page 175, Orchard Lake Village needs to improve the OakWin System such as portable repeaters to be used for fire emergencies.
- Page 176, Ortonville needs to provide additional tornado sirens.
- Page 176, Ortonville flooded road info.
- Page 176, Oxford Township needs to install additional tornado sirens.
- Page 177, Village of Oxford needs to install additional tornado sirens.
- Page 178, Pleasant Ridge – provide a dedicated/automatic switch-over generator for the city hall and additional generators for the community center.

- Page 179, Rochester erosion info.
- Page 179, Rochester Hills flood area/erosion.
- Page 179, Rose Township needs to install tornado sirens in the Township.
- Page 180, Rose Township – pave Rose Center Road and improve local road/primary road intersections.
- Page 181, City of Royal Oak, boosters for the OakWin System to address dead zones in the network.
- Page 181, South Lyon flood/drainage – senior complex.
- Page 181, South Lyon needs to upgrade generators for the Police Station and City Hall to provide power during emergencies.
- Page 182, Springfield Township needs to install additional tornado sirens.
- Page 182, Sylvan Lake, address sewer back-ups.
- Page 183, Sylvan Lake, address the deficiencies in the OakWin System.
- Page 184, City of Walled Lake needs to upgrade the generators at the police station and fire hall.
- Page 184, Waterford Township flood info.
- Page 184, Waterford Township needs to install generators for emergency power at the Water and Wastewater Treatment Plants.
- Page 185, West Bloomfield Township flood info.
- Page 185, White Lake Township needs to install additional tornado sirens.
- Page 186, Avondale Schools need to acquire additional generators to augment or replace aging equipment to provide emergency power.
- Page 187, Berkley Schools need to acquire additional generators to augment or replace aging equipment to provide emergency power. Also needs additional surveillance cameras.
- Page 187, Birmingham Public Schools need to obtain additional generator coverage for all school buildings.
- Page 187, Bloomfield Hills Schools needs to obtain additional generators at all of the schools buildings in case of power outages. Also needs security cameras.
- Page 187, Brandon School District needs to acquire and install additional surveillance cameras for all buildings.
- Page 188, Clarenceville School District needs security cameras.
- Page 188, Clarkston Community Schools need to obtain generators for all the school buildings in the school district. Also, they need security cameras at all the schools.
- Page 188, Clawson Public Schools – Complete the technology bond grant to obtain new generators to power school phones and computers for communications.
- Page 189, Farmington Public Schools need to obtain additional automatic dedicated generators. Also needs an increase in surveillance capabilities.
- Page 189, Ferndale Public Schools – provide generators in all of the school buildings for backup power in case of power outages. Also needs security cameras.
- Page 189, Holly Area Schools need security cameras.
- Page 190, Lake Orion Community Schools – provide generators for all school buildings. Also need security cameras.
- Page 190, Lamphere Schools needs security cameras.
- Page 190, Madison District Public Schools need security cameras and generators.
- Page 191, Oakland Community College, implement the use of outdoor emergency notification system. Also need to obtain and install additional cameras for security systems.
- Page 191, Oakland University needs additional generators to cover the entire campus.
- Page 191, Pontiac School District needs security cameras and generators.
- Page 192, Rochester Community Schools need security cameras.
- Page 192, Royal Oak School District needs security cameras.
- Page 192, South Lyon Community Schools need additional back-up generators.
- Page 192, Southfield Public Schools need security cameras and generators.
- Page 193, Troy School District needs security cameras.
- Page 193, Walled Lake Consolidated Schools need security cameras and generators.
- Page 193, Waterford School District needs security cameras.

City of Port Huron (in St. Clair County)

- Page ES-4 and 8-7, implement flood control projects, including bridge and culvert improvements, where they prove to be the most appropriate approach to reduce flood damage.
- Page 5-3 and 10-4, upgrade and increase the capacity of the drainage system.
- Page 5-4 and 8-6, the City is in the process of separating the waste water and sanitary sewers. Additionally, efforts to encourage flood retrofitting should focus on those structures located in or near the flood plain.
- Page 5-10 and 7-7, currently there are no repetitive loss properties in the city. As mentioned previously, there are two properties that are currently at risk to become repetitive loss but mitigation projects are already planned to avoid possible repetitive loss.
- Page 7-8, due to the rarity of flooding on the Lake Huron and St. Clair River shoreline, there is no warning system in place on these shorelines.
- Page 8-6 and 8-7, 35 acres of City property, Sanborn Park, currently drains into a private sewer system that is under capacity. City personnel have plans to install a fully capable sewer system on a public right away.
- Page 10-4, construct tornado safe rooms.

St. Clair County

- Page 23, leaking underground storage tanks are a problem throughout St. Clair County.
- Page 35, St. Clair County bridge improvement projects.
- Page 38, St. Clair County is constructing two regional trail systems.
- Page 40, The St. Clair County International Airport (SCCIA) has developed a 10-year Capital Improvement Program that includes construction projects.
- Page 58, there are infrastructure concerns in St. Clair County.
- Page 61, the Village of Capac wants to expand their wastewater treatment capacity by constructing a fourth lagoon. The village has also secured land for the siting of another municipal well.
- Page 61, Ira Township wants to install five miles of distribution mains to growth areas of the township.
- Page 61, Kimball Township is in the process of expanding their sewer and water lines which are already in a position to serve the airport.
- Page 62, the City of St. Clair is expanding its wastewater treatment capacity in five years.
- Page 62, improvements are planned for Yale's water distribution system.
- Page 70 and 71, St. Clair County wants to construct a river walk that stretches over one mile of the St. Clair River.
- Page 92, there is a plan to build a nuclear waste site on Lake Huron.
- Page 109 – 111, St. Clair County repetitive loss information.
- Page 115 – 118, St. Clair County road, drain and bridge replacement projects.
- Page 180, St. Clair County wants to invest in 800-megaheretz communications towers.
- Page 217, 220, 223, 224 and 299, improve early warning systems to adequately warn the public in high – risk areas.
- Page 222 and 224, separation and/or expansion of sewer storm systems that will otherwise fail completely due to overloading.
- Page 222, use of generators for backup power at critical facilities.
- Page 222, replacement or renovation of aging structures and equipment.
- Page 223, providing back – up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 224, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 224, Brownfield and urban blight clean – up activities.
- Page 225, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 226, dry and wet floodproofing of structures.
- Page 226, 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.
- Page 226, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 226, structural projects to channel water away from people and property or to increase drainage or absorption capacities.

- Page 226, anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be permanently relocated outside of flood-prone areas and erosion areas.
- Page 229, retrofitting or purchase of properties that have had multiple flood insurance claims.
- Page 234, acquire flood-prone properties.
- Page 234, flood mitigation for Bunce Creek and Huffman Drain, including the acquisition of property, culvert upsizing, channel reshaping, and installation of erosion control structures.
- Page 236, build new communication radio towers and upgrade existing radio towers in the county.
- Page 236, obtain mobile generators that can be moved to various emergency locations to provide power.
- Page 236, install new all-hazards sirens throughout the county and increase the number of all-hazards/outdoor warning sirens.
- Page 236, upgrade and/or replace existing all-hazards/outdoor warning sirens.
- Page 237, construct storm shelters in public buildings, public properties and mobile home parks.
- Page 237, construct emergency shelters for special needs populations.
- Page 239, installation of emergency warning systems for severe weather, fires, and other hazard events for Brockway Township.
- Page 239, enhance emergency shelters for public facilities and manufactured home parks in Burtchville Township.
- Page 239, installation of emergency warning systems for severe weather, fires, and other hazard events, public education and outreach for Capac Village.
- Page 239, enhance emergency warning system to notify residents of a hazard event for Casco Township.
- Page 239, flood control measures: Acquisition of flood-prone property; Elevation of structures; localize flood control projects in China Township.
- Page 239, upgrade existing and install new all-hazard warning systems; protection of gas and electric transmission lines in Columbus Township.
- Page 239, flood control measures: Acquisition of flood-prone property; elevation of structures; localize flood control projects in East China Township.
- Page 240, upgrade and improve radio communications systems to enhance emergency response; upgrade existing and install new all-hazard warning systems for Emmett Township.
- Page 240, upgrade and improve radio communications systems to enhance emergency response; upgrade existing and install new all-hazard warning systems for Emmett Village.
- Page 240, upgrade existing and install new all-hazard warning systems for hazardous materials spills, fires and tornadoes for Greenwood Township.
- Page 240, enhance emergency shelters for public facilities and manufactured home parks in Ira Township.
- Page 240, upgrade existing and install new all-hazard warning systems; public education and outreach for Mussey Township.

District/Region 2 South

City of Ann Arbor (in Washtenaw County)

- 2007 Flood plan, Pages 17-19, 22-55, 69 – relocation and acquisition information. Pages noted as relevant in the 2012 hazard mitigation plan (includes 1 home acquisition): 39-55, 90, 101, 105, 120, 125-126, 129.
- 2007 Flood plan, page 56 (elevation), page 56 (barriers), pages 56-57 (barriers and flood-proofing)
- Page 95, protect critical infrastructure through security measures (cameras, etc.)
- Page 97, install emergency generators.
- Page 111 – 112, flood plain overlay zoning district. Zoning, and other regulatory strategies, don't involve a need for FEMA funds.
- Page 114, add additional freeboard for flood elevation. NOTE: "freeboard" might be a reference to the floodplain regulations, rather than an actual physical project.
- Page 119, remove freestanding structures and obstructions to mitigate flooding.
- Page 120, create drain setbacks to mitigate flooding. "Setbacks" might refer to a regulation on future development, instead of a physical project to implement.

- Page 121, create stream buffer zones to mitigation flooding. Buffer zones may be purely regulatory, not necessarily physical projects that need funding.
- Page 125 – 126, relocation, acquisition, elevation, add barriers, flood proofing, to mitigate flooding.
- Page 132, remove railroad berm fill at Allen Creek
- Page 136, install emergency generators.

Canton Township (in Wayne County)
- Page 86, construct concrete safe rooms in shelter areas in mobile home parks, parks, shopping malls and other vulnerable areas.

City of Dearborn Heights (in Wayne County)
- Page 24 - 26, complete structure relocation, or property acquisition and demolition.
- Page 26 and 27, provide retrofitting of structures.
- Page 28 - 31, implement storm water management structural projects.
- Page 37 -42, address the repetitive loss properties primarily located in the Ecorse Creek floodplain area.
- Page 46 -47, expand the capacity of the retention area(s) in the city and acquire properties that are at risk.
- Appendix D Page 5, provided re-lining of sewer installations.
- Appendix D Page 5, constructed the Dearborn Heights CSO Retention Basin.
- Appendix D Page 5, constructed the Ecorse Creek Wetland Retention Basin.
- Appendix D Page 6, made local improvements to Ecorse Creek Watershed Sewage System.
- Appendix D Page 7, provided remediation of the River Oaks Pond.

City of Detroit (in Wayne County)
- Page 1-14, remove abandon and dilapidated structures.
- Page 1-15, generators for critical infrastructures are in the plans.
- Page 4-3, reduce the number of abandoned structures.
- Page 4-4, 4-5, 4-8 use generators for backup power at critical facilities.
- Page 4-4, replacement or renovation of aging equipment and structures.
- Page 4-7, install a seawall.
- Page 4-7, install backflow preventers.
- Page 4-7, Elevate basement electrical equipment.

Eastern Michigan University (in Washtenaw County)
- Page 131 – 132, Property Protection: building relocation/building elevation, retrofitting, demolition and barriers.
- Page 134, Structural Projects: reservoirs and detention areas, roadways & pedestrian pathway improvements, and drainage & storm water improvements/maintenance.
- Page 137, expand mass notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.
- Page 137, identify critical facilities/ infrastructure needing backup power sources and means to provide backup power.
- Page 138, identify opportunity for the creation of a dual-use storm shelter for the athletic (West) campus.
- Page 138, identify storm water projects such as rain gardens and detention areas to help reduce and control runoff and to promote protection of the Huron River Watershed.

Estral Beach Village (in Monroe County)
- Page 78, obtain back-up generators for pump houses.
- Page 78, elevate homes and structures.
- Page 79, install air conditioning unit in Village Hall.
- Page 80, maintain back-up power generator at Village Hall.

Frenchtown Township (in Monroe County)
- Page 38, Estral Beach and north side of Swan Creek (Berlin Township): structure relocation.

- Page 38, Stony Pointe to Detroit Beach (Frenchtown Township): seawall/levee system.
- Page 38, Bolles Harbor through Luna Pier: seawall/levee systems.
- Appendix G, Frenchtown Charter Township Resort District Authority "Lake Erie Dike Reconstruction Standards".

City of Lincoln Park (in Wayne County)

- Page 18 and Appendix C, install or upgrade back-up electrical, communication, and computer network systems at all city buildings; install or upgrade surge protectors on the city's critical electronic equipment; authorize city's grant consultant to apply for available grants on back-up systems; and/or install or upgrade lightning protection devices for city's communication system at all city buildings.
- Page 20, establish a back-up communication and computer network systems for the city in case the main system fails or is temporary shut-down.
- Page 22, remove and replace inadequate sewer runs and rehabilitate the remaining sewer runs to properly transport sewage from the city's residences and businesses.
- Appendix B, water-main replacement and installation for numerous roads.

City of Livonia (in Wayne County)

- Page 69, replace vulnerable infrastructure such as old water, storm and sewer lines.
- Page 69, acquire sufficient generators for traffic control, vulnerable population services and health care to mitigate the effects of infrastructure failure, especially when compounded with other hazards.
- Page 72 and 74, purchase generators to accommodate people with special needs when the recreation center is used for a shelter.

Monroe County

- Page 1 and 3, flood projects.
- Page 1, retrofit and rebuild an existing intake structure.
- Page 34, 47, 92, 112 and 117, public early warning systems and networks.
- Page 47, 92 and 166, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 48, 52, 64, 65, 72, 103 and 168, NFIP information.
- Page 74, dry and wet floodproofing of structures within known flood areas.
- Page 75, elevation of flood-prone structures above the 100-year flood level.
- Page 75, 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.
- Page 75, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 75, employing techniques of erosion control within the watershed area.
- Page 75, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 75 and 107, installing storm drainage systems, including the separation of storm and sanitary sewage systems.
- Page 75, flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
- Page 75, back-up generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 75, increasing the function and capacity of sewage lift stations and treatment plants, including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Page 82, separation and/or expansion of sewer systems to handle anticipated storm water volumes.
- Page 82, use of generators for backup power at critical facilities.
- Page 82, replacement or renovation of aging structures and equipment.
- Page 107, providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 107, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 107, brownfield and urban blight clean-up activities.
- Page 127, filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.

- Page 167, develop community warning systems in areas of the county not presently covered.
- Page 168, purchase, relocate, or flood-proof homes that are prone to flooding.
- Page 171 and 172, Berlin Township would like to increase its supply of back-up generators. They would also like to build a community shelter for weather events.
- Page 173, Dundee Township, install a natural-gas-powered generator for the township hall located on 179 Main Street, Dundee.
- Page 173, Dundee Township, acquire two portable diesel-powered generators.
- Page 174, Village of Dundee, install a natural-gas-powered generator for the senior center located at 284 Monroe Street, Dundee.
- Page 174, Village of Dundee, install a natural-gas-powered generator for Rawson Place, at 501 Rawson Street, Dundee.
- Page 174, Village of Dundee, acquire two light towers.
- Page 175, Village of Estral Beach, install cameras.
- Page 175, Village of Estral Beach, re-route a pipeline away from the canal in the rock and clay dike system that surrounds the village.
- Page 175, Village of Estral Beach, the village has only one stretch of roadway that allows normal entry and exit by land vehicles. Serious retrofitting would be required to allow an alternative access point to be developed by way of the north bowl dike.
- Page 177, Village of Estral Beach, obtain backup generators for pump houses.
- Page 177, Village of Estral Beach, elevate homes and structures.
- Page 178 and 179, Village of Estral Beach, flood mitigation information.
- Page 179, Village of Estral Beach, mitigate dike failures.
- Page 179, Village of Estral Beach, mitigation of infrastructure failures through redundancies in the area's water system, power sources, and utility infrastructure.
- Page 180, Exeter Township, South Stony Creek Road Emergency Evacuation Route: Crumbling pavement on this major East-West arterial road inhibits its usefulness as an evacuation route.
- Page 180, Exeter Township, explosion risk from the anhydrous ammonia fill station located in the adjacent Village of Maybee.
- Page 180, Exeter Township, Stoneco Quarry mining operations and reclamation (located in the adjacent Village of Maybee).
- Page 182, Frenchtown Township, add 2 generators for infrastructure support.
- Page 182 and 183, Frenchtown Township, Seawall Restoration Project.
- Page 184, City of Luna Pier, maintain the current dike system and the flood control system (pumps) throughout the city.
- Page 184, City of Luna Pier, remove substandard housing.
- Page 184, City of Luna Pier, install a power generator at the City Hall.
- Page 186, Village of Maybee, a backup generator was recently installed at the L.M.R. Fire Department.
- Page 186, Village of Maybee, an old natural gas pipeline that had been made of steel was replaced with noncorrosive plastic materials.
- Page 187, Village of Maybee, install a backup generator at a sanitary sewer facility owned by the village.
- Page 188, City of Milan, Riverbank and Roadbed Erosion along Ford Lake: seek remediation of the bank in the affected area.
- Page 188, City of Milan, Construction of Truck Route/Business Spur along US23: There is a need for a business loop directly traversing a length of US23 that could serve area truck traffic and divert it from the Downtown and associated residential population.
- Page 188, City of Milan, Generators for lift stations: need 9 generators to install at each of the 9 stations that are not presently equipped.
- Page 188, City of Milan, install a charcoal filter for the water treatment plant.
- Page 188, City of Milan, remediation of roadbed erosion near the waste water treatment plant. In addition, there are several sewage delivery lines in the vicinity of the roadbed that could be compromised if the erosion is not eventually remediated.
- Page 188, City of Milan, install natural gas generators for City Hall and the Senior Center.

- Page 189, City of Milan, install natural gas generator at the fresh water pumping station.
- Page 189, City of Milan, replace diesel generator at waste water treatment with a natural gas generator.
- Page 190, City of Monroe, Floodplain mitigation.
- Page 190 and 191, City of Monroe, Footing Drain Disconnection Program.
- Page 191, City of Monroe, install lift station generators.
- Page 191, City of Monroe, install additional raw water pumps/piping.
- Page 191, City of Monroe, replace the 36" raw transmission line.
- Page 192, City of Monroe, add an additional water clarifier.
- Page 192, City of Monroe, install main plant generators.
- Page 192, City of Monroe, replace the ozone generator.
- Page 192, City of Monroe, replace distribution pumps.
- Page 192 and 193, City of Monroe, replace booster station generators.
- Page 193, City of Monroe, replace water distribution system.
- Page 194, City of Monroe, replace all existing lead water service lines with the City water system to eliminate lead contamination in the drinking water system.
- Page 197, Monroe Township, the township's central water system, which relies upon central facilities in the City of Monroe, is being expanded by an extension of a 12-inch line from Telegraph Road at Davis Swale, for approximately ½ mile farther south, to Albain Road. Also, a key water system facility for raw water intake and water treatment has updates underway involving its ozone injection system, roof, and raw water pump drive system.
- Page 197, City of Monroe, "Wet Weather Facilities Plan Study".
- Page 198, Monroe Township, NFIP properties.
- Page 198, Monroe Township, storm water management project.
- Page 198, Monroe Township, inflow/infiltration removal.
- Page 198, Monroe Township, expand the area's wastewater treatment plant.
- Page 200, Raisinville Township, safe-room school shelter areas.
- Page 200, Raisinville Township, improve the design of its current truck routes.
- Page 201, Raisinville Township, remove dams.
- Page 203, Village of South Rockwood, to alleviate flooding at Gildersleeve and Edward the village desires to expand the area's drainage capacity.

City of Romulus

- Page 62, develop community detention ponds to handle additional storm water volumes.
- Page 62, use generators for back-up power at critical facilities and major intersection traffic signals.
- Page 62, replace or renovate aging structures or equipment.
- Page 64, proper separation and buffering between industrial areas and other land uses.
- Page 64, provide public warning systems and networks.
- Page 65 and 66, demolish abandoned and/or condemned buildings or other structures that may be potential risk for arson.
- Page 66, provide back-up generators to maintain quality sources of water and sewer.
- Page 66, separation of storm and sanitary sewer systems.
- Page 76, assess the City/County storm drain system and implement needed improvements to prevent future urban flooding such as creation of new retention/ detention ponds, construction of new drains, alterations and improvements to existing drains, or possible installation of backflow prevention valves, and other automatic monitoring systems.
- Page 76, purchase back-up generators for main city buildings and community facilities needed during power outages such as City Hall, Police Station, Fire Station, and local shelters.
- Page 77, construct needed building improvements to accommodate storm shelters.
- Page 34 (from the other plan), the City of Romulus is updating and adding to the siren system.
- Page 116 (from the other plan), construction has begun on another Detroit Metropolitan Airport southern entrance off I-275 to the new Midfield Terminal.

- Page 117 (from the other plan), currently there is only one entrance to the airport, Merriman Road. With the expansion of the airport and midfield terminal, a south entrance and a ring road is being planned. This would allow the airport to have an alternate ingress and egress.

Washtenaw County

- City of Ann Arbor, page 16 and 21, remove dams.
- City of Ann Arbor, page 16 and 21, replace and upgrade emergency generators for key facilities like the Police Department, Department of Public works, and City Hall and fixed generator lift stations.
- City of Ann Arbor, page 18, replace and upgrade current sirens and add additional upgraded warning sirens.
- City of Ann Arbor, page 19 and 22, Flood Mitigation Plan (acquisition and modifications).
- Ann Arbor Township, page 9, 10 and 13, add a warning siren to the northeast section of the township.
- Ann Arbor Township, page 10 – 13, purchase generators and back-up water supplies for both government and commercial properties.
- Ann Arbor Township, page 12 and 13, add warning sirens.
- Augusta Township, page 7, 9 and 11, installation of warning sirens.
- Augusta Township, page 7, 10 and 11, installation of emergency generators.
- Augusta Township, page 7, construction of safety shelters in existing communities.
- Barton Hills Village, page 7, 9 and 10, install emergency generators (for the water wells).
- Barton Hills Village, page 7 and 10, install warning sirens.
- City of Chelsea, page 9,10 and 12, install warning sirens.
- City of Chelsea, page 9 and 11, install emergency generators at key city buildings.
- City of Chelsea, page 9 and 12, provide a new emergency shelter for mobile home park residents.
- Dexter Township, page 7 and 10, new warning sirens should be installed and located to cover the Township's schools, disaster shelter, Township Hall and special care facilities.
- Dexter Township, page 7, 9,11 and 12, install emergency generator(s).
- Dexter Township, page 11 and 12, install a public warning system that would alert downstream residents and businesses in the event of a dam failure, giving them time to evacuate.
- Village of Dexter, page 7, 10, 11 and 12, install emergency generators at the police and fire stations, village hall and shelters so that the village may function when disasters occur.
- Village of Dexter, page 11 and 12, repair the Main Street Bridge over Mill Creek.
- Lima Township, page 7, 10 – 12, install warning sirens.
- Lima Township, page 7, 9, 11 and 12, install emergency generators.
- Lima Township, page 12, dam repair work.
- Lima Township, page 12, build an overpass or an at-grade crossing.
- Lodi Township, page 9, 10 and 12, future warning sirens should be strategically located to maximize coverage of residents and large facilities.
- Lodi Township, page 9, 10 and 12, install an emergency generator at the township hall.
- Lodi Township, page 9, construct an emergency shelter at the Washtenaw Farm Council Fairgrounds.
- Lyndon Township, page 7, 9, 10 and 12, install warning sirens.
- Lyndon Township, page 7, 9 – 12, at least one emergency generator should be installed at the Township Hall in order to provide shelter or relief to Township residents.
- City of Milan, page 7, 9 – 11, install emergency generators at the City Hall, Police Station and Fire Station.
- Northfield Township, page 7, 11 and 12, install warning sirens.
- Northfield Township, page 7, 10, 11 and 13, install emergency generators.
- Northfield Township, page 12, detention ponds or other appropriate measures to alleviate flooding around Horseshoe Lake.
- Pittsfield Township, page 7, 11 and 13, install warning sirens.
- Pittsfield Township, page 7, 11 – 14, install emergency generators.
- Salem Township, page 7, 9 and 11, install warning sirens.
- Salem Township, page 9, construction of safety shelters in existing communities.
- City of Saline, page 9, 10 and 13, install warning sirens.

- City of Saline, page 9 – 11, and 13, install emergency generators.
- City of Saline, page 9 and 13, construct a shelter for the manufactured housing communities.
- Saline Township, page 7, 10 and 11, install warning sirens.
- Saline Township, page 7, 10 and 11, install emergency generators.
- Scio Township, page 7, 9 and 11, install warning sirens.
- Scio Township, page 7, 9 – 11, install an emergency generator at Scio Township Hall.
- Southwest Washtenaw Region, page 9, 12, 13 and 15, install warning sirens.
- Southwest Washtenaw Region, page 9, 12 – 15, install emergency generators.
- Southwest Washtenaw Region, page 13 – 15, replace the culvert along Schleweis Road.
- Southwest Washtenaw Region, page 14 and 15, replace the Furnace Street Bridge in the Village of Manchester.
- Southwest Washtenaw Region, page 14 and 15, dam repair, operation, and maintenance.
- Superior Township, page 7 and 12, install warning sirens.
- Superior Township, page 7, 10 and 11, install emergency generators.
- Sylvan Township, page 7, install warning sirens.
- Sylvan Township, page 7, 10 – 12, install emergency generators.
- Sylvan Township, page 12, road improvements at Kalmbach/I94 and Werkner Road/ M52 intersections.
- Webster Township, page 7 and 10, install warning sirens.
- Webster Township, page 7, 10 and 11, install emergency generators (Township Hall).
- York Township, page 7, 10 and 11, install warning sirens.
- York Township, page 7, 10 and 11, install emergency generators.
- City of Ypsilanti, page 7, 10 – 12, 14, 16 and 17, install emergency generators.
- City of Ypsilanti, page 7, 10, 13, 16 and 17, install warning sirens.
- City of Ypsilanti, page 14 and 17, repair the Peninsular Park Dam.
- Ypsilanti Township, page 7, 10, 11, 14, 15 and 17, install warning sirens.
- Ypsilanti Township, page 7, 10 – 13, and 17, install emergency generators.
- Ypsilanti Township, page 9, construct safety shelters in existing communities throughout the township.
- Ypsilanti Township, page 16 and 18, target buildings that pose to be a public health threat for condemnation and razing.

Wayne County

- Page 55, repetitive loss properties information.
- Page 113, Brownstown Township needs early warning sirens.
- Page 115, City of Dearborn Heights needs a more comprehensive public warning and information distribution system.
- Page 117, City of Ecorse needs tornado sirens in the community.
- Page 118 and 119, Grosse Pointe Park needs a better tornado warning system.
- Page 119, Grosse Pointe Woods wants a generator.
- Page 121, Huron Township wants to install more tornado sirens.
- Page 126, Sumpter Township wants emergency generators.
- Page 160, City of Allen Park sewer improvements needed.
- Page 160, City of Allen Park needs back-up generators.
- Page 160, City of Belleville needs back-up generators.
- Page 161, Brownstown Township wants to install new warning sirens.
- Page 163, City of Ecorse wants to install a tornado siren.
- Page 164, Garden City wants to purchase generators.
- Page 164, City of Gibraltar, elevate 1 home, project involving storm-water pump station.
- Page 165, Grosse Ile Township, improve and/or replace the county bridge linking Grosse Ile with the mainland.
- Page 165, Grosse Pointe Farms, replace the water filtration system with a system that utilizes hydro liquid Chloride.
- Page 165 and 166, Grosse Pointe Park wants to install generators and warning sirens.
- Page 166, Grosse Pointe Woods wants a generator.

- Page 168, Huron Township wants to install sirens.
- Page 169 and 170, City of Livonia – water detention (in coordination with storm-water management plan). Also install generators and replace outdated emergency notification siren network.
- Page 171, City of Northville wants to install additional tornado sirens. Also, they want to replace the generator at City Hall and the Fire Station.
- Page 171, Northville Township wants to install tornado sirens.
- Page 172, Redford Township wants to install tornado sirens.
- Page 173, City of Rockwood, wants to install tornado sirens and install shoreline restoration along the Huron River.
- Page 174, City of Romulus detention/sewer project potential. Also, expand warning system and provide generators.
- Page 174, City of Southgate wants to provide back-up generators.
- Page 175, City of Taylor – I-75 and Allen location identified for project potential. They also want to purchase generators.
- Page 176, Van Buren Township wants to install tornado sirens.
- Page 177, City of Westland wants to install emergency generators.
- Page 178, Wyandotte basement flood vulnerabilities could be addressed through mitigation.
- City of Wyandotte, Henry Ford Hospital mitigation activities (NOTE: Since this time, the hospital has completed its own annex, appended to the Wayne County plan, and a similar annex appended to the Oakland County plan.)
- Page 178 and 180, Wayne County, prepare as generator ready, and complete other measures for pump and lift stations in sanitary sewer systems, to ensure that drainage infrastructure is not impeded.
- Page 179 and 180, Wayne County, encourage the construction of concrete safe rooms to retrofit existing single and multi-family homes and shelter areas in mobile home parks, fairgrounds, shopping malls, and other vulnerable public areas.
- Page 181, Wayne County, construct a berm and flood control structure at the French Landing Dam.

District/Region 3

Alcona County

- Page 8-1, provide community wide hazard warning systems.
- Page 8-2, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 9-3, communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing and shelters.
- Page 9-8 and 9-9, construct elevated or alternative roads that are unaffected by flooding, or make roads more flood resistant.
- Page 9-8 and 9-9, dry floodproofing of structures within known flood areas.
- Page 9-8 and 9-9, initiate structural projects to increase drainage or absorption capacities.
- Page 9-11, require new mobile home parks to have tornado/wind shelters.
- Page 9-13, purchase and/or maintain generators for backup power at critical facilities.
- Page 9-14, demolish and clear vacant condemned structures in populated areas to prevent rodent infestations.

Arenac County

- Page 61, 62, 66, 67, 144, 149, 155, 157,160, 164, 165, 168, 169 and 171, install community wide outdoor hazard warning siren systems.
- Page 83, state and federally assisted infrastructure mitigation projects are mentioned.
- Page 144 and 172, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 147 and 172, communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, emergency health care, and shelters.
- Page 150 and 165, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls or other vulnerable public areas.
- Page 153, 167 and 173, arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, etc.)
- Page 158 and 172, separation and/or expansion of sewer systems to handle anticipated storm water volumes.
- Page 161, 169 and 170, structural projects to channel water away from people and property, or to increase drainage or absorption capacities.
- Page 162, 169 and 173, installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
- Page 162, 169 and 170, government acquisition, relocation, or condemnation of structures with floodplain or floodway areas.
- Page 163, 169 and 170, 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.
- Page 163 and 170, increasing functioning and capacity of sewage lift stations and treatment plants, including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Page 163 and 170, back-up generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 168, constructing emergency access roads to dams.
- Page 169 and 170, dry and wet flood proofing of structures.
- Page 172, use of generators for back-up power at critical facilities.
- Page 172, demolition and clearance of vacant condemned structures to prevent rodent infestations.

Bay County

- Page 45, 46 and 118, NFIP related information.
- Page 117 and Appendix H, reduce exposure to hazards through building or parcel specific activities, such as flood proofing or property acquisition.
- Page 118 and Appendix H, minimize impacts through projects, such as detention basins or tornado shelters.
- Page 119 and Appendix H, install and or expand warning systems county wide.
- Page 119 and Appendix H, structural projects that can include the following: storm sewers, floodwalls, highway projects, and tornado shelters.
- Appendix H, purchase homes in the 100-year floodplain and convert the space to a park or greenspace to reduce flood impacts.
- Appendix H, dredging of Kawkawlin River to move flood waters from area during major rain events in Bangor Township.
- Appendix H, increasing the drainage of the KawKawlin River where drainage is inadequate or non-existent in Bangor Township.
- Appendix H, installing pump stations near the KawKawlin River to allow more water to get to the river faster in Bangor Township.
- Appendix H, improved road grades in areas that water is not allowed to drain properly into the drains in Bangor Township.
- Appendix H, develop an evacuation route for Killarney Beach Road residents and create a 30+ foot green space West of Killarney Beach Road that will act as a fire break in Bangor Township.

- Appendix H, James Clements Flood Protection Dike stabilization and improvement Ditch drainage and pump station improvements in the city of Bay City.
- Appendix H, Liberty and Independence Bridges Erosion Protection in the city of Bay City.
- Appendix H, Establish sea wall along the Saginaw River in the city of Essexville.
- Appendix H, build barrier or purchase homes along Saginaw Bay in the Township of Fraser.
- Appendix H, Clean Tebo Drain and enlarge Lake State Railroad Bridge in the Township of Fraser.
- Appendix H, purchase back-up generator to facilitate Township Hall as an emergency shelter.
- Appendix H, increase height of dike to remove twp 1% flood plain in the Township of Hampton.
- Appendix H, retrofitting sanitary sewer system to remove storm water in the Township of Hampton.
- Appendix H, build tornado shelters at both Manufacture Mobile Home community and twp. RV campground in the Township of Hampton.
- Appendix H, develop an evacuation route for Brissette Beach and Linwood Beach Road residents and create a 30+ foot green space West of Brissette Beach and Linwood Beach Roads that will act as a fire break in the Township of Kawkawlin.
- Appendix H, build tornado shelters in our trailer parks in the Township of Monitor.
- Appendix H, erect sea walls and barriers to reduce ice floes along the Saginaw Bay in the Township of Pinconning.
- Appendix H, shelter for Riverview Trailer Park in the Township of Portsmouth.
- Appendix H, install community shelters in schools and manufactured housing complexes in the Township of Williams.
- Appendix H, expansion of fire ambulance substation so that it can be used as a severe weather station in the Township of Williams.

Genesee County

- Page 9, strategies are in progress to further develop the Foreign Trade Zone so that local businesses can pursue additional international import/export opportunities.
- Page 15, 33, 34, 41, 42, 54, 56, 65, 89 and 236, demolitions of vacant structures occur, especially within the city limits of Flint.
- Page 19, 30, 41, 46, 49, 55 – 57, 60, 62, 64, 67, 69, 75, 77, 78, 89, 99 – 102, 109, 110, 124, 165, 166, 181 – 184, 192, 218, 236, 240, 242 and 243, there is a need for additional warning sirens throughout the community.
- Page 20, groundbreaking for the construction of the Karegnondi Water Pipeline occurred in June of 2013. The waterline will distribute water from Lake Huron to communities along the I-96 corridor of Genesee County.
- Page 31, 148, 155, 165, 187, 195, 197 and 208, natural gas backup generator for Atlas Township Office/Hall which also serves as a Community Room and sub-station for Genesee County Sheriff Department.
- Page 31 and 149, drainage improvements at Catherwood/Farnsworth, Hill Road, Washburn Road between County Line (Ray Road) and Kipp Road in Atlas Township.
- Page 31, 134, 215, 221 and 224, install high pressure 10-inch water wells (electric) in Atlas Township.
- Page 41, 197, 238 and 241, infrastructure development and repair: electrical, sewer, roads, bridges, etc in the City of Flint.
- Page 41, 43, 149, 174 and 175, river project involving the elimination of the Hamilton Dam in the City of Flint.
- Page 45, continue to improve storm water drainage in the City of Grand Blanc.
- Page 47, 100, 149, 166, 182, 187 and 208, stand-alone generator for the City of Linden City Hall.
- Page 49, the city of Montrose is working with the Huron & Eastern Railroad to mitigate drainage issues.
- Page 54, work with the County on two main drains that run through Clayton Charter Township (Mistygay and Cole Creek) to reduce flooding.
- Page 57, install generators in Fenton Charter Township.
- Page 60 and 149, dredge Brent Creek and Cole Creek in Flushing Charter Township.
- Page 60, 101, 149, 155, 183, 187, 198 and 208, install a backup generator at Flushing Charter Township Hall.
- Page 62, obtain generators for shelter sites in Forest Township.
- Page 65, add stand-alone generators for Genesee Charter Township.
- Page 67, construction of a saferoom at the Grand Blanc Charter Township Government Center.
- Page 76, Thetford Township wants to put a back-up generator in the Senior Center.

- Page 80 and 175, improve or replace the Mill Pond Dam in the Village of Goodrich.
- Page 82, retro existing structures in the Village of Otisville to have standby power.
- Page 89, 100, 102, 109, 114, 124, 128, 154, 182, 184, 197, 207, 236, 238, 240 – 242, provide additional storm shelters in the county (especially for mobile homes).
- Page 100, 101, 109, 114, 118, 124, 128, 148, 154, 165, 182, 192, 197, 207, 226, 236 – 238, 240 – 242 and 244, emergency generators for police/fire departments, special needs facilities, and facilities identified as community shelters during hazardous weather in the county.
- Page 101, 166, 183, 187, 198 and 209, enhance First Street Residence Hall evacuation and sheltering at the University of Michigan Flint.
- Page 101, 166, 183, 188 and 198, upgrading and improving the U of M Flint EOC and Department of Public Safety at the University of Michigan Flint.
- Page 102 and 184, install a portable diesel-powered generator to provide back-up power to three separate locations that serve special needs students in the Genesee Intermediate School District.
- Page 102 and 184, provide structural reinforcement for the walls and roof of the gyms and multi-purpose rooms at three separate locations that serve special needs students at the Genesee Intermediate School District.
- Page 110, 128 and 209, install emergency generators in the Goodrich Area Schools.
- Page 128, 129 and 209, install a back-up generator for the Village of Lennon Police department and the Village Hall.
- Page 138, 148 and 237, NFIP information.
- Page 150, relocate mobile home parks from flood-prone areas in Genesee County.
- Page 174 and 239, repair, improve and/or remove dams in Genesee County.
- Page 175, remove and replace the Thread Dam in the City of Flint.
- Page 182, create an emergency shelter in Fenton Township.
- Page 184, install emergency generators in Bendle Public Schools.
- Page 199, a city of Flint project is stand-by power (for the Cedar Street pump station and reservoir, the westside pump station and the Flint Water Plant) to ensure that the Flint water supply would not be interrupted during an emergency.
- Page 199, a city of Flint project is stand-by power (for the Torrey Road booster pumping station) to ensure that water main pressure remains constant for a high-elevation water district during an emergency.

Gladwin County

- Page 73, NFIP information.
- Page 100, 104, 106, 107, 115 – 117, 151, 153, 159, 161, 164, 166, 168, 170, 172, 175, 177, 180 and 185, provide and/or update community wide hazard warning systems/sirens (natural, health and terrorism).
- Page 100, one warning siren at each fire department (7 total) that can be activated from Central dispatch, also include Public Address system.
- Page 100 and 115, repair or replace critical infrastructure and facilities that are damaged and degraded.
- Page 100 and 115, shelters in case of a hazard event-Designate township halls, K of C halls, etc. as shelters. Build new shelters; acquire generators for shelters.
- Page 101 and 115, maintain communication infrastructure-fire, police, EMS; install second communications tower in the southern end of the county.
- Page 102, 114, 117 – 120, 157, 161, 164, 168, 170, 175, 180, 185 and 188, communities will acquire and maintain an adequate level of emergency power generators (especially for critical facilities). Also, purchase battery back-up packs for generators.
- Page 104, 174 and 179, constructing emergency access roads to dams.
- Page 107, 176 and 181, proper separation and buffering between industrial areas and other land uses.
- Page 114, 176 and 181, replacement or renovation of aging structures and equipment (to be made as hazard-resistant as economically possible).
- Page 122, 168 and 190, upgrade a one-mile section of Wagarville Road in Sage Township to meet current road standards. In addition, many of the other roads in the Township are in a severe state of disrepair.
- Page 122 and 190, construct additional firefighting facilities to help reduce response times for fires within the County.

- Page 123, retrofit at-risk structures with ignition-resistant materials.
- Page 157, trench/retrench the drains at Lake Lancer in Butman Township.
- Page 164, roads need to be wider in Grout Township to accommodate different modes of traffic. While this may be unreasonable in certain areas, the widening of the roads in the most critical areas may be appropriate. Road improvements also are needed to address the concerns with failing infrastructure.
- Page 168, roads need to be wider in Sage Township to accommodate different modes of traffic.
- Page 168, Sage Township's culvert system is in a state of disrepair and as a result flooding has occurred. Culverts need to be repaired/replaced to meet the standards of the State of Michigan.
- Page 172, complete dam maintenance in Sherman Township.
- Page 174 and 177, use appropriate wind engineering measures and construction techniques to strengthen public and private structures against severe wind damage.
- Page 174 and 177, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 174 and 179, dry/wet floodproofing of structures within known flood areas.
- Page 174 and 179, elevation of flood-prone structures above the 100-year flood level.
- Page 174 and 179, 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.
- Page 174 and 179, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 174, 175, 180 – 182, increasing functioning and capacity of sewage lift stations and treatment plants, including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Page 174 and 181, Brownfield cleanup activities.
- Page 175 and 182, create paved lanes (where possible) designated for horse-drawn vehicles.
- Page 180, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 182, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 192, replace older, damaged culverts throughout the county as needed.

Huron County

- Page 73 – 75 and 78, expand public warning system.
- Page 73 – 75 and 78, generators at public facilities.
- Page 73 – 75 and 78, infrastructure maintenance and replacement.

Iosco County

- Page 93, designated fallout shelters and public warning systems for a nuclear attack.
- Page 93, 126, 176, 177 and 187, construction of concrete safe rooms (or shelters) in houses, trailer parks, fairgrounds, community facilities, shopping malls, and business districts.
- Page 101, 119, 124, 127, 129, 130, 132, 174, 177, 180 – 183, 187 and 189, provide community wide hazard warning systems.
- Page 101 and 129, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 104, 111, 118, 131, 174, 182 – 184, 189 and 190, communities will acquire and maintain an adequate level of emergency power generators (especially for critical facilities).
- Page 112, 117, 119, 174, 175, 181 – 184, separation and/or expansion of sewer systems to handle anticipated storm-water volumes.
- Page 112 and 183, replacement or renovation of aging structures and equipment.
- Page 115, 120, 175 and 181, 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.
- Page 117, 121 and 181, structural projects to channel water away from people and property or to increase drainage or absorption capacities.

- Page 117, 121, 175 and 181, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 118, 122, 175 and 181, elevation of flood-prone structures above the 100-year flood level.
- Page 119, 121, 175 and 181, dry/wet floodproofing of structures within known flood areas.
- Page 125 and 180, constructing emergency access roads to dams.
- Page 137 and 196, enhance the warning and monitoring of systems in the Huron Shore Water Treatment Plant and surrounding infrastructure.
- Page 182 and 184, Brownfield cleanup activities.
- Page 182 and 184, proper separation and buffering between industrial areas and other land uses.
- Page 184, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 188, filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.

Lapeer County

- Page 5, 26, 28 – 30, 42, 51, 77, 80, 101, 109 – 112, 117, 118 and 123, increase warning siren system coverage and NOAA Radio use.
- Page 31, 42, 51, 52, 58, 64, 71, 77, 80, 95, 104, 106, 109 – 111, 113 – 118, 122 and 124, purchase emergency generators.
- Page 52, 80, 111 and 118, Elba Township wants a public tornado shelter in the Township Hall.
- Page 52, 80, 111 and 118, City of Lapeer wants to construct a tornado shelter at the Crestview Manor Trailer Park.
- Page 58, 84 and 119, repair of critical infrastructure.
- Page 58 and 113, retrofit existing sanitary sewer lift stations and/or general infrastructure components to be more resistant to natural disasters in the Village of Almont.
- Page 58 and 113, expand 18-foot concrete culvert at the corner of Blacks Corners Road and Attica Road in Imlay City.
- Page 71, mitigation assistance program for structures in the flood plain.
- Page 71 and 115, complete soil stabilization projects along the Clinton River in the Village of Almont.
- Page 71 and 115, analyze culverts throughout the Village of Almont and make necessary improvements to protect residents from flooding. This work also could include installing retention basins.
- Page 71 and 115, Imlay City Bell River restoration project.
- Page 77, 110, 113, 114 and 117, create community storm shelters (especially for mobile home communities).
- Page 80 and 117, construction of a safe room in the Village of Almont for use during emergencies. A stand-alone building that is constructed on municipal property.
- Page 87 and 120, repair of critical dams.

City of Midland

- Page 37 – 41 and 44, purchase/acquire existing structures/buildings located in the flood plain and move or demolish them.
- Page 37, 39, 41 – 44, ensure emergency warning sirens in the city are upgraded and operational.

Midland County

- Page 14, 60, 65, 73 and 74, improve and/or expand the outdoor warning system in areas of public assembly.
- Page 14, 41, 62 and 70, flood mitigation improvements.

Ogemaw County

- Page 87, 123, 124, 217, 221, 223, 228, 236, 240, 247 – 249, add more public warning sirens in the future.
- Page 99, recently a new airport terminal building was constructed to offer visitors additional airport services.
- Page 218 and 250, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 224, 227, 233, 247, 250 and 251, critical facilities, hospitals, schools, jails and prisons, nursing homes, emergency communication facilities, care facilities and similar institutions require the use of back-up generators for electrical power in the event of a power failure.
- Page 228 and 241, identify then construct where necessary concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.

- Page 236 and 245, construct emergency access roads to dams.
- Page 246 and 247, dry/wet flood proofing of structures within known flood areas.
- Page 246 and 248, elevation of flood-prone structures above the 100-year flood level.
- Page 246 and 248, construction of elevated or alternative roads that may be unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of the vulnerable shoulders and embankments.
- Page 246 and 248, government acquisition, relocation, or condemnation of structures within a floodplain or floodway areas.
- Page 246 and 248, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 246, 247, 250 and 251, installing storm drainage systems, including the separation of storm and sanitary sewage systems.
- Page 249 and 251, proper separation and buffering between industrial areas and other land uses.
- Page 251, demolition and clearance of vacant condemned structures to prevent rodent infestations.

Oscoda County

- Page 8-1 and 9-12, provide community wide hazard warning systems.
- Page 8-2, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 9-5, 9-10 and 9-13, acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, emergency health care, and shelters (especially at critical facilities).
- Page 9-8, require new mobile home parks to have tornado/wind shelters.
- Page 9-10 and 9-13, improve critical road/stream crossings.
- Page 9-11, demolish and clear vacant condemned structures in populated areas to prevent rodent infestations.
- Page 9-11, seek support and funding to clean up sites of environmental contamination.

Saginaw County

- Page 4-15, 9-6, 9-21, 9-26, 9-43, 9-47, 9-51, 9-56, 9-61, 9-69, 9-74, 9-83, 9-87, 9-93, 9-101, 9-105, 9-109, 9-115, 9-122 and 9-137, NFIP related information.
  Page 5-1, 5-2 and 9-13, enhance early warning siren systems coverage.
- Page 9-5, 9-8, 9-9, 9-13, 9-14, 9-17 to 9-19, 9-21, 9-23, 9-26, 9-28, 9-31, 9-33, 9-35, 9-36, 9-39, 9-40, 9-43 to 9-45, 9-47, 9-49, 9-51, 9-53, 9-56, 9-58, 9-61 to 9-63, 9-65, 9-66, 9-69, 9-71, 9-72, 9-76, 9-78, 9-80, 9-81, 9-83 to 9-85, 9-87, 9-89, 9-90, 9-93, 9-95, 9-97, 9-98, 9-101, 9-103, 9-105, 9-107, 9-112, 9-114, 9-115, 9-117, 9-118, 9-121, 9-122, 9-124, 9-125, 9-128, 9-130, 9-131, 9-134 and 9-135, emergency generators for police and fire department, special needs facilities and community shelters.
- Page 9-6, 9-13, 9-17, 9-47, 9-51, 9-61, 9-69, 9-74, 9-87 and 9-101, removal of existing mobile home parks from floodplain.
- Page 9-43, implement levee improvements to mitigate the risk of flooding and flood losses.

Sanilac County

- Page 159, 166, 167, 169 – 171, 175 – 178, 189 and 191, provide community wide hazard warning systems.
- Page 159 and 179, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 167, 172 and 190, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping smalls, or other vulnerable areas.
- Page 175, constructing emergency access roads to dams.
- Page 175 and 177, dry/wet floodproofing of structures.
- Page 175 and 177, 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.
- Page 175 and 177, government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.

- Page 176 and 177, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 176, 179 and 180, installing storm drainage systems, including the separation of storm and sanitary sewage systems.
- Page 176, 179 and 180, generators for back-up power at critical facilities, water and wastewater treatment facilities, also in pumping and lift stations in sanitary sewage systems, and other measures.
- Page 180, demolition and clearance of vacant condemned structures to prevent rodent infestations.

Tuscola County

- Page 30, built 2 diversion pipes with back flow prevention structures at their outlets in the Cass River at Vassar, complete channel and culvert improvements along the Moore Drain to increase capacity, and to construct a low berm between the Moore Drain and Cass River drainage districts in the City of Vassar.
- Page 31, recent upgrades to sewer and water systems have occurred in the City of Caro, Village of Millington, and the Village of Akron. Denmark Township had also received USDA grants and loans to install a sanitary sewer system.
- Page 42, 115, 116, 121, 127, 128 and 140, improve, update and expand warning sirens systems.
- Page 54 – 56, 133, 143 and 148, NFIP related information.
- Page 58, in 2013 the City of Vassar removed the Vassar Dam.
- Page 58 and 116, potentially remove the Caro Dam.
- Page 63, there are abandoned coal mines located in Akron, Fair Grove and Juniata Townships.
- Page 118, replace culverts on public land that are undersized and create obstructions in water flow.
- Page 121 and 143, physical relocation, acquisition of land or structures, and development or modifications.
- Page 130, construct guardrails around drainage ditches that run alongside major roads.
- Page 130, eliminate drainage ditches that run next to roads.
- Page 130, relocate drainage ditches to a safe distance away from the roadway.
- Page 130, improve roadside shoulders to help prevent drainage ditch accidents.
- Page 130, make drainage ditches less deep so that accidents inside them will be more quickly noticed and attended to.
- Page 136, expand storm water drains in highly flood-prone areas like Western Caro.
- Page 136 and 144, expand sewer and drainage systems in areas most affected by floods.
- Page 145, purchase back-up generators.
- Page 147, construct a series of retention ponds and flow constrictors in the city of Caro.

University of Michigan – Flint (in Genesee County)

- Page 5-32, 5-49, 7-13, 7-24 and 7-38, construct a berm, physical barrier or levee to provide protection for the William S. White building located near the dam on the north side of the river.
- Page 7-11, install a near or on campus outdoor warning siren.
- Page 7-12, 7-23, and 7-38, identify emergency response resource enhancements at the university: generators, equipment spares, and temporary generator connections.
- Page 7-13 and 7-38, facilitate installation of USGS river gage near U of M Flint campus.
- Page 7-15, implement an off-site back up operations location for the primary ITS data center environment, and network access equipment.
- Page 7-15 and 7-39, provide fiber optic connection to Merit and the cloud.
- Page 7-38, repair, replace or improve the Hamilton Dam.

City of Vassar (in Tuscola County)

- Page 10, 20, 21 and 32, improvements need to be made to the Moore Drain that will reduce or eliminate flooding problems associated with the drain. Relocation is a possibility.
- Page 16, 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.
- Page 18, establish a post-flood temporary moratorium on repair or floodway and repetitive flood-loss buildings.
- Page 21, 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.
- Page 28 and 29, update early public notification warning sirens.
- Page 31, buildings need to be repaired and rehabilitated, as well as retrofitted to prevent further flood damage. Also, buildings could be reconstructed and elevated, or permanently relocated to another site, either paralleling the river along Main Street, up the hill (further west on Huron Street) or some location across the river.

District/Region 5

Allegan County

- Page V, 103, 112, 127, 137, 140, 144, 313, 316 and 321, maintain, strengthen, or otherwise modify damn structures for improved flood relief and conduct flood mitigation projects to protect vulnerable areas in the County's incorporated areas.
- Page VI, VI, 107, 115, 116, 118, 119, 124, 130 – 132, 134, 136, 145, 149, 150, 226, 229, 230, 233, and 236 – 238, 315 – 318 and 323, purchase, enhance and/or install county-wide advanced warning systems.
- Page VI and 146, elevate existing roads, or plan and construct new alternative roads, to reduce or eliminate flooding and washouts. Make roads more flood resistant through improved drainage and/or stabilization/ armoring of vulnerable shoulders and embankments.
- Page VII, 154 and 155, ensure adequate backup power generators for warming and cooling or other emergency housing/relief centers.
- Page 44, dams at the City of Plainwell, upstream of Otsego, were removed in 2007 and 2009, and feasibility studies for the removal of the Otsego City and Township dams have been completed. The Trowbridge Dam could be removed by 2020, if funding allows.
- Page 101, in the City of Allegan: rebuilt water plant and WWTP, raising them above the 500-year floodplain elevation, and incorporating fencing, signage and other monitoring devices.
- Page 102, in the City of Allegan: MDOT has spent millions of dollars to stabilize an embankment below M-222 at a bend in the Kalamazoo River, and homes that were once at that location have been abandoned and removed. Similar efforts are likely needed to protect local businesses at the next bend upstream.
- Page 103, evaluate state highways and private properties along the Kalamazoo River for needed repair and/or protection from river-related erosion and flood damage.
- Page 111 and 112, in the Village of Hopkins: previous efforts to reduce flooding have included improvement to the outlet of the Bear Swamp Drain to the Rabbit River Drain downstream of the Village of Hopkins, creation of an 80-acre wetland mitigation bank for flood storage, and removing structures from flood-prone areas.
- Page 120, in Ganges Township: identify localized drainage problems, and at-risk roads or other infrastructure for erosion from Lake Michigan and/or surface water runoff. Prioritize locations for repair, stabilization, or preventative action.
- Page 121 and 125, Laketown Township: seek funding to remove existing structures from floodplains or flood-prone areas.
- Page 121, Laketown Township: seek funding for an emergency electrical generator for the Township Hall and Fire Station.
- Page 131 and 236, in Salem Township: undertake structural projects to lessen the effects of hazard events.
- Page 141 and 315, construct flood walls to protect vulnerable areas in the incorporated areas of the county.
- Page 147, replace culverts to relieve flooding.

- Page 329, there was the design and implementation of improvements to the French Landing Dam. As part of this improvement, Van Buren Township contracted for engineering and construction services to construct a berm and flood control structure to reduce the potential risk of dam failure.

Barry County

- Page 22, the warning siren in Middleville is currently not working. However, they said it has been indicated there are no plans for repair.
- Page 57, construct additional Class A roads, where appropriate, to lessen truck traffic on major thoroughfares.
- Page 57, 68 – 70, NFIP related information.
- Page 58, develop a program which would construct alternative bridges to minimize isolation in the case of a wash out.
- Page 58 and 63, improve the warning system coverage.

Berrien County

- Page 27, 165, 170 and 171, update and improve the warning system coverage.
- Page 168, the Village of Berrien Springs built a new waste water treatment facility, went into operation in 2008. The new facility was relocated several hundred feet from the old facility.
- Page 168, two dams were removed from Watervliet in 2011.
- Page 168, Watervliet Township was able to purchase generators for all of their wells.
- Page 168, the Berrien County Drain Commission was able to complete the replacement of an undersized culvert, reducing flooding and lessening erosion in the Galen Township area. The location was on Buffalo Road, half a mile west of Hampton Road.
- Page 168, the St. Joseph Charter Township was able to purchase and install a generator at the Township Hall for public safety services.
- Page 177, install a generator for Benton Harbor Water Treatment Plant.
- Page 177, install a generator for County Road Commission headquarters.
- Page 177, install a generator for Eau Claire Village Hall for public safety services.
- Page 178, install a generator for Berrien Township public safety services.
- Page 178, install a generator for lift station #4 and one other portable generator.
- Page 179 and 180, replace undersized culverts to reduce flooding.
- Page 180, remove two aging dams on Paw Paw River.

Branch County (this plan was never completed)

- Page 26 (from document 3), provide resources such as back-up generators to facilitate business recovery and resumption following a disaster.

Calhoun County

- Page 176, floodplain/ NFIP related information.
- Page 180, 181, 185 and 245, warning system upgrades.
- Page 180, 181, 185 and 246, backup generators.
- Page 180, 181, 185 and 246, elevate structures.
- Page 180, 181, 185 and 247, FEMA Code 361 safe room projects.
- Page 180, 181, 185 and 250, relocate vulnerable structures.
- Page 180, 181, 185 and 250, storm water drainage system upgrade.
- Page 181 and 185, rainwater retention/detention project.
- Page 182, campus-wide building renovations.
- Page 182, roof rainwater runoff renovation.

Cass County

- Page 41 and 42, water and sewer infrastructure improvements over the next 20 years.
- Page 72, 82, 106, 107 and 111, enhance early public warning systems and networks.

- Page 73, 85, 87, 106, 107, 111 and 112, emergency generators and power supply for public service departments, special needs facilities and community shelters.

City of Kalamazoo

- Page 37, continue to utilize programs that provide funding to acquire and remove structures in flood-prone areas, especially repetitive loss properties.
- Page 38, encourage the development/redevelopment of flood-prone property into land uses that can enhance the quality of life of residents (e.g. recreation, open space, etc.) and increase the economic benefit to the community.
- Page 39, property protection on a building-by-building or parcel basis: relocation, acquisition, retrofitting, flood proofing, and insurance.
- Page 39 and 40, modify flooding through structural projects, designed by engineers and managed by DPS staff, to control flood waters: dams and reservoirs; levees and floodwalls; high flow diversions; detention measures; channel modifications; and storm sewer systems.

Kalamazoo County

- Page 92 and 219, NFIP information.
- Page 133, 135, 138, 193, 224, 227, 228 and 232, install public early warning systems and networks.
- Page 138, build a community center which would include a basement for taking cover.
- Page 181, 197, 211, 212, 217, 224, 228, 230 and 232, provide emergency power generators for key facilities.
- Page 185 and 202, improve design, routing, and traffic control at problem roadway areas.
- Page 185 and 202, improve designs at problem railway/roadway intersections.
- Page 212, in the Village of Augusta: reroute traffic, or provide additional routes/bridges to cross over the Kalamazoo River and nearby canal.
- Page 214, in Comstock Township: install storm shelters in the area of Sprinkle and Gull Roads at the trailer park, the large 3-story senior apartment building, subsidized housing complex, etc.
- Page 214, in Comstock Township: implement a roof adjustment or re-design project to prevent winter ice dam damage at the Central Fire Station.
- Page 214, in Comstock Township: widen I-94 in order to reduce the wind tunnel effect currently experienced by drivers (between expressway walls and large trucks). Also, improve and add lighting around key roadway curves and intersections. Roadway segments that might benefit from this lighting improvement, or from improvements in design, include (1) the Interstate's curve near exit 81, (2) I-94 exit 85, and (3) the 35th Street interchange.
- Page 217, City of Galesburg: support the expansion of I-94 with an added third lane to reduce accidents and alleviate risky congestion.
- Page 219, City of Kalamazoo: demolish/remove vacant structures that are deteriorated and may contribute to blight. Parcel by parcel and building by building property protection actions should be implemented.
- Page 219, City of Kalamazoo: modify flood impacts through structural projects to control flood waters. This may include dams and reservoirs, levees and floodwalls, high-flow diversions, detention measures, channel modifications and storm sewer system improvements.
- Page 219, City of Kalamazoo: consider ways to further channelize water flows upstream and down from the Morrow Dam in Comstock. Removing structures from the floodplain, allocation of permanent open space, and other activities of that kind may be helpful.
- Page 220, City of Kalamazoo: Investigate/support the expansion of I-94, or the locations and designation of alternative routes. Similar activities should be investigated for U.S. 131.
- Page 226, City of Portage: Fire Station #2 (on Oakland) could benefit from roof adjustments to reduce its vulnerability to ice dams, and possibly include structural bracing or other wind-resistance engineering techniques.
- Page 226, City of Portage: Westnedge Road mainly on its south end, and at the lumber company driveway, may benefit from some roadway enhancements or redesign efforts.

Pokagon Band of Potawatomi Indians (part of Allegan, Berrien, Cass, and Van Buren Counties)

- Page 30, the Pokagon Band does not have outdoor warning systems installed for the purpose of warning citizens of impending weather-related hazards.
- Page 68, 72 and 74, implement warning systems to adequately warn Tribal citizens in hazard areas.

- Page 72 and 79, build acceptable safe rooms for the community.
- Page 72 and 79, provide back-up power generation units / facilities for critical facilities.

Van Buren County

- Page 71 – 74 and 129, NFIP related info.
- Page 91 and 130, Lawrence has a poor drainage system that is inadequate during heavy rains. The biggest problem is on 68th Avenue and Territorial Road where the road is currently closed due to flooding problems.
- Page 117, 119, 121, 131 and 133, improve and/or install warning systems to adequately warn the public in high-risk areas.
- Page 119 and 126, install generators for essential critical facilities.
- Page 119, replace undersized or failed culverts and address the roads that flood.
- Page 124, construct storm shelters in mobile home parks where needed.
- Page 125, construct a shelter at the County Fairgrounds.
- Page 130, repair roads and alleviate flooding problems.
- Page 131, install storm-water relief drains in Hartford City to mitigate serious flooding of several houses in an older neighborhood.

District/Region 6

Bridgeton Township

- Page 91, use cost-effective approaches to protect existing sites, buildings and facilities from flood hazards.
- Page 93, 102, update warning systems.
- Page 93, 102, install back-up generators.
- Page 99, install septic tanks in flood plain locations.
- Page 100 – 101, raise or relocate buildings in areas that flood and/or acquire properties in flood areas for demolition and re-use of the land as open space.
- Page 100, dry flood-proofing, wet flood-proofing, incorporating sanitary sewer controls for flooding.

Clare County

- Page 109, 118, 128, 170, 178, 179 and 186, communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, backup power at critical facilities, emergency health care, and shelters.
- Page 110, 114, 122, 172 and 178, where feasible and cost effective (more densely populated areas) bury and protect power and utility lines.
- Page 118, 170 and 174, enclose the foundations of homes and buildings rather than leaving them open and the underside exposed to blown embers or materials.
- Page 119 and 178, replacement or renovation of aging structures and equipment.
- Page 119 and 179, separation and/or expansion of sewer system to handle anticipated storm water volumes.
- Page 126 and 184, deepening, widening, clearing of Tobacco Creek/ Drain through Downtown Clare.
- Page 127, 175 and 184, remove existing structures from flood hazard areas.
- Page 128, tower site improvements for Public Safety Communications.
- Page 131 and 188, purchase mobile generators for special needs population facilities and prepare the special needs population facilities for generator use.
- Page 132 and 190, replace older damaged culverts throughout the county as needed.
- Page 175, constructing emergency access roads to dams.
- Page 175, dry and wet flood proofing of structures.
- Page 176, backup generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 179, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 182, construction of concrete safe rooms in houses, trailer parks, community facilities, and business districts.
- Page 192, enhance the security system for the Clare County Courthouse.

- Page 193, purchase portable electronic message boards.

City of Ionia
- Page 60, construct bridge.
- Page 61, 69 and 71, acquire and maintain additional portable generators.
- Page 61, 68 and 71, install 320-foot tower.
- Page 61, 64, 68, 73 – 76, identify flood-prone structures and develop specific mitigation actions for individual structures (involving relocation or other actions).
- Page 63, 69 and 71, construct an additional bridge across the Grand River.
- Page 66, 70 and 72, redesign intersection at the bottom of the hill.
- Page 66, build a new jail.

Ionia County (this plan was not officially approved)
- Acquire and maintain additional portable generators (including providing back-up generators for water and wastewater treatment facilities).
- Install 320-foot tower.
- Identify flood-prone structures and develop specific mitigation actions for individual structures (involving relocation or other actions).
- Build a new jail.
- Construct dikes at the Ionia County Jail.

Isabella County
- Page 107, 120, 161 and 178, Encourage the construction of shelters/safe rooms at City and County Parks, and mobile home / manufactured housing communities.
- Page 112 and 170, Erosion control along the Chippewa River.
- Page 112 and 170, Install additional river gauges, markers and flow meter along the Chippewa River in a joint effort with the Saginaw Chippewa Indian Tribe.
- Page 113 and 171, Install additional LED street lighting in M2 district (City of Mt. Pleasant).
- Page 114 and 172, Install video surveillance cameras in M2 district (City of Mt. Pleasant).
- Page 114, 160, 163 and 172, Removal of blighted buildings and structures.
- Page 160 and 166, Protect critical equipment/information with the use of surge protectors on critical electronic equipment, the use of generators, on critical equipment, and using proper back-up procedures.
- Page 160, 165 and 166, Brownfield cleanup activities.
- Page 164, Back-up generators for pumping and lift stations in sanitary sewer systems and other measures to ensure that drainage infrastructure is not impeded.
- Page 166, Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 166, Demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 168, Construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts in the event of a nuclear attack.

Kent and Ottawa Counties (including Grand Rapids, Kentwood, and other local jurisdictions)
- Page 154, replace culvert at 104th Avenue.
- Page 154 and 155, survey needs and add sirens to the regions as needed.
- Page 157, add generators for City Hall and Public Safety Buildings.
- Page 158, purchase a four-wheel drive medical-rescue apparatus for fire department.
- Page 158, advanced snow removing equipment and shelters with generators.
- Page 159, upgrade the current radio console & repeater as it is 30 years old and parts are not available. Dedicated generator for the repeater & console that would activate when there is a power interruption.
- Page 160, maintaining and upgrading our 2-way radio communication system to optimize its capability if needed as primary communication system.
- Page 160, in process of using Dept. of Homeland Security funding for an inter-operable radio system.

- Page 160, communications tower is needed to assure coordination for public safety purposes at OCRC N. Holland garage.
- Page 160, large portable generators for buildings with quick disconnect to operate buildings if they are out of power. A very large diesel generator that will be able to operate our main power building.
- Page 161, standby generators for the fire department.
- Page 161, A portable 75 kw generator to provide backup power for OCRC Public Utilities operated sanitary sewer lift stations and water metering stations during power outages. 50 kw generators stations for OCRC Hudsonville and Coopersville garages are needed to assure timely emergency service for the public during power shortages.
- Page 162, portable generator for pumping station.
- Page 162, permanent stand-by power for sewer system.
- Page 163, standby generators for lift stations.
- Page 163, additional pump stations alarms and generators.
- Page 164, additional standby power, generators and portable pumps.
- Page 164, upgrade of the public health and hospital emergency communications systems.
- Page 164, a sewer system is needed at Crockery Lake.
- Page 165, purchase new four-wheel drive brush truck for fire department.
- Page 166, additional pump station at the river to assist with removal of water.
- Page 168, the extension of water lines to the US-31 highway right-of-way for large scale incident where Haz-mat and gas tanker accidents are possible.
- Page 174, add a generator to the fire station (Ada Township).
- Page 177 and 178, large portable generators for buildings with quick disconnect to operate buildings if they are out of power. A very large diesel generator that will be able to operate our main power building. Small portable lighting systems for areas on campus. A back-up lighting system for our stadium. On site generator for the police department in the event of a power failure. (Grand Valley State University).
- Page 177 and 179, sprinklers in all buildings on campus. Purchase of additional pumper to assist in fire suppression. (Grand Valley State University).
- Page 177 and 178, upgrade the current radio console & repeater as it is 30 years old and parts are not available. Dedicated generator for the repeater & console that would activate when there is a power interruption. Additional radios on campus frequently to be used by staff. (Grand Valley State University).
- Page 177, additional pump station at the river to assist with removal of water. Water could be transferred by additional water lines to the east side of campus to assist the fire department. (Grand Valley State University).
- Page 178, an additional siren needs to be installed on the South side of campus. (Grand Valley State University).
- Page 178, adding a generator for the Grand Valley State University (GVSU) Facilities Building on campus.
- Page 183, portable generator for pumping station (Bowne Township).
- Page 193 and 195, purchase a four-wheel drive medical-rescue apparatus for fire department. (Chester Township)
- Page 194 and 195, permanent stand-by power for sewer systems (Chester Township).
- Page 194 and 195, a sewer system is needed at Crockery Lake (Chester Township).
- Page 194 and 195, purchase a new four-wheel drive brush truck and a new tanker-pumper apparatus for the fire department (Chester Township).
- Page 203, shelters with generators (City of Ferrysburg).
- Page 203, additional pump stations alarms and generators (City of Ferrysburg).
- Page 211, add sirens to the region as needed (City of Grand Rapids).
- Page 217, provide enhancements to emergency shelters to include generators and access to supplies in case of brownouts or widespread power outages. (City of Holland)
- Page 217, implement NIXEL or other form of all hazard electronic notification system in addition to outdoor warning sirens. (City of Holland).
- Page 217 and 218, relocate the portion of the storm sewer that is currently located under buildings (Holland USA, commercial building on the north side of West 17th Street between Homestead and Diekema). Improve or replace crossing to improve drainage Crossing on Azalea at South Shore Drive Crossing on Azalea at South Shore Drive. Improve the Holland Heights Drain, from approximately East 12th and Cambridge and running westerly to US-31. Hope Avenue between East 8th and East 16th: Tie this portion of Hope Ave storm sewer into Paw Paw Relief

Drain. Add detention capacity in several locations from East 24th Street south to the M-40 Midway Drain, located between Myrtle and Old Orchard. (City of Holland).

- Page 218, install valves and piping on the beach near the low lift station at the water plant to utilize a 36" concrete drain line as an emergency intake. Install emergency generator to provide backup power to plant and pumps. Install two backup generators at two major water pumping station at approximately $75,000. Install a water supply interconnect with Wyoming Water Supply to provide emergency water supply to each entity. (City of Holland).
- Page 218, provide 15 backup generators at sewage lift stations. Extend and replace a force main from the west end (Old Orchard to Myrtle), to alleviate wet weather issues. Install second bypass pump at the head of the treatment plant to assist with water flows during wet weather events and as an emergency backup pump. (City of Holland).
- Page 220, standby generators for the fire department (Holland Township).
- Page 220, standby generators for the lift stations (Holland Township).
- Page 224, add sirens to regions as needed (Kent County).
- Page 225, maintaining and upgrading Kent County's 2-way radio communication system to optimize its capability if needed as primary communication system (Kent County).
- Page 226, in process of using Dept. of Homeland Security funding for an inter-operable radio system in Kent County (Kent County).
- Page 230, assure that warning and cooling centers have adequate backup power generators (City of Kentwood).
- Page 231, replace/enhance public warning systems (sirens, City Watch, cable TV) (City of Kentwood).
- Page 239, add sirens to regions as needed (Ottawa County).
- Page 240, communications tower is needed to assure coordination for public safety purposes at the OCRC North Holland garage (Ottawa County).
- Page 240, a portable 75 kw generator to provide backup power for OCRC Public Utilities operated sanitary sewer lift stations and water metering stations during power outages. 50 kw generators stations for OCRC Hudsonville and Coopersville garages are needed to assure timely emergency services for the public during power shortages. (Ottawa County).
- Page 241, sirens were added to county system according to what the survey had suggested. Sirens were upgraded to 2-way sirens. Project complete. (Ottawa County).
- Page 241, reverse 911 system ($100,000): Purchased City Watch; Project complete. 6 Short-range AM/FM Transmitter Systems @ $50,000; $300,000 – one AM transmitter was purchased and was deemed to be sufficient; project complete. (Ottawa County).
- Page 241, Coolidge Street west of 16th Avenue, Sec 26 Chester Township: Remove and replace dual 95x67 metal culverts with an adequately sized concrete box culvert. (Ottawa County).
- Page 242, Ottawa Beach Road at Anchorage Marina, Sec 27 Park Township: Install new culvert under Ottawa Beach Road and storm drain for the northwest quadrant of the new crossing. (Ottawa County).
- Page 242, Main Street from Arch to Jackson. Marne, MI located in Sec 35 Wright Township: Install storm drainage outlet to Dayton Drain or other acceptable storm water drainage system. (Ottawa County).
- Page 242, Leonard Road approx. 570' west of 68th Ave: Existing 10.3x6.2' steel beam type drainage structure to be replaced. Also, a storm sewer should be placed to the west along the north side of the road to ease the flooding problem at the intersection of Church Street. (Ottawa County).
- Page 242, 104th and Perry. Sec 23, 24, 25, 26. Holland Township: Remove and replace the drainage structures in Drain 4 and 43 located under Perry and 104th and rebuild as one structure with associated pedestrian path and intersection improvements. (Ottawa County).
- Page 242, 64th Avenue north of Adams Street. Drenthe, Sec 26/27 Zeeland Township: Remove and replace the dual 96" dimeter metal culverts located under 64th approximately ¼ mile north of Adams with a single concrete box culvert. (Ottawa County).
- Page 242, South Shore Drive 175' west of Park Street. Sec 34 Park Township: Remove and replace the drainage structure under South Shore Drive in the Kelly Lake Intercounty Drain. (Ottawa County)
- Page 242, Riley Street ¼ mile west of 152nd Avenue. Sec 11/14 Park Township: Remove and replace the drainage structure under Riley Street in the Number 37 County Drain. (Ottawa County).
- Page 242, State Street east of 130th Avenue. Sec 9/16 Crockery Township: Remove and replace the triple 81x59" metal culverts located under State Street with a single opening concrete box culvert. (Ottawa County).

- Page 243, a communications tower is needed to assure coordination for public safety purposes at the Ottawa County Road Commission's North Holland garage. A portable 75 kw generator to provide backup power for facilities operated by OCRC Public Utilities – sanitary sewer lift stations and water metering stations during power outages. 50 kw generator stations for the Ottawa County Road Commission's Hudsonville and Coopersville garages are needed to assure timely emergency services for the public during power shortages. Security fencing and lighting for the following OCRC Public Utility above groundwater installations: Olive-Blendon Water Tank at 96th Ave & Polk St; Metering Station at 96th Ave. and New Holland St; Crockery Township on 120th Avenue, north of M-104. (Ottawa County).
- Page 245, we are upgrading our fixed-base radio system to improve reliability of our primary communications system. (Plainfield Township).
- Page 251, blacktop and raise Buchann St. near and east of 112th Ave above the high-water level. Also, Johnson St. east of the 11500 block to 104th Ave and Pierce St. between 120th and 112th Ave. (Robinson Township).
- Page 251, install public water and sewage system along two river roads on Van Lopik and Limberlost Lanes. (Robinson Township).
- Page 258, advanced snow removing equipment and shelters with generators (Spring Lake Township).
- Page 258, sewer lift station bypass valves installed in various locations to prevent further damage from power outages and other events. (Spring Lake Township).
- Page 259, additional pump stations alarms and generators (Spring Lake Township).
- Page 259, the extension of water lines to the US-31 highway right-of-way for large scale incident where Haz-mat and gas tanker accidents are possible. (Spring Lake Township).
- Page 259, sewer lift station bypass valves installed at various locations to prevent further damage from power outages or other events. (Spring Lake Township).
- Page 260, shelters with generators, sea walls. (Spring Lake Township).
- Page 270, add generators for City Hall and Public Safety Buildings (City of Zeeland).
- Page 270, replace culvert at 104th Avenue (City of Zeeland).
- Page 270, provide an emergency generator to power the building in the event of power loss so the city administration can function and occupy the building whenever necessary, 21 South Elm Street. Install an emergency power generator as a secondary power source when a power failure occurs, 227-103rd Avenue. Install natural gas generator at the police/fire/EOC building for EOC operation, 29 West Main Avenue. Install an emergency power generator as a secondary power source when a power failure occurs to provide standby power at lift stations with a generator, 295 Royal Park Drive. Install an emergency power generator as a secondary power source when a power failure occurs to provide standby power at lift stations, 644 Rich Avenue. Install an emergency power generator as a secondary power source when a power failure occurs, 115 Carlton Avenue. Portable generator for Street Maintenance Facility, 600 East Roosevelt. (City of Zeeland).
- Page 271, Install cameras, door and gate alarms and connect this all to the 24/7 city dispatch center. Zeeland BPW needs security at the water tanks and substations and generating facilities to reduce the possibility of water contamination and power outages by unknown forces. (City of Zeeland).
- Page 273 and 274, additional standby power, generators and portable pumps (Zeeland Township).

City of Kentwood

- Page 75, 87, 90, 92 and Appendix D, assure that warning and cooling centers have adequate backup power/generators.
- Page 77, dry flood-proof structures within known flood areas and wet flood-proof structures.
- Page 77, locate pipelines away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible.
- Page 77, demolish and clear vacant/condemned structures to prevent rodent infestations.
- Page 78, require construction of concrete safe rooms for new construction of single and multi-family homes and shelter areas in mobile home parks, fairgrounds, shopping malls, etc.
- Page 78, evaluate existing pipes for "brittleness" and replace as necessary and prudent.
- Page 80, 86, 87, 89, 90 and Appendix D, acquire, relocate, or condemn structures within floodplain or floodway areas.
- Page 80, participate in structural projects to channel water away from people and property.

- Page 80, maintain/obtain backup generators for pumping and lift stations and treatment plants, including possible separation of combined storm/sanitary sewer systems, if appropriate.
- Page 81, properly locate, design, and maintain water and sewer systems.
- Page 81, use generators for backup power at critical facilities.
- Page 81, replace or renovate aging structures and equipment.
- Page 82, provide backup generators for water and waste water treatment facilities to maintain acceptable operating levels during power failures.
- Page 82, undertake brownfield and urban blight clean-up activities.
- Page 82, fill or buttress subterranean open spaces (such as abandoned mines) to discourage their collapse
- Page 86, 89 and Appendix D, construct or elevate existing roads or plan 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.
- Page 88, 90 and Appendix D, reduction of blight.
- Page 90 and Appendix D, create a communication infrastructure relying on radio waves instead of cellular.
- Page 93, relocate, elevate or purchase structures in floodplain and other flood-prone areas.

Lake County

- Page 125, Raise or relocate buildings above the 100-year flood level, and/or acquire properties in flood areas for demolition and re-use of the land as open space.
- Page 125, Identify structural projects to channel water away from people and property (e.g. berms, dikes, levees, or floodways), or to improve drainage capabilities (e.g. culvert improvements, bridge modifications, spillways, relief drains, or floodgates).
- Page 127, 134 and 140, Install back-up generators, as needed for short term relief from power failures, at critical facilities such as sewage pump stations, road commissions, medical centers, nursing home facilities, schools, and shelters.
- Page 128, construct concrete storm / tornado safe rooms in homes, public buildings, major industrial sites, shopping malls, and other large complexes; and shelter areas in parks, campgrounds, fairgrounds, mobile home parks, and other vulnerable public areas.

Mason County

- Page 138, Raise or relocate buildings above the 100-year flood level, and/or acquire properties in flood areas for demolition and re-use of the land as open space.
- Page 138, Identify structural projects to channel water away from people and property (e.g. berms, dikes, levees, or floodways), or to improve drainage capabilities (e.g. culvert improvements, bridge modifications, spillways, relief drains, or floodgates).
- Page 141, 148 and 155, Install back-up generators, as needed for short term relief from power failures, at critical facilities such as sewage pump stations, road commissions, hospitals and medical centers, nursing home facilities, schools, shelters, correctional facilities and governmental facilities.
- Page 142, construct concrete storm / tornado safe rooms in homes, public buildings, major industrial sites, shopping malls, and other large complexes; and shelter areas in parks, campgrounds, fairgrounds, mobile home parks, and other vulnerable public areas.

Mecosta County (this plan was not officially approved)

- Identify (inventory) shelters with generators – must be free standing and self-supporting.
- Review generator plans with communities.
- Encourage/require the placement of emergency shelters in large mobile home parks.

Montcalm County (this plan was not officially approved)

- Communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, emergency healthcare, and shelters.
- Work to identify and remove old and abandoned underground storage tanks.

Muskegon County

- Page 146, Raise or relocate buildings above the 100-year flood level, and/or acquire properties in flood and high-risk erosion areas for demolition and re-use of the land as open space.
- Page 149, 155 and 162, Install back-up generators, as needed for short-term relief from power failures, at critical facilities such as sewage pump stations, hospitals and medical centers, nursing home facilities, schools, shelters and government facilities.
- Page 150, Construct concrete storm / tornado safe rooms in homes, public buildings, major industrial sites, shopping malls, and other large complexes; and shelter areas in parks, campgrounds, fairgrounds, mobile home parks, and other vulnerable public areas.

Newaygo County

- Page 316, 326 and 329, Install back-up generators, as needed for short-term relief from power failures, at critical facilities such as sewage pump stations, municipal wells, municipal buildings, road commissions, hospitals and medical centers, nursing home facilities, schools, and shelters.
- Page 317, 326 and 330, Construct and/or designate storm shelters/tornado shelters in parks, campgrounds, mobile home parks, and developments that do not have shelters. Consider retrofitting existing or constructing public buildings, industrial sites, and other large businesses or complexes to include shelters.
- Page 318, Raise or relocate buildings above the 100-year flood level, and/or acquire properties in flood and high-risk erosion areas for demolition and re-use of the land as open space.
- Page 318 and 330, Identify structural projects to channel water away from people and property (e.g. berms, dikes, levees, or floodwalls), or to improve drainage capabilities (e.g. culvert improvements, bridge modifications, spillways, relief drains, or floodgates).

Norton Mounds (in Kent County)

- Page 37, remove 4 active oil wells.
- Page 52 and 53, construct a trail and platform.
- Page 55 – 57, reconstruct the mounds.

Oceana County

- Page 140, Identify structural projects to channel water away from people and property (e.g. berms, dikes, levees, or floodwalls), or to improve drainage capabilities (e.g. culvert improvements, bridge modifications, spillways, relief drains, or floodgates).
- Page 143, 149 and 156, Install back-up generators, as needed for short-term relief from power failures, at critical facilities such as sewage pump stations, municipal wells, municipal buildings, road commissions, hospitals and medical centers, nursing home facilities, schools, shelters and government facilities.
- Page 144, Construct concrete storm / tornado safe rooms in homes, public buildings, major industrial sites, shopping malls, and other large complexes; and shelter areas in parks, campgrounds, fairgrounds, mobile home parks, and other vulnerable public areas.

Osceola County

- Page 2-18, Purchase and installation of generators at some critical facilities.
- Page 2-61, Improved design, routing, and traffic control at problem roadway areas.
- Page 2-61, Providing more connector roads for reduced congestion of arterial roads.
- Page 2-82 and 3-13, Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
- Page 2-82 and 3-13, Structural projects to channel water away from people and property or to increase drainage or absorption capabilities.

- Page 2-82 and 3-13, Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewer systems.
- Page 2-82 and 3-14, Increasing functioning and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance).
- Page 2-82 and 3-14, 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.
- Page 2-93 and 3-15, Develop structure for storage of water for use in drought events (especially for human needs during extreme temperatures).
- Page 2-97, Demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 3-23, Middle Branch Twp-3, and Rose Lake Twp-3, Add sirens to parks and campgrounds as needed.
- Page 3-24, City of Evart-3, Hersey Twp-3, Marion Tmp-4, Reed City-3 and Sylvan Twp-3, Purchase property vulnerable to flooding as funds become available.

Plainfield Township (in Kent County)

- Page 51, dry/wet flood proofing of structures.
- Page 51, 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.
- Page 51, government acquisition or relocation of structures within floodplain or floodway areas.
- Page 52, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 52, installing (or re-routing or increasing the capacity of) storm drainage systems.
- Page 53, back-up generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 53, eliminate the jog at Millcreek Street Railroad Crossing, where overflows always happen.
- Page 53, improve conveyance in York Creek, or provide alternative relief.
- Page 53, construct Grand River spillway diversion with storage.
- Page 53, discuss possible modification to the 6th Street Dam with EGLE and City of Grand Rapids.
- Page 57, constructing emergency access roads to dams.
- Page 57, pump and flood gate installation/automation.
- Page 65, purchase and install a river level gauge for the Jupiter Bridge.
- Page 65, obtain an emergency watercraft for the township for search and recovery operations.
- Page 65, purchase generator for Water Treatment Plant
- Page 65, raise roads that are currently in the Grand River floodplain.
- Page 68, purchase flood warning signage for frequently flooded streets.
- Page 70, pursue the possibility of adding a gate at the 6th Street Dam to lower flood hazard levels.

Robinson Township (in Ottawa County)

- Page 49 and 56, purchase several repetitive flood loss properties in the area.
- Page 57 and 123, dry/wet flood proofing of structures.
- Page 57 and 123, 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.
- Page 58, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 58, installing (or re-routing or increasing the capacity of) storm drainage systems.
- Page 58, back-up generators for pumping and lift stations in sanitary sewer systems, and other measures to ensure that drainage infrastructure is not impeded.
- Page 66 and 74, construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.
- Page 84, use of generators for backup power at critical facilities.

- Page 84, replacement or renovation of aging structures and equipment (to be made hazard-resistant as economically possible).
- Page 84 and 123, road paving and upgrades, possibly including road elevation and improvements in roadside culverts/drainage systems/infrastructure.
- Page 103, providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Page 103, demolition and clearance of vacant condemned structures to prevent rodent infestations.
- Page 103 and 114, brownfield and urban blight clean-up activities.
- Page 114, public warning systems and networks for hazardous materials releases.
- Page 159, constructing emergency access roads to dams.
- Page 171, construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
- Page 175, filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.
- Page 177, "harden" critical infrastructure systems to meet seismic design standards for "lifelines".
- Page 180, acquire and remove structures along Van Lopik and Limberlost Roads to protect lives and avoid repetitive property damages and other costs.
- Page 182, convert cleared spaces along Van Lopik and Limberlost Roads into open spaces and water retention areas (including the removal of existing roadways) to enhance water holding capacity of the Grand River area and thus mitigate flooding potential and severity elsewhere along the river.
- Page 184, expand warning siren coverage within the township, in accordance with the township's existing siren plan, by installing three new sirens at specifically selected locations.

District/Region 7

Alpena County

- Page 5-2, extension of the sewer and water infrastructure for future expansion of the system into Alpena Township.
- Page 5-3, potentially construct a multi-jurisdictional sewer system.
- Page 5-13, make upgrades to the County Courthouse.
- Page 5-14, construct a new County Jail.
- Page 5-14, replace the roof at the Family Independence Agency (FIA).
- Page 8-1 and 9-5, provide and/or expand community wide hazard warning systems.
- Page 8-1, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 9-4, provide back-up generators to maintain community infrastructure at acceptable operating levels during extended power failures.
- Page 9-6, recommend that a study be done to determine whether removal of the old bridge waste to improve flow at George Washington Bridge on US-23 is advisable.
- Page 9-8, recommend study to determine if repair of George Washington Bridge is needed in order to improve flow of Thunder Bay River.

Antrim County

- Page 22, the Village of Bellaire has flaws or shortcomings in existing sewer infrastructure; undersized or poorly designed storm water control practices; collective effects of land use and development trends; illegal diversion of water, or actions that interfere with system function.
- Page 23, Mancelona and Bellaire sirens are not working because there is no funding available for maintenance.
- Page 26, create storm shelters and safe rooms where necessary in the Village of Bellaire area.
- Page 33, work on a multi-hazard warning plan.
- Page 46, the following are considered by Antrim County as examples of past mitigation projects: replace culvert with a bridge, install storm-water relief drains, upgrade a road culvert, acquire floodway properties, create a retention basin, construct a new dike, upgrade bridge over a creek, install a sea wall, re-route various county drains, construct new drains for flood relief, expand storm sewer network for a subdivision, remove an abandoned

dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and/or facilities, construct a mobile home park storm shelter, upgrade warning sirens, install warning sirens, relocate sewer mains, etc.

Benzie County

- Page 11, repair roadways susceptible to structural damage.
- Page 11, 26 and 32, promote the relocation of structures.
- Page 11 and 33, create shelters for campgrounds areas.
- Page 11, work on a multi-hazard warning plan.
- Page 17, NFIP information.
- Page 24, there are currently no emergency warning systems in operation in Benzie County.
- Page 26, repair roadways susceptible to erosion.
- Page 45, the following are considered by Benzie County as examples of past mitigation projects: replace culvert with a bridge, install storm-water relief drains, upgrade a road culvert, acquire floodway properties, create a retention basin, construct a new dike, upgrade bridge over a creek, install a sea wall, re-route various county drains, construct new drains for flood relief, expand storm sewer network for a subdivision, remove an abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and/or facilities, construct a mobile home park storm shelter, upgrade warning sirens, install warning sirens, relocate sewer mains, etc.

Charlevoix, Cheboygan & Emmet County Regional Plan

- Page 17 – 19 and 122, dam management grant program to remove and/or maintain dams.
- Page 38, 39, 68 – 70, 77, 79, 101, 104, 106 – 109, 115, and 117 – 121, create a better and consistent weather event warning system(s).
- Page 39, re-engineer culverts for flood mitigation.
- Page 71, increase stream and storm sewers' carrying capacity as suggested in the Little Black River Flood Management Study.
- Page 72 and 73, rehabilitate and reconstruct the inlet of the Wildwood Lake Dam.
- Page 82, government acquisition, relocation, or condemnation of structures within the floodplain.
- Page 95, need power substations (Wolverine Power).
- Page 95, 104 and 118, need more fire stations where needed to reduce the response times.
- Page 104 and 118, develop connector roads to reduce fire response time.
- Page 104, 107 and 118, construct prearranged shelters.
- Page 106 and 118, construct fire towers.
- Page 106 and 107, add a National Oceanic and Atmospheric Administration weather station for the area.
- Page 118 and 121, retrofitting existing publicly owned facilities with generators.
- Page 121, raise and rebuild the garage for road equipment on Beaver Island.
- Page 122, examine and improve existing storm shelters to ensure storm water drains properly. US 31 near M119 and in the Bayview area Storm Sewers are inadequate causing repetitive flooding.
- Page 122, install storm sewers in Cross Village at the commercial district and at the Catholic church.
- Page 122, repair foundations on cabins in the girl's camp that were damaged by years of flooding.
- Page 122, repair flooding that occurs on Campbell Road in Beauregard.
- Page 123, improve and/or install water supply systems where possible for both structure fires and wildfires.

Crawford County

- Page 5-15, there are no siren warning systems functioning in the City of Grayling. However, there is currently on file with the State of Michigan a request for grant money to erect 10 warning sirens around the county.
- Page 8-1 and 9-3, provide community wide hazard warning systems.
- Page 8-2, aggressively inspect, maintain and upgrade all critical infrastructure and facilities.
- Page 8-2, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 9-3 and 9-8, maintain an adequate level of emergency power generators for emergency needs.
- Page 9-10, demolish and clear vacant condemned structures in populated areas to prevent rodent infestations.

Grand Traverse Band of Ottawa and Chippewa Indians (part of Antrim, Benzie, Charlevoix, Grand Traverse, and Leelanau Counties)

- Page 35, purchase emergency generators for police and fire departments, special-needs, facilities, and community shelters, or other facilities.
- Page 35, installing lightning protection devices and methods, such as lightning rods and grounding, on communications infrastructure and other critical facilities.
- Page 36, retrofitting or constructing the emergency operations center to FEMA 361 standards.
- Page 40, implementing damage reduction measures for existing buildings such as acquisition, relocation, retrofitting, and maintenance of drainage ways and retention basins.
- Page 40, increasing drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection.
- Page 40, requiring developers to construct on-site retention basins for excessive storm water and as a firefighting water source.
- Page 40, elevating roads and bridges above the base flood elevation to maintain dry access.
- Page 40, raising low-lying bridges
- Page 48, establish emergency shelters with generators

Grand Traverse County

- Page 10, 29 and 34, removal of unsafe dams on the Boardman River (2).
- Page 10, 29 and 35, establish new generators where needed.
- Page 18, NFIP information.
- Page 25, 29 and 34, inadequate drainage infrastructure under South Airport road near the commercial/retail development Logan's Landing are causing frequent flooding of the road and nearby property, especially during heavy rain events and the spring snow melt season.
- Page 26, there is an inactive flood warning system located on River Road.
- Page 27, develop public warning systems.
- Page 47, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

Kalkaska County

- Page 36, 37, 39, 46 and 67, Rugg Dam is considered a potentially "high hazard" dam due to the height of the head and the size of the impoundment. Should failure occur, damages will be greater from flash flood types of events than they would from gradual floodplain inundation. In addition to "regular" flooding in a riverine floodplain, other flooding may involve low-lying areas that collect runoff waters; flaws or shortcomings in existing sewer infrastructure; undersized or poorly designed storm water control practices; collective effects of land use and development trends; illegal diversion of water, or actions that interfere with system function.
- Page 37 and 47, the range for the counties warning siren coverage extends throughout the entire Village of Kalkaska. All other areas in the county are not served by warning sirens. Need to work on a multi-hazard warning plan.
- Page 59, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

Leelanau County

- Page 24, the Michigan Hazard Analysis of 2012 identifies the Leland and Meeuwenber Dams as a "high hazard"; and the Cedar Lake Dam as a "significant hazard".
- Page 34, establish riparian buffers along the waterway.
- Page 52, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

Manistee County

- Page 10, 25 and 30, acquisition of flood areas.
- Page 21, 22 and 25, dam failures at Tippy and Hodenpyl that would cause bridge damage are a concern.
- Page 43, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

Missaukee County

- Page 10 and 29, propose to build additional shelters if needed.
- Page 22, the warning siren system in Lake City is currently obsolete and therefore, not available.
- Page 24, develop public warning systems.
- Page 41, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

Montmorency County

- Page 5-2 and 5-3, there are no siren warning systems functioning in either the Village of Hillman or Lewiston population centers.
- Page 5-6, there is no hospital in Montmorency County.
- Page 5-7, The Village of Hillman recently extended both the water and sewer lines out to serve the new high school/middle school complex located west of the Village on M-32. In the near future, the Village plans to upgrade some of the older lift stations and dredge the lagoon.
- Page 5-7, Briley Township does not operate a public sewage or waste water disposal system.
- Page 5-7, numerous septic systems in downtown Atlanta have experienced failures in the past.
- Page 5-8, there are currently significant areas in Montmorency County that have no telephone coverage.
- Page 6-23, improve road stream crossing on the streams and rivers in Montmorency County; improvements have included culvert extension and relocation, and bridge construction.
- Page 8-1, Chapter 9 page 1-1, Chapter page 1-9 and Chapter 1-10, install community wide hazard warning systems.
- Page 8-2, aggressively inspect, maintain and upgrade all critical infrastructure and facilities.
- Page 8-2, repair or replace critical infrastructure and facilities that are damaged or degraded.

- Chapter 9 page 1-2, provide back-up generators to maintain community infrastructure at acceptable operating levels during extended power failures.

Otsego County

- Page 8-1, 9-4 and 9-5, provide community wide hazard early warning systems.
- Page 8-2, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 9-3, 9-4, 9-16 and 9-19, communities will acquire and maintain an adequate level of emergency power generators.
- Page 9-16, demolish and clear vacant condemned structures in populated areas to prevent rodent infestations.
- Page 9-18, continue brownfield cleanup activities.

Presque Isle County

- Page 5-5, there is currently only one siren activated in the county, located at the Fire Hall in the Village of Posen. Although there is a siren in Onaway, it is located at the old police station that is no longer manned. Rogers City does not have a warning siren. There has been some discussion of installing a more complete warning system through the years, but nothing has been materialized. The National Weather Service's NOAA Weather Radio alert system and the National Emergency Alert System also serve the county warning system. Signal coverage from the transmitter located in Alpena County covers much of the county with a few areas in the western reaches not served at this time.
- Page 5-15, the Rogers City County Airport has improvement projects going on.
- Page 8-1 and 9-5, provide community wide hazard public early warning systems.
- Page 8-1, repair or replace critical infrastructures and facilities that are damaged or degraded.
- Page 9-5 and 9-7, communities will acquire and maintain an adequate level of emergency power generators.
- Page 9-10, construct safe areas and storm shelters at campgrounds, fairgrounds, parks and outdoor recreational facilities.
- Page 9-10, require new mobile home parks to construct tornado/wind shelters.
- Page 9-11, continue brownfield cleanup activities.
- Page 9-12, demolish and clear vacant condemned structures to prevent rodent infestations.

Roscommon County

- Page 28, Roscommon County has no active warning sirens.
- Page 79, 100, 103, 111, 112, 146, 151, 153, 154 and 160, acquire and maintain an adequate number of emergency power generators for back-up power at critical facilities.
- Page 79, 100, 103, 146 and 153, replace or renovate aging structures or equipment.
- Page 88, 96, 98, 99, 103, 108, 147 and 150, develop community wide public hazard warning systems and networks.
- Page 88, 112, 145, 147, 156 and 160, construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
- Page 96 and 108, repair or replace critical infrastructure and facilities that are damaged or degraded.
- Page 103 and 154, separation and/or expansion of sewer systems to handle anticipated storm water volumes.
- Page 109, 110 and 158, upgrade the current system (free NIXLE) to a higher-grade system that allows notification to targeted populations and areas.
- Page 110 and 158, add warning sirens when needed to fill gaps in Roscommon County's current warning system.
- Page 145, 150 and 151, dry/wet floodproofing of structures within known flood areas.
- Page 146, 151 and 152, structural projects to channel water away from people and property or to increase drainage or absorption capacities.
- Page 146 and 151, installing storm drainage systems, including the separation of storm and sanitary sewage systems.
- Page 150, garnering community support for removal or repair of dams in disrepair.
- Page 152 and 154, brownfield and urban blight cleanup activities.
- Page 154, demolition and clearance of vacant condemned structures to prevent rodent infestations.

- Page 161, dam repairs in accordance with the dam Emergency Action Plans and the local Emergency Operations Plan.

Wexford County

- Page 10, 26, 27 and 31, establish additional sirens for early public warning weather systems.
- Page 27 and 32, drainage improvements such as larger culverts.
- Page 43, examples of past mitigation projects: replace culvert with bridge, install storm water relief drain, upgrade road culvert, create retention basin, construct new dike, upgrade bridge over a creek, install sea wall, install rip rap to protect roadway, re-route various county drains, construct new drains for flood relief, expand storm sewer network for subdivision, excavate floodway channel bypass, remove abandoned dam, construct emergency floodway, construct storm shelters in public buildings, construct storm shelters for homes and facilities, construct mobile home park storm shelter, upgrade and/or install warning sirens, relocate sewer mains, elevated and build casing for generator for EOC, etc.

District/Region 8

Alger County

- Chapter 1: Page 5, in Au Train Township, the Au Train River flooding caused by sand shoaling from NW winds and ice dams. Could work with MDOT – USACOE, EGLE and the County Road Commission for maintenance dredging and/or emergency dredging.
- Chapter 1: Page 5, in Au Train Township, Forest Lake Dam needs warning system and hazard sign.
- Chapter 1: Page 5, in Au Train Township, could repair the Orange Bridge on Woodland Ave. for an alternate route.
- Chapter 1: Page 5, in Au Train Township, there are issues with curves on the Forest Lake Au Train Rd. by the Au Train Lake; could install safety rails.
- Chapter 1: Page 5, in Mathias Township, could install a snow fence at the M-67 and Hwy 41 intersection.
- Chapter 1: Page 5, in Mathias Township, could purchase a generator to mitigate the power loss problem.
- Chapter 4: Page 1, 2 and 6; Chapter 5: Page 5 and 6, maintain and improve/expand emergency warning systems in communities across the county.
- Chapter 4: Page 1, 2, and 4 – 6; Chapter 5: Page 2, 4, 6 and 7, provide adequate generators for shelters, medical facilities, school facilities, municipal fuel pumping facilities, designated gas stations, water/wastewater treatment facilities, the county airport, and the county jail.
- Chapter 4: Page 2 and 6; Chapter 5: Page 5, restore or reconstruct the break wall at the Grand Marais harbor.

Baraga County

- Page 25 and 84, Baraga County has two sirens in the County located in Covington and L'Anse. The sirens are currently used for fire dispatch but not for community warning. The community warning system(s) needs to be improved.
- Page 81 and 94, Baraga County continues to have stream erosion problems along the Sturgeon River. The county should continue to address bank stabilization problem areas along the Sturgeon River.
- Page 86, 91 and 92, primary structural projects in Baraga County have focused on improvements to the current drainage system. The Baraga County Road Commission has identified and upgraded inadequate culverts and problem roadways, and it continues to do so.
- Page 91 and 96, retrofit underground pipes.
- Page 92, install emergency power generator at L'Anse Area School.
- Page 92, in Beaufort Lake (Spurr River), Spurr Township, replace existing culvert with low-profile Con-Span structure on a concrete pile cap, with a spill-through opening.
- Page 93, in Second Sand Beach Road (Sucker Creek), L' Anse Township, replace existing culvert with a Con-Span structure on a concrete pile cap, with a spill-through opening.
- Page 93, in Sturgeon Road, Covington Township, reconstruct and raise road and add cross-culvert capacity for storm drainage.

- Page 93, Tahtinen Road/ Strugeon River Bank Stabilization, Baraga Township, 700 feet of bank stabilization and road reconstruction.
- Page 93, in East River Drive and others, Village of L'Anse, increase culvert capacity.

Chippewa County

- Page 66, 104 and 116, add public early warning systems and networks.
- Page 70, clean up areas of abandoned or collapsed structures.
- Page 83 and 119, replace or renovate aging infrastructure, buildings or equipment.
- Page 88, bridge concern area #1: Prairie Road Bridge in Rudyard Township.
- Page 89, bridge concern area #2: The Mackinac Trail Bridge, in Rudyard Township on the pine river.
- Page 89, bridge concern area #3: in Superior Township, on Bound Road, south of Highway M-28 a bridge structure over the West Branch of the Waishkey River is vulnerable to bank erosion.
- Page 89, bridge concern area #4: in Bruce Township, an undersized structure on the South Branch of the Charlotte River along W. 12 Mile Road causes water flow issues, making it a high area of concern for the road commission.
- Page 90, bridge concern area #5, in Dafter Township, on 10 Mile Road, west of Dafter, there is an undersized culvert with a steep ravine along a small branch of the Waishkey River with water flow issues.
- Page 90, bridge concern area #6, in Dafter Township, on Maple Road, just north of 10 Mile, there is an undersized culvert that has flow issues.
- Page 90, bridge concern area #7, in Trout Lake Township, a bridge span on Huckleberry Road over the Carp River which is an outlet of the Lakes of Carp, Frenchman and Wegwaas is too small and has critical failures.
- Page 91, bridge concern area #8, identified areas where there are undersized culverts include 18 Mile Road over School Creek on the border of Bruce and Pickford Township.
- Page 91, bridge concern area #9, in Pickford Township on E. 20 Mile Road over Desormeaux Creek.
- Page 91, bridge concern area #10, in Bruce Township on 12 Mile Road over the Charlotte River.
- Page 92 and 119, constructing barriers such as levees, replacing the identified smaller culverts causing flooding issues with bigger structures, and reinforcement of the bridge with timber understructure with steel beams and a large bridge structure where it has been identified as being too small for the flow of water.
- Page 104, construction of safe houses around campgrounds or trailer courts would give people a place of shelter in case of an emergency.
- Page 106, brownfield cleanup activities on identified sites.
- Page 119, create a storm water detention basin.
- Page 120, construct storm shelter "safe rooms" for critical facilities.
- Page 124, 3 Mile road, erosion/ditching project to prevent road collapse.
- Page 125, Alford Park, sinkhole.
- Page 125, Carbide Dock, sinkhole.
- Page 125, modify bridge structure support, Pine River / Mackinac Trail.
- Page 125, drainage improvements, Main Street Rudyard.
- Page 125, replace/ upsize culvert, East 9th Avenue.
- Page 125, replace/ upsize culvert, East 10th Avenue.
- Page 125, Eureka/Peck, water drainage improvements and reconstruction.
- Page 125, West 4th Ave: drainage issues, culvert replacement, and ditching improvements.
- Page 126, East Spruce Street, damaged sewer system replacement.
- Page 126, Sims Street, improve drainage for flooding issues.
- Page 126, storm water retention basin / waste water system, Kinross Township street flooding.
- Page 126, upsize culvert, erosion protection: Waishkey River / Bound Road.
- Page 126, upsize culvert, Charlotte River / West 12 Mile Road.
- Page 127, Sherman Park – Shoreline erosion protection.
- Page 127, I-500 – erosion / earth stabilization.
- Page 127, 3047 West 10 Mile Road / Chums Creek branch of Waishkey River; Culvert is too small for driveway and it floods every year.
- Page 127, East Easterday Ave, sewer line.

- Page 128, upsize culvert, Waishkey River / 10 Mile Road.
- Page 128, upsize culvert, Waishkey River / Maple Road.
- Page 128, upsize culvert, Carp River outlet / Huckleberry Road.
- Page 129, upsize culvert, School Creek / 18 Mile.
- Page 129, upsize culvert, Desormeaux Creek / East 20 Mile.
- Page 170, Bay Mills Township: safe house construction at campgrounds.
- Page 171, 197 and 200, Bruce Township: land acquisition of flood plain area for a retention basin, larger bridge / culvert on 12 Mile Road.
- Page 174 and 197, Dafter Township: 10 Mile Road – replace existing culvert with a larger culver for improved water flow, Maple Road – replace existing culvert with a larger culvert for improved water flow.
- Page 178, Drummond Island Township: retrofit critical facilities.
- Page 180 and 196, Kinross Charter Township: replace damaged storm sewers as needed to relieve flooding issues.
- Page 197, Pickford Township: upsize culvert – School Creek / 18 Mile Road, upsize culvert – Desormeaux Creek / East 20 Mile Road.
- Page 182, Raber Township: safehouse at the boat launch.
- Page 184, 196 and 197, Rudyard Township: Main Street drainage improvements, bridge / culvert replacement – Pine River / Prairie Road, bridge structure support – Pine River / Mackinac Trail.
- Page 186 and 200, Sault Ste. Marie, City: culvert upgrades, E. Easterday Ave sewer line, replace / upsize culvert – East 9th Ave, replace / upsize culvert – East 10th Ave, Alford Park – sinkhole, Carbide Dock – sinkhole, Eureka / Peck – water drainage improvements / reconstruction, 3 Mile Road – erosion / ditching to prevent road collapse, West 4th Ave – drainage issues / culvert replacement, East Spruce Street – damaged sewer system replacement, and I-500 – erosion / earth stabilization.
- Page 189, Sugar Island Township: culvert replacement.
- Page 197, Superior Township: upsize culvert, erosion protection – Waishkey River / Bound Road.
- Page 191 and 197, Trout Lake Township: culvert replacement at Carp River / Lake outlet / Huckleberry Road.
- Page 193, Whitefish Township: culvert replacement, retrofit critical facilities.

Delta County

- Chapter 1: Page 6 and 7, Chapter 4: Page 2, 4, 9 and 10, Chapter 5: Page 3 – 5, install/ improve/ expand emergency warning systems.
- Chapter 1: Page 7, and Chapter 4: Page 1, in Escanaba Township there is a concern with the railroad-switching yard in Gladstone that is located along a major highway and near population. A suggested mitigation strategy is relocating the Gladstone Rail switching yard to a more rural site.
- Chapter 1: Page 7, in Maple Ridge Township there is a concern with poor visibility at the intersection of M-35 and Maple Ridge 37th Road.
- Chapter 4: Page 1, NOAA weather radio coverage is absent in a large section of northeastern Delta County.
- Chapter 4: Page 2, 3, 7, 10 and 11, Chapter 5: Page 7, 9 and 10, provide adequate back up emergency generators.
- Chapter 4: Page 3 and 9, Chapter 5: Page 5, construct connector roads to reduce congestion of arterial roads.
- Chapter 4: Page 6 and 11, Chapter 5: Page 10, construct 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.
- Appendix A: Page 8, Bay de Noc Township has no fire department.
- Appendix A: Page 32, in Masonville Township funding has been secured to construct a wastewater collection system in the community of Rapid River.

Dickinson County (summarized from its draft plan, prior to official completion)

- Page 34, there are warning sirens located in Iron Mountain and the City of Norway but neither siren covers their cities.
- Page 54, 155, 159 and 162, maintain and improve/expand local emergency warning systems.
- Page 98, 156, 160 and 162, the City of Kingsford has a repetitive loss property that has ideas for mitigating the property.
- Page 98 and 156, there is inactive mine site flooding in the City of Iron Mountain and Norway.

- Page 155, 159, 160 and 162, provide adequate emergency generators.
- Page 155, 160 and 163, construct storm shelters in public buildings and areas where vulnerable populations are located.
- Page 156, 160 and 162, filling or buttressing abandoned miles to discourage their collapse.

Gogebic County

- Page 39, 47, 87, 89, 98, 107 and 110, the City of Wakefield has had flooding problems exacerbated by a non-functioning floodgate at Sunday Lake.
- Page 47, the City of Ironwood has been separating its storm and sanitary systems since 2011, with most of the work already completed.
- Page 47, Lac Vieux Desert has installed drainage systems to draw water away from its Tribal operations buildings in Watersmeet.
- Page 86, in the City of Ironwood urban flooding occurs along U.S. 41 / M-28 as a consequence of heavy rains, though this susceptibility has been reduced by recent storm sewer reconstruction.
- Page 104 and 117, improve public notification and emergency response capabilities.
- Page 107 and 113, improve the drainage system in Gogebic County through structural projects.
- Page 107 and 113, the Gogebic County Road Commission continues to update inadequate culverts and problem roadways.
- Page 111, repair the Presque Isle Wildlife Dam.
- Page 116, retrofit underground pipes.

Houghton County

- Page 39, 40, 97 and 101, the Redridge Dam was labeled a "significant hazard" and may need to be removed.
- Page 42, 43, 101 and 104, a number of areas in Houghton County are susceptible to riverine and urban flooding. To deal with these risks, storm sewer upgrades, ditch maintenance and culvert replacement are ongoing activities.
- Page 64, a Superfund site contaminated by stamp sands, a copper mining waster product, is located in Torch Lake Township.
- Page 64, a former power plant site in Torch Lake Township, south of the Village of Lake Linden, is being remediated by the EPA due to the presence of a variety of chemicals.
- Page 64 and 112, the Pedersen/Lahti landfill in Portage Charter Township is a historic contamination site in need of remediation and/or closure.
- Page 67, install generators.
- Page 72, dilapidated buildings in need of mitigation are abundant in many jurisdictions in Houghton County.
- Page 94 and 101, improve public warning systems.
- Page 97 and 105, the Houghton County Road Commission continues to identify and upgrade inadequate culverts and problem roadways as needed. The communities of Houghton, Hancock, Lake Linden, Hubbell, Ripley, Dollar Bay and Painesdale regularly experience high runoff related to steep topography and should continue upgrades that assist in management of these conditions.
- Page 101 and 104, Sturgeon River Road bank stabilization project.
- Page 102 and 103, the Portage Lake Lift Bridge project.
- Page 106, complete mine shaft and stope safety projects.
- Page 107, retrofit underground pipes.
- Page 108, complete bridge approaches for emergency (temporary) bridge project.
- Page 109, complete portable water treatment system project.
- Page 110, construct community storm shelter(s).

Iron County

- Page 36 and 83, river banks north of the Paint River Dam in the City of Crystal Falls and Crystal Falls Township, segments of the Iron River in the cities of Iron River and Caspian, and other areas with inadequate culverts, have been overburdened, causing occasional flooding and washouts. To deal with these risks, upgrading of storm sewers in Caspian and culvert replacement throughout the county are ongoing activities.

- Page 44, Michigan Mine #2 is critical in east Iron County: A shaft underlies the Park City Road east of Amasa, and a stope is located nearby south of the road.
- Page 44, Warner Mine is critical in east Iron County: Underground workings intersect the Warner Mine Road at a point between the Gibson Mine location and Old Highway US-141 about one mile southeast of Amasa.
- Page 44, Tobin-Columbia Mine is critical in east Iron County: A section underlies Tobin Road at one point about one half mile southwest of Crystal Falls and nearly underlies it at another.
- Page 44, Dunn-Richards Mine is critical in east Iron County: Stopes underlie the Tobin-Alpha Road at two locations about one mile southwest of Crystal Falls.
- Page 44, Chicagon Mine is critical in east Iron County: Workings underlie a section of the Chicagon Mine Road west of Krans Road, about 8 miles west of Crystal Falls south of US-2.
- Page 44, Davidson #1 Mine is critical in the Iron River District: Surface subsidence cracks affect Mineral Avenue.
- Page 44, Cardiff-Homer Mines are critical in the Iron River District: Deep stopes underlie 16th Street (9th level).
- Page 44, Homer-Wausea Mine is critical in the Iron River District: Stopes are located at 35 to 150 feet distance from 16th street at the depth of (10th and 12th levels).
- Page 44, Beta-Nanaimo Mine is critical in the Iron River District: A 53-foot vertical opening 18 feet wide at a depth of 310 to 350 feet is located beneath Highway US-2 west of Iron River.
- Page 44, Delta Mine is critical in the Iron River District: A stope of 40 feet in maximum vertical dimension lies 224 feet below US-2 west of the Iron River and just east of the intersection with River Avenue and Genesee Street. Also, the west margin of a 325-foot-deep stope lies 40 feet east of the railway south of US-2.
- Page 45, Chatham Mine is critical in the Iron River District: Stopes underlie the Selden Road at least 270 feet upward from the 1,00-foot level. Also, the railway passes over a 60-foot-wide by 500-foot-long stope at a depth of about 325 feet.
- Page 45, Riverton Mine is critical in the Iron River District: Stopes from the 4th and 6th level of this early mine underlie the railway west of Stambaugh in the Iron River Valley.
- Page 45, Bengal Mine is critical in the Iron River District: The north edge of the subsidence pit from this top slicing mine very nearly extends to Ninth Street. At depth, some of the stopes lie within 15 feet of the center line of Ninth Street.
- Page 45, Baker Mine is critical in the Iron River District: The uppermost workings are within 170 feet of the surface and within 80 feet of the bedrock. A county road overlies these workings.
- Page 45, Hiawatha Mine (Stegmiller Lease) is critical in the Iron River District: A stope underlies Selden Road at a depth of about 300 feet. The stope has a vertical height of approximately 150 feet. Workings also underlie the railway.
- Page 45, Dober-Isabella Mines are critical in the Iron River District: Working from both mines underlie 19th Street. The Isabella workings are shallower, with stope tops at 195 feet and 600 feet below the surface.
- Page 80 and 81, improve community emergency warning systems.
- Page 83, primary structural projects in Iron County have focused on improvements to the current drainage system.
- Page 87, 92 and 93, retrofit underground pipes.
- Page 87 and 88, acquisition of blighted buildings/properties. The city of Crystal Falls is considering two properties for demolition and/or remediation: they are 317 Superior Avenue and 11 Super Avenue.

Keweenaw County

- Page 36, 37 and 83, upgrade storm sewers and culverts within the county.
- Page 74, 87 and 88, erosion stabilization projects should be considered to address persistent problems along the Gay-Lac-La Belle Road and other affected locations. Stabilization is anticipated to cost $140,000 per location compared with $250,000 per location if the roadway must be moved.
- Page 81, 87 and 90, improve public notification with community warning systems.
- Page 83, 89 and 90, primary structural projects in Keweenaw County have focused on improvements to the current drainage system.
- Page 87 – 89, Eliza Lake/Dam/Creek flood mitigation project.

Luce County

- Page 49, construct contour bunds, trenches and stone walls.
- Page 49, construct check dams and other gully-plugging structures.
- Page 49, construct percolation ponds.
- Page 57, construct barriers such as levees.
- Page 75, 78, 101, 106, 108, 154 and 159, install public early warning systems and networks.
- Page 78, construct safe houses around campgrounds or trailer courts.
- Page 89, replace or renovate aging infrastructure.
- Page 99, 105 and 155, improve damaged infrastructure in the Village of Newberry.
- Page 99, 106 and 154, equip county emergency operations shelters and/or identified critical facilities with an emergency generator(s).
- Page 100, a significant historical site, the Crisp Point Lighthouse, is on the verge of collapse due to shoreline erosion.
- Page 101, the Tahquamenon Logging Museum is located near the Tahquamenon River. Should flooding continue to occur that affects the museum, priceless historical artifacts/buildings could be damaged or destroyed.
- Page 105, relocate Muskallonge Park Headquarters Building out of the critical shoreline area.
- Page 106, install weather station at Muskallonge Lake Campground.
- Page 106 and 156, construct a building for protective shelter.
- Page 147, construct a safe house at the State Park in McMillan Township.
- Page 149, replace culverts in the Village of Newberry.
- Page 149, in the Village of Newberry, identify areas in road infrastructure to improve storm drainage/spring flooding issues – ditching or paving wider shoulders.
- Page 151, upgrade culverts in Sault Tribe of Chippewa Indians.
- Page 156, in the Muskallonge Lake State Park there is a significant erosion problem along an approximate one-half mile section of the park's shoreline in an area where the park headquarters and operations area are located. The erosion of the bluff now threatens the buildings and structures and has forced the closure of a one-half mile section of the North Country Trail. New Park headquarters facilities and operations area should be constructed at a new location south of County Road 407. All buildings and structures at the existing headquarters and operations site should be abandoned and demolished and the site restored to a natural state.

Mackinac County

- Page 56, construct contour bunds, trenches and stone walls.
- Page 56, construct check dams and other gully-plugging structures.
- Page 56, construct percolation ponds.
- Page 60, 112 and 152, replace older relatively shallow water distribution and sewer pipes below the anticipated frost line to prevent line freezing.
- Page 65, construct barriers such as levees.
- Page 82, 85, 98, 104, 106, 114 and 153, install public early warning systems and networks.
- Page 85, construct safe houses around campgrounds or trailer courts.
- Page 95, replace or renovate aging infrastructure.
- Page 106, water/sewer pipe replaced and buried deeper project.
- Page 107, construct larger storm water detention basins.
- Page 107, acquire flood-prone NFIP properties.
- Page 107, purchase generators for shelters/construct housing for generator in the City of St. Ignace.
- Page 113 and 152, provide drainage improvements and road stabilization for Epoufette Hill in Hendricks Township.
- Page 138, in Garfield Township, purchase generator for Township Hall.
- Page 140, in Hudson Township, purchase generator for Fire Hall.
- Page 143, in Moran Township, pursue additional communication towers for cell phone and internet service.
- Page 145, in Portage Township, construct an additional road crossing/bridge over Manistique River.
- Page 149, upgrade culverts in Sault Tribe of Chippewa Indians.

Marquette County

- Page 43, create a public notification system for weather events.
- Page 66, in Champion Township, there is a need for a dry hydrant on Wolf Lake Road, Section 21 at the stream crossing.
- Page 67, in Chocolay Township, dredge the mouth of the Chocolay River and protect the nearby lift station.
- Page 68, in the City of Ishpeming, dredge the Carp River.
- Page 68, in the City of Ishpeming, replace old/failing water supply and delivery infrastructure with sustainable new infrastructure designed to withstand cold weather events, minimize leakage, and provide potable drinking water.
- Page 68, in the City of Ishpeming; dredge Lake Bancroft, Lake Bacon, and other local lakes to ease flooding and sedimentation problems.
- Page 68, in the City of Ishpeming, there needs to be a solution for there being too much storm water in sanitary sewers (inflow and infiltration) in Eighth Addition and the Cleveland location.
- Page 69, in the City of Marquette, protect Hawley Street lift station from flooding, especially from storm surges off Lake Superior.
- Page 69, in the City of Marquette, provide shoreline restoration and road relocation- Lakeshore BLVD.
- Page 70, in the City of Negaunee, replace old/failing water supply and delivery infrastructure with sustainable new infrastructure designed to withstand cold weather events, minimize leakage, and provide potable drinking water.
- Page 71, in Ely Township, a larger culvert on a bridge is needed on Co Rd CP.
- Page 72, in Ewing Township, drainage solutions are needed on N end of Airport Road and County Road DH.
- Page 73, in Forsyth Township, raise the bridge over the East Branch Escanaba River on Southgate Drive.
- Page 73, in Forsyth Township, protect the township transfer station on Depot road from flooding.
- Page 74, in Humboldt Township, raise Wolf Lake Road in its crossing of the Escanaba River floodplain.
- Page 74, in Humboldt Township, propane powered generators are needed.
- Page 75, in Ishpeming Township, improve culverts on Cooper Lake Road.
- Page 76, in Marquette Township, establish a permanent water source for firefighting in the northern part of the township, somewhere along County Road 550. Fire officials thought that the Lindberg gravel pit south of Sugar Loaf would be a possibility.
- Page 77, in Michigamme Township, additional pump stations are needed on the levees and break walls at the wastewater plant. The estimated cost is $15,000 per unit.
- Page 77, in Michigamme Township, more break walls are needed along the Lake Michigamme shore to protect adjacent properties.
- Page 77, in Michigamme Township, wastewater system improvements are needed.
- Page 78, in Negaunee Township, raise the Carp River Bridge on Heritage Drive.
- Page 78, in Negaunee Township, culvert or drainage solution(s) are needed where Carp River crosses M-35.
- Page 78, in Negaunee Township, flood proofing or movement of structures in the flood zone along Dead River Storage Basin and near the Dead River Storage Basin are needed.
- Page 79, in Powell Township, insure stability of Lake Independence Dam on the Iron River.
- Page 80, in Republic Township, Hawk Road – raise road from hollow, passed dam, back to the intersection of 601.
- Page 80, in Republic Township, raise the level of River Road, so that it is less likely to be flooded by the Michigamme River.
- Page 81, in Richmond Township, make road improvements – heavy mine truck impact.
- Page 82, in Skandia Township, purchase a generator for the pump house located near the intersection of US-41 and M-94 E.
- Page 82, in Skandia Township, purchase a generator for the Skandia – West Branch Township Evacuation Center.
- Page 83, in Tilden Township, improve the bridge over Ely Creek on County Road PCC.
- Page 83, in Tilden Township, dry hydrants needed in Charlie Lakes area.
- Page 83, in Tilden Township, dredge Ely Creek alongside County Road 476, National Mine.
- Page 84, in Turin Township, improve culverts along County Road RM.

- Page 85, in Wells Township, improve drainage along County Road 557 in Section 19 and improve the crossing of County Road 426 over Erie Creek, near Arnold. These two roads are the critical links between Wells Township and the rest of the region.
- Page 86, in West Branch Township, purchase a generator for the Skandia – West Branch Township Evacuation Center.
- Page 86, in West Branch Township, improve ditching and build up the roadbed of Engman Lake Road.
- Page 92, there are no storm drains on the western part of the Forsyth Township community. There are a number of old catch basins that detain water but are not connected to a true drain system.
- Page 93, remove the Carp Intake Dam #158 in Sands Township.
- Page 94, the City of Ishpeming has infrastructure projects.
- Page 94, there are various culvert replacement projects throughout the county.

Menominee County

- Chapter 1: Page 5, in the Village of Carney, there are concerns about poor road design, railroad tracks, and building locations at the intersection of guard and G-18. A possible solution is to add curbing and removing buildings.
- Chapter 1: Page 5, in the Village of Carney, there is concern about poor visibility at the intersection of Railroad St. and G-18.
- Chapter 1: Page 5, in the Village of Carney, there is concern about poor visibility at the intersection of G-18 and US-41.
- Chapter 1: Page 5, in the Village of Carney, there is concern about poor visibility at intersection of G-18 and US-41 due to the utility poles and road signs. The poles and signs could be moved.
- Chapter 1: Page 5, in the Village of Carney, there is concern about poor visibility at intersection of CR 374 and US-41.
- Chapter 1: Page 5 and 6, in the Village of Carney, there is a concern about a blind exit at the intersection of CR 374 and Lindstrom Lane. There is also a concern with the area at the intersection of US-41 and Superior Cedar Plant exits where loaded trucks pull onto the highway.
- Chapter 1: Page 6, in Gourley Township, there is concern about road washouts. A solution could be better ditching, culverts and road construction.
- Chapter 1: Page 7, in Mellen Township, install sirens on power poles.
- Chapter 1: Page 7, in Meyer Township, there is a concern about a blind exit at CR388 @ fire # W6502.
- Chapter 1: Page 7, in Meyer Township, there is a need for a tornado early warning system.
- Chapter 1: Page 7, in Meyer Township, there is a concern about the condition of side roads.
- Chapter 1: Page 7, in Spalding Township, there is a concern about drainage and flooding on Ash St., Maple St., and US-2. A possible solution is to install larger culverts and enhance ditch maintenance.
- Chapter 1: Page 8, in the City of Stephenson, the local severe warning system should be enhanced.
- Chapter 1: Page 8, in Stephenson Township, there is a concern about poor road conditions.
- Chapter 2: Page 13, construct a new water system upgrade to the Hannahville system.
- Chapter 4: Page 1, 8 and 9; Chapter 5: Page 5 and 10, maintain, install and improve/expand emergency notification warning systems in communities within the County.
- Chapter 4: Page 2 and 8; Chapter 5: Page 8, provide generators for use at municipal fuel pumping facilities and designated gas stations throughout the county.
- Chapter 4: Page 2, 8 and 9; Chapter 5: Page 8 and 10, provide emergency generators for use at medical, school facilities, sewage lift stations, airport, governmental buildings which serve as shelters, and at 911 communication facilities.
- Chapter 4: Page 4 and 8; Chapter 5: Page 9, construct elevated or alternative roads that are unaffected by flooding, or make roads more flood-resistant through better drainage and/or stabilization/ armoring of vulnerable shoulders and embankments.
- Chapter 4: Page 5 and 8; Chapter 5: Page 8, provide back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
- Chapter 5: Page 11, identify and construct escape and entry routes in areas with high wildfire risk.

Michigan Technological University

- Page 62, 64, 139 and 174, there is a cracked storm sewer in Houghton County that starts near the Rosza Center and runs parallel to U.S. Hwy-41.
- Page 140, 175 – 177, 182, 183 and 189, upgrade warning systems.
- Page 140 and 176, install storm sewer outtakes in problem parking lots.
- Page 140 and 177, implement an off-site datacenter as a primary datacenter, using existing center a secondary location.
- Page 140, 177 and 182, replace current halon gas fire suppression system in 11 labs with human friendly system.

Ontonagon County

- Page 36, 83, 90 and 91, upgrades of storm sewers, problem roadways, drainages, bridges and culvert replacements is an ongoing activity in the county.
- Page 74, 88 and 94, key facilities such as the Village Office, Department of Public Works, and Fire Hall can consider relocating to higher ground outside of the floodplain.
- Page 81 and 91, improve public notification such as community warning systems.
- Page 92, construct a new South Branch Bridge at M-28.
- Page 94 and 95, purchase back up power for emergency facilities/ designated shelters using generators.

Schoolcraft County

- Chapter 1: Page 6, in Germfask Township, on M-98 at way out of Germfask the road and bridge are in need of replacement.
- Chapter 1: Page 6, in Germfask Township, the bridge on County Road H44 needs upgrading.
- Chapter 1: Page 6; Chapter 3: Page 32; Chapter 4: Page 5, in the City of Manistique, the city needs warning sirens and systems.
- Chapter 1: Page 6, in the City of Manistique, need to develop a local bypass around the US-2 overpass and railroad at Tannery Road.
- Chapter 4: Page 1, 2, 7 and 9; Chapter 5: Page 3 and 6, maintain, install and improve/expand emergency warning systems in communities within Schoolcraft County.
- Chapter 4: Page 1, 2, 5, 7 and 9; Chapter 5: Page 4, 7 and 10, provide adequate generators.
- Chapter 4: Page 4 and 8; Chapter 5: Page 8, construct 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.

City of Wakefield (in Gogebic County)

- Page 12, the City of Wakefield has no early weather warning systems.
- Page 23, 24, 26 and 27, repair/replace the floodgate in the Northeast corner of Sunday Lake to help minimize the threat of future flooding in the City of Wakefield.
- Page 23, and 25 – 27, remove the natural beaver dams in the Little Black River.
- Page 25 and 27, remove the gas storage tanks of the commercial gas stations within the floodplain.

Appendix 14: Hazard Mitigation Strategies for Declared Disasters

Note: In order to keep the size of this publication manageable, the Michigan Hazard Mitigation Plan no longer includes the text of all historical Hazard Mitigation Strategy (HMS) documents from past disasters. Only select mitigation strategies have been retained, in most cases using the original formatting from those FEMA documents. Newer HMS documents have been summarized.

Select disaster strategies included in the previous edition of this plan:

Federal Disaster #774: 1986 Central Michigan Flooding
Federal Disaster #1028: 1994 Northern Michigan Deep Freeze
Federal Disaster #1128: 1996 East Michigan Tornado and Flooding
Federal Disaster #1181: 1997 Southeast Michigan Tornadoes and Flooding
Federal Disaster #1226: 1998 West Michigan Windstorm
Federal Disaster #1237: 1998 Detroit Area Windstorm
Federal Disaster #1346: 2000 Detroit Area Urban Flooding
Federal Disaster #1413: 2002 Central and Western Upper Peninsula Flooding
Federal Disaster #1527: 2004 Southern Michigan Severe Storms and Flooding
Federal Disaster #1777: 2008 Severe Storms and Flooding
Federal Disaster #4121: 2013 Central and Southern Michigan Flooding

Select disaster strategies occurring since the previous edition of MHMP:

Federal Disaster #4195: 2014 Detroit Metropolitan Flooding
Federal Disaster #4326: 2017 Mid-Michigan Floods
Federal Disaster #4381: 2018 Western Upper Peninsula Floods
Federal Disaster #4547: 2020 Flooding and Dam Failures in Five Counties

These agency designations are used in the following summaries of the post-disaster strategies:

ASCS	Agricultural Stabilization and Conservation Service
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FmHA	Farmers Home Administration
IHMT	Interagency Hazard Mitigation Team
MACDC	Michigan Association of County Drain Commissioners
MDA	Michigan Department of Agriculture
MDNR	Michigan Department of Natural Resources
MDOCm	Michigan Department of Commerce
MDPH	Michigan Depart of Public Health
MDOT	Michigan Department of Transportation
MSP/EMHSD	Michigan State Police / Emergency Management and Homeland Security Division
NWS	National Weather Service
NRCS	Natural Resources Conservation Service
SBA	Small Business Administration
SCS	Soil Conservation Service
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

Hazard Mitigation Strategy for Federal Disaster #774: 1986 Central Michigan Flooding

Within the Saginaw River Basin there has been considerable activity pertaining to proposed flood control projects and floodplain management activities. Flood control projects have been active since 1954. The remaining river basins within the disaster area are more rural and activity has been limited to floodplain management activities at the state and local level.

Flood protection projects were recommended to be constructed at Frankenmuth, Vassar, Flint, Corunna, Owosso, Midland and Shiawassee Flats. The Flood Control Project for the City of Frankenmuth was constructed, and significantly reduced the flood damage within the city. A December 1982 Flood Control Project for the City of Vassar was approved but unfunded. The project consisted of the construction of flood walls and levees, bridge improvements, drainage structures, and the diversion of Moore Drain. The U.S. Army Corps of Engineers indicates that the project would have contained the 1986 flood. Using current interest rates, the project would not be economically justified.

In April 1975, the Corps of Engineers prepared a Flood Control Project Design Memorandum for the City of Midland. The project involved a dike and flood wall, construction and enlargement of the Tittabawassee River. The city rejected the structural approach, in favor of a nonstructural project. The January 1977 Flood Control Project Design Memorandum at Midland provided for permanent evacuation, floodplain regulation and recreational development. This particular project was not implemented; however, the city is purchasing flood prone parcels as they become available.

The November 1982 Flood Control Project at the Shiawassee Flats proposed construction of new levees, drainage and control structures, channel improvement, relocation of buildings, and raising bridges. Local support was not available for the project.

The July 1975 Rogue River Watershed Plan was prepared by the U.S. Department of Agriculture, Soil Conservation Service for the upper portion of the Rogue River in Kent County. The plan involved channel modification, water level control structures, and sediment traps.

The 1960 Misteguay Creek watershed project designed by the U.S. Department of Agriculture, Soil Conservation Service consisted of 3 flood water retarding structures, 43.4 miles of channel work, and 5.7 miles of levees. As a result of the 1985 and 1986 floods, the Soil Conservation Service has begun to repair and redesign portions of the project.

A major area of nonstructural flood hazard mitigation is the system of local and state regulations that govern building and rebuilding in the floodplain. Both the local and state provisions serve as continuing flood hazard mitigation tools.

Local regulations dealing with floodplain development—the communities involved in this disaster declaration have various levels of floodplain management regulations. They vary from none to more stringent than state or federal regulations. Local enforcement of more stringent ordinances than required can result in more restrictive floodplain land use and increased flood loss mitigation.

Individually, the state or local controls are not as comprehensive as desirable for proper floodplain management; however, when used together, the controls are fairly effective. The local unit of government has authority to enact and enforce comprehensive floodplain management by going beyond the state and National Flood Insurance Program minimum regulations. To do this, local officials must have floodplain management firmly in mind when developing land use plans.

The city of Midland has purchased and removed homes within the floodplain/floodway of the Tittabawassee River. The purchase is done solely on a voluntary basis, as money becomes available.

During the 1986 flood, the City of Zilwaukee used a volunteer sandbagging effort to reduce the flood damages from the Saginaw River.

Existing mitigation measures are reducing flood damages. This is evident in Frankenmuth in which the construction of a Corps of Engineers Flood Control Project prevented flood damage during the 1986 flood.

State wide measures: relocation and acquisition, warnings/emergency plans, dam safety/operations, floodplain management, agriculture, infrastructure, state flood hazard mitigation planning, legislative needs.

Provide local units of government with technical expertise and encouragement to develop a relocation/acquisition plan for damaged buildings that lie within the floodway of the Muskegon River in Newaygo County. Acquired lands should be dedicated

to public open space with restrictive covenants prohibiting future development. Lead Agency: *FEMA, SBA, MDNR, MSP/EMHSD, MDOCm, and Newaygo County and affected townships (Brooks, Garfield, Bridgeton and Ashland).*

Provide technical expertise and encouragement to the City of Vassar officials to define available options for handling the severely flood damaged buildings in the city. The Flood Insurance Study for the City should be revised to reflect current 100-year flood discharge estimates, and to better define the 100-year flood elevation. Structural flood protection projects as well as nonstructural measures, including acquisition, relocation, and floodproofing, should be considered. Lead Agency: *FEMA, SBA, City of Vassar, MSP/EMHSD, MDNR, MDOCm, and USACE.*

Provide technical expertise and encouragement to flood stricken communities to help define available mitigation projects that could be funded with Community Development Block Grant funds.

Projects include relocation of existing structures, clearing of the floodway, relocation of sanitary sewage facilities, protective diking and elevation of buildings above the 100-year flood level. Lead Agency: *MDOCm, MSP/EMHSD, and MDNR.*

Develop a realistic Federal, State, and/or local program to relocate or flood proof flood damaged structures.

The impetus to remove flood prone structures from the floodplain has to come from the local level. The state and federal government can provide technical support and funding but the decision to clear flood prone structures if primarily local. The city of Midland has an ongoing acquisition program for property in flood prone areas; the city of Owosso just completed removing 40 structures from the floodplain as part of a redevelopment project; in 1986, the state had a loan subsidy program from relocation or floodproofing along Lake Michigan, Huron, St. Clair, Erie and Superior; and in 1986, the state also implemented a shoreline protection program which made grants of up to $30,000 available to Great Lakes jurisdictions for shoreline protection or hazard mitigation measures.

Block Grant funds available to communities for flood hazard mitigation purposes to aid in recovery from the September 1986 flood. The block grant is based upon urgent need and its limited to one million dollars per community.

The state needs to continue looking at financial incentives to move or elevate structures in hazard areas in pre-flood disaster format. A version of the low interest loan program offered by the state in 1986 should be considered on a statewide basis and as a permanent program. Lead Agency: *MDOCm, MSP/EMHSD, MDNR, City of Midland and City of Owosso.*

Develop and test river basin warning/communication networks, as monies become available.

Improve the flood gage level system which will require: a network of rainfall measuring devices; additional river stage gages to be placed upstream of vulnerable communities; a network of volunteers to read the rain gages and river gages and report the results to a central location; and a central collection point to provide the NWS River Forecast Center with data. Lead Agency: *NWS, USGS, MSP/EMHSD, MDNR, county emergency coordinators, local law enforcement agencies, dam owners, volunteers, and radio/television stations.*

Review and update local Emergency Operations Plans (EOP). Lead Agency: *MSP/EMHSD, MDNR and FEMA.*

Adopt State legislation that effectively addresses dam safety issues, including periodic inspections, maintenance standards, emergency action plans, and impoundment regulations. Lead Agency: *MSP/EMHSD, MDNR, FEMA, and the Governor's office.*

Expand emergency action plans for dams to include notification and warning procedures for the occasional unusual increase in flow release. Lead Agency: *MSP/EMHSD, MDNR, Public Service Commission, appropriate power companies, FERC, FEMA, NWS, USGS, USACE, and local governments.*

Increase public awareness of the NFIP.

A program should be developed to review and monitor Federally regulated lenders to ensure that flood insurance is purchased and maintained for structures within identified flood prone properties. Lead Agency: *MSP/EMHSD, MDNR, FEMA, and the banking industry.*

Map areas susceptible to flooding and include the best available elevation data on existing floodplain maps. Lead Agency: *MSP/EMHSD, MDNR, FEMA, SCS, USAGE, and USGS.*

The State of Michigan should sponsor an annual "Flood Awareness Week." Lead Agency: *MSP/EMHSD, and NWS.*

Increase awareness of hazard provisions in building code standards, ordinances, and procedures with local elected officials, building code officials, and flood plain residents.

Awareness of the NFIP minimum requirements and building code requirements need to be strenghthened. Suggestions put forth toward improving enforcement: evaluate resource requirements for NFIP enforcement; expand local building inspector training awarness programs; develop procedures and definitions to clarify the enforcement of substantial improvement requirements; and propose legislation to require identification of flood prone parcels on title abstracts (public disclosure). *Lead Agency: MSP/EMHSD, FEMA, NWS, MDNR, Michigan Department of Labor-Construction Code Division, and Code Officials Association.*

The State of Michigan should establish design, construction, and maintenance guidelines for dikes and levees protecting agricultural land. *Lead Agency: MDNR, MDA, USACE, and SCS.*

Review the programs avialable for providing floodproofing technical assistance in non-project areas for farmsteads located in the 100-year flood plain (e.g., ring dikes and elevavted structures.)

The MDNR has been working with the Flint River Dike Committee to develop a dike design that will provide protection to crops, while maintaining the flow carrying capacity of the river. A dike configuration has been developed; however, funding has not been obtained for construction. *Lead Agency: MDNR, USDA, FEMA, MDA, ASCS, FmHA and SCS.*

Review existing programs to revise or redirect ongoing assistance efforts to adequately provide disaster coverage to the farm community and to incorporate mitigation measures. *Lead Agency: USDA, extension services, Farm Bureau, National Milk Producers Association, and National Farm Organization.*

Create a multi-disciplinary task force to evaluate flood damage to and caused by the failure of sewage handling systems.

Throughout the disaster area, flooding caused damage to sewage handling systems, which in turn, caused additional damages. This task force should review existing guidelines and revise/develop new ones, as necessary. These should address, at a minimum, the following functional areas: auxiliary power for lift stations and treatment facilities; site locations and related floodproofing requirements; adequacy/necessity of storage/holding basins and related design criteria; minimizing infiltration and/or inflow, including separation of storm water and sanitary systems, prohibiting footing and roof drains emptying into sanitary systems, and identifying building code changes where appropriate; criteria for determining optimum level of floodproofing/protection in relation to storm frequency/cost effectiveness; maintenance operations, and emergency plans to minimize flood damage; and post flood recovery operations plans and policies.

The City of Vassar's new sewage treatment facility will be relocated outside of the 100-year floodway. The proposed new facility for the City of Newaygo will be located outside of the floodplain. *Lead Agency: MDNR, MSP/EMHSD, Michigan Public Health, EPA, EDA, FEMA and USACE.*

Create a task force to evaluate the hydraulic design of roads, bridges and culverts. *Lead Agency: MDNR, FHWA, MDOT and County Road Commission.*

Create a State Hazard Mitigation Team with representation from key State agencies. *Lead Agency: MDNR, MSP/EMHSD, and the Governor's Office.*

MSP/EMHSD should reprioritize their training and education needs to include the training of State agency personnel identified to serve on the State Hazard Mitigation Team. *Lead Agency: MSP/EMHSD and FEMA*

The Michigan legislature should adopt the drafted legislation, entitled "Flood Damage Reduction Act." *Lead Agency: MDNR, MSP/EMHSD, and the Governor's Office.*

The State of Michigan should review existing legislation and regulations addressing storage of hazardous materials in flood-prone areas for adequacy and/or enforcement. *Lead Agency: MDNR, MSP-Fire Marshal and EPA.*

Hazard Mitigation Strategy for Federal Disaster #1028: 1994 Northern Michigan Deep Freeze

Improve capabilities to predict severe cold weather periods which may hamper operation of water and sewer systems, and to take appropriate actions to prevent system freeze ups and damage.

Ensure all future construction, alterations and repairs to water and sewer systems adhere to state codes and standards and system master plans.

Integrate mitigation into long range capital improvements planning to identify and implement preventive measures for vulnerable system components.

Where appropriate, improve state codes and standards to better address the problems associated with frost damage caused by severe cold weather.

Decrease the vulnerability of those system components not directly affected by the disaster, or which were damaged but not covered under the Public Assistance Grant Program, but nonetheless could be susceptible to frost damage from a similar event in the future.

Jurisdictions had until July 15th, 1994, to submit Pre-Application Forms for proposed mitigation measures to EMHSD. A total of 62 projects proposals were received, with funding requests totaling nearly $5.7 million dollars. FEMA set the total amount of available HMGP funding for this disaster at $669,539. On July 20th, 1994, a State Selection Panel was convened to review, prioritize and approve project proposals for funding under the HMGP. A total of 21 projects were selected by the Panel for funding consideration. EMHSD then submitted a State Grant Application to FEMA, with the individual project applications attached. FEMA then reviewed the individual project applications and provided a grant to the State for disbursement to those applications whose projects are approved. *Lead Agency: MSP/EMHSD.*

Increase awareness of community officials about state codes and standards for water and sewer systems, and the permit processes for system alterations. *Lead Agency: MDPH and MDNR*

Develop water system master plans for those communities that don't presently have one. *Lead Agency: MDPH*

Provide technical assistance and encouragement to communities to apply for and use Community Development Block Grant funds for implementing mitigation measures. *Lead Agency: MSP/EMHSD and MDOCm.*

Ensure that all water/sewer system repairs and mitigation measures funded under the PAGP and HMGP use appropriate cold weather engineering practices, and are consistent with state codes and standards. *Lead Agency: MSP/EMHSD, MDPH and MDNR.*

Increase awareness of community officials about state codes and standards for water and sewer systems, and the permit processes for system alterations. *Lead Agency: MDPH and MDNR.*

Develop water system master plans for those communities that don't presently have one. *Lead Agency: MDPH*

Provide technical assistance and encouragement to communities to apply for and use Community Development Block Grant funds for implementing mitigation measures. *Lead Agency: MSP/EMHSD and MDOCm.*

Ensure that all water/sewer system repairs and mitigation measures funded under the PAGP and HMGP use appropriate cold weather engineering practices, and are consistent with state codes and standards. *Lead Agency: MSP/EMHSD, MDPH and MDNR.*

Incorporate appropriate cold weather engineering practices into state codes and standards for design, construction and alteration of public water and sewer systems throughout the state. *Lead Agency: MDPH and MDNR.*

Establish formal "let run" policies and procedures to keep water moving through a community's system to prevent freezing during periods of extended or extreme cold weather. *Lead Agency: MDPH and MDNR.*

Work with the National Weather Service, Army Corps of Engineers Cold Regions Research and Engineering Laboratory, and other appropriate agencies to better identify periods of extended sub-zero weather which could lead to widespread water and sewer system freeze ups. *Lead Agency: NWS, USACE, MDPH, MDNR, MSP/EMHSD.*

Hazard Mitigation Strategy for Federal Disaster #1128: 1996 East Michigan Tornadoes and Flooding

Prepare a Construction and Maintenance Manual for road and drainage construction and maintenance personnel. This Manual will be designed for use by the Michigan Department of Transportation, Michigan County Road Association, Michigan River Basin Association; and County Drain Commissioners, and contain the following: construction standards and simplified details for sizing, design of facilities, materials, installation methods for culverts, drainage ditches and bridges; maintenance techniques and maintenance scheduling methods (planning for maintenance, funding issues, personnel issues, managing costs, etc.)

Hold training workshops to explain the use of the Construction and Maintenance Manual and, schedule workshops on an annual cycle for current and new personnel.

Develop a Hazard Mitigation Planning Manual containing a description of planning procedures and model text that addresses hazard mitigation principles associated with land use planning and building inspection in the State of Michigan. Emphasis should be placed on drainage issues and proper design for subdivisions and individual development sites.

Hold Insurance Agent workshops sponsored by the Michigan Department of Environmental Quality to provide information regarding program details, benefits of purchasing insurance, and the mandatory land management and building permit requirements associated with flood insurance availability.

Pursue the development of projects for 404 funding through correspondence, meetings and phone calls.

Coordinate with Public Assistance (Infrastructure Support) to review Damage Survey Reports for mitigation opportunities. Encourage the development of mitigation projects associated with the Section 404 and 406 Programs.

Areas of possible concern are drainage canals, water and waste treatment plants, and other governmental facilities and infrastructure.

Promote the acquisition of repetitively flooded and substantially damaged properties through a voluntary flood damaged property acquisition program. One of the few mitigation options available for this type of situation is to buy out the owners and remove the structures from the floodplain. Property acquisition programs are complex; information presented to affected individuals must be accurate and understandable.

Many areas experienced broad scale flooding (particularly Tuscola and Lapeer Counties); many structures may be situated where elevation of the building could be effective in reducing future flood losses. The elevation of utilities and appliances can also be an effective mitigation technique for communities where broad scale flooding occurred in developed areas.

Incorporate mitigation into infrastructure repairs by considering the Section 406 Hazard Mitigation Program.

Amend the Michigan State Enabling Legislation to incorporate "hazard mitigation" within the list of elements that constitute a comprehensive plan. *Lead Agency: MSP/EMHSD. Support Agencies: MDEQ, Michigan Chapter of the American Planning Association, Michigan Society of Planning Officials and MDNR.*

Amend the State Enabling Legislation to require that the County Drain Commission be included in the review and approval or disapproval of all land use change proposals as an integral step in the land development process for the State of Michigan. The review will include condominiums, development site plans and mobile home parks in addition to the existing review requirement for land subdivisions. *Lead Agency: MDEQ and MACDC. Support Agencies: MDA, MSP/EMHSD and Michigan Association of Conservation Districts.*

Amend the Michigan county, municipal and township zoning enabling legislation to permit county overlay zoning of designated hazardous river and stream corridors, hazardous transportation corridors, and intercommunity hazardous areas.

The EMHSD should establish and coordinate a State Hazard Mitigation Council to address the mitigation recommendations found in the Michigan Hazard Mitigation Plan and to assure that the plan will be carried out in a coordinated and effective manner. *Lead Agency: MSP/EMHSD. Support Agencies: Local, state and federal agencies.*

Establish a "State Hazard Mitigation Fund" to address the mitigation opportunities that are identified during flood events. *Lead Agency: MSP/EMHSD. Support Agencies: MDEQ, MDOT and Consumer and Industry Services.*

Develop a list of potential mitigation projects within the State of Michigan. There is a general idea of the problem areas; however, communities, counties, and emergency managers should be contacted to obtain specific areas of concern. *Support Agencies: MSP/EMHSD*

The EMHSD should require and coordinate the preparation of county hazard mitigation plans as subcomponents of the State of Michigan Mitigation Plan. These county plans can also serve as components of county comprehensive plans for those counties that have established county planning commissions.

Prepare a handbook for planning commissioners addressing the process for hazard mitigation planning at the local level. The handbook would be used as the text for training courses giving on an annual basis. *Lead Agency: MSP/EMHSD. Support Agencies: MDEQ, other agencies and groups associated with land use management, MDA, and MACDC and Department of Consumer & Industry Services.*

Initiate and or expand the training programs for planners to include hazard mitigation planning as a component of local comprehensive plans. The initiative would be sponsored and coordinated through the Michigan Society of Planning Officials with educational sessions and materials distributed through the professional and trade associations encompassing land change activity in Michigan. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD and MDA.*

Establish a provision in State law that requires the disclosure of flood prone areas as a step in real estate transactions. This should be mandatory regardless of the method of financing or financing institution. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD*

Create improved instructional information for the National Flood Insurance Program. Other state handbooks could also be upgraded to include current flood plain management guidelines. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD, FEMA, NFIP Coordinator, State Insurance Industry and State Insurance Bureau.*

Flood insurance questions should be added to insurance qualifications tests for agents and real estate personnel. *Lead Agency: MDEQ, NFIP Coordinator, Department of Consumer & Industry Services. Support Agencies: MSP/EMHSD, FEMA, Insurance Industry, Insurance Associations and State Insurance Bureau.*

An educational program for Insurance Agents should be initiated to address the need for selling specific policies for reimbursement of disaster costs. *Lead Agency: MDEQ and NFIP Coordinator. Support Agencies: MSP/EMHSD, FEMA, Insurance Industry, Insurance Associations and State Insurance Bureau.*

Identify properties experiencing repetitive loss in Michigan. Priority projects for action that are identified through the property inventory will require additional funding either through a "State Hazard Mitigation Fund," Flood Mitigation Assistance Program funds or community funding. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD, FEMA, USACE, Association of State Floodplain Managers, and the communities.*

Mapping needs should be identified and prioritized. MDEQ should develop a listing of unmapped communities and continue to identify flood prone areas. FEMA will continue to develop county wide maps within Michigan, following the priority developed by the MDEQ. *Lead Agency: MDEQ. Support Agencies: FEMA, USACE, NRCS, MDNR, MDA, MACDC and MACD.*

The results of the map overlays digitizing program should be reviewed to determine its applicability to flood preparedness and mitigation. If the program is worthwhile, it should be expanded to the rest of the state. *Lead Agency: MDNR. Support Agencies: MSP/EMHSD, MDEQ, FEMA, MDA, MACDC, MACD and DNR.*

A public education program should be developed for retrofitting structures in flood prone areas. This information should be disseminated before a disaster occurs. *Lead Agency: MSP/EMHSD. Support Agencies: FEMA, MDEQ, NFIP Area Coordinators, County Emergency Management Coordinators, State Insurance Bureau, Insurance Associations, MSU Extension Service and Soil Conservation Districts.*

In order to maximize production, farmers commonly cultivate their land to the edge of the drain network. This practice weakens the banks and allows erosion to take place. Consequently, the eroded material constricts the drainage system during a heavy rain event. By establishing a greenbelt of uncultivated land, a filter strip is created that can prevent bank erosion and excessive runoff

from fields and crops. The green belt could be established through a "state setback standard" or the acquisition of a buffer on either side of the drainage ditches.

Legislation is needed to establish a setback requirement for agricultural drainage ditches. *Lead Agency: MDA. Support Agencies: MSP/EMHSD and MDEQ.*

All drains in Michigan should be evaluated for the degree of sedimentation. Establish filter strips within the drain easement where impacted drains are identified. An effort should be made to determine if the effectiveness of the filter strips could be improved with an increase in width. Other strategies to increase the use, extent, effectiveness and permanence of the filter strips could include: tax incentives, direct payment, reduced flood insurance premiums, and land acquisition by the drain commission. *Lead Agency: MDA. Support Agencies: Association of County Drain Commissioners, NRCS, and Local Conservation Districts.*

Conduct a study of Michigan land character and its influence on storm water runoff (site runoff study). The study should be designed with the objective to establish a formula for calculating the maximum land coverage for impervious surfaces. Soil characteristics, slopes and vegetation types will be considered in the development of the maximum lot coverage methodology. Managing the impervious surface coverage of development parcels will help to reduce the high flow regimen in drainage structures and thus preserve the efficiency of the drainage system during major storms. *Lead Agency: MDA. Support Agencies: MDEQ, Michigan Chapter of the American Planning Association, Michigan Society of Planning Officials, possibly other township, municipal and county associations, MACDC and MACD.*

Amend the Planning Enabling Legislation to require that development proposals include an analysis of runoff potential and soil characteristics to establish a maximum property coverage for impervious surfaces. This requirement must be based on accepted standards developed through a study of Michigan land and runoff characteristics. *Lead Agency: MDEQ. Support Agencies: MDA, MACDC and MACD, MDEQ, Michigan Chapter of the American Planning Association, Michigan Society of Planning Officials, possibly other township, and municipal and county associations.*

Amend the Michigan State Planning Enabling Legislation to require cross jurisdictional hydrologic planning between legal entities within watershed units. Designate this coordinated planning as a prerequisite for accepting State funds in the State's jurisdictions. *Lead Agency: MDEQ – Land & Water Management Division. Support Agencies: MSP/EMHSD, MDNR and MDA.*

Conduct a watershed hydrologic analysis to determine the adequacy of the existing drain capacity given the development pattern and a series of standard storm events. Also, conduct the watershed hydrologic analysis using a land buildout scenario developed through the distribution of the currently allowed zoning ordinance densities. *Lead Agency: MDA. Support Agencies: MDEQ and Michigan Association of Drain Commissioners.*

Develop and adopt minimum standards for drain design and construction. A state-wide watershed management standard must be adopted in order to apply a uniform specification for drain design and installation throughout the watershed. This standard must be developed to address peal flow rates and peak volumes. Develop a mechanism to coordinate all agencies that impact the drain system. *Lead Agency: MDA. Support Agencies: Association of County Drain Commissioners, Natural Resources Conservation Service, MDEQ.*

Prepare a construction and maintenance manual for road and drainage construction personnel. All Road Commissioners should be required to design and construct their roads based on the MDEQ standards. The workshops should also incorporate the recommendations made by the Road Infrastructure Mitigation Committee following the 1986 flood disaster. The manual should emphasize that the key to reducing serious repetitive flood damage to the local, county and state transportation infrastructure is through a cooperative, innovative and coordinated effort at all levels of government. The manual should also emphasize that MDEQ permits are needed for road crossings of all watercourses including designated county drains. *Lead Agency: MDEQ, MDA and MDOT. Support Agencies: Training organizations: CRAM, MTU, T-Square.*

Develop a training program for drain commissioners addressing their role in a flood emergency situation. Establish a mechanism to encourage the cooperation of County Emergency Management Coordinators with the County Drain Commissioners.

Presently there are no automated river gages in Michigan other than those located at airports. NOAA is planning to install one automated river gage in Midland in a secure area owned by Dow Corning. NOAA and the National Weather Service are being funded to install new state-of-the-art forecasting equipment. *Lead Agency: MSP/EMHSD. Support Agencies: MDA and Michigan Association of County Drain Commissioners*

Identify funding sources and take the necessary steps to install real-time rain and flow gages in Central Michigan. Develop an action plan that establishes an effective flood warning system for Central Michigan. *Lead Agency: MDEQ. Support Agencies:*

MSP/EMHSD, NOAA National Weather Service, US Geological Survey, County and local emergency coordinators, dam owners, volunteer, media and MDA.

Prepare and distribute detailed maps showing drains and their flow direction as well as transportation routes to assist with disaster response actions associated with liquid pollutants. Drain routes should be part of the county road maps provided by each road commission. They should be incorporated into county land use and zoning maps. *Lead Agency: MSP/EMHSD. Support Agencies: MDA and MDEQ.*

The FEMA Region V Mitigation Division and the Michigan State Flood Insurance Coordinator should develop a written request to the Federal Insurance Administration suggesting that they consider initiating a program for flooding insurance coverage for farm crops. *Lead Agency: FEMA and USDA. Support Agencies: MDA, State legislators, MDEQ, NFIP Coordinators, Michigan Insurance Industry, Michigan Insurance Bureau, and Farmers Association.*

A nationwide policy addressing development downstream of dams should be drafted and incorporated into the NFIP regulations. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD, FEMA, Association of State Floodplain Managers, Association of State Dam Safety Officials.*

Obtain the Michigan Attorney General's legal opinion of the Michigan state regulations pertaining to floodway habitation. If a more stringent interpretation is provided, develop a strategy for administering the updated directive. *Lead Agency: MDEQ. Support Agencies: FEMA*

The Vassar project and other potential hazard mitigation projects should be reviewed for action and, if appropriate, incorporated into the Michigan Hazard Mitigation Plan. *Lead Agency: MDEQ. Support Agencies: MSP/EMHSD*

Increase Public awareness of the NFIP. *Lead Agency: FEMA, MDNR, MSP/EMHSD and the banking industry.*

The State of Michigan should sponsor an annual "Flood Awareness Week." *Lead Agency: MSP/EMHSD and NWS*

The State of Michigan should establish design, construction, and maintenance guidelines for dikes and levees protecting agricultural lands. *Lead Agency: MDNR, MDA, USACE and SCS.*

Review mechanisms available for providing technical assistance in non-project areas for farmsteads located in the 100-year floodplain for floodproofing. *Lead Agency: USDA, FEMA, Agricultural Stabilization and Conservation Service, FmHA, SCS, MDA, and MDNR.*

Review existing programs to revise or redirect ongoing assistance efforts to adequately provide disaster coverage to the farm community and to incorporate mitigation measures. *Lead Agency: USDA, extension services, Farm Bureau, National Milk Producers Association, and National Farm Organization.*

Create a multi-disciplinary task force to evaluate flood damage to and caused by the failure of sewage handling systems. The following functional areas should be addressed: auxiliary power for lift stations and treatment facilities; site locations and related floodproofing requirements; adequacy/ necessity of storage/holding basins and related design criteria; minimizing infiltration and/or inflow, including the separation of storm water and sanitary systems, disallowing footing and roof drains to empty into sanitary systems, and identifying building code changes where appropriate; criteria for determining optimum level of floodproofing/protection in relation to storm frequency/cost effectiveness; maintenance, operations and emergency plans to minimize flood damage; and post flood recovery operations plans and policies. *Lead Agency: MDNR, MSP/EMHSD, Michigan Public Health, EPA, EDA, FEMA, and USACE.*

Increase awareness of floodplain management code standards, ordinances, and procedures with local elected officials, building code officials, and floodplain residents. Suggestions for improving enforcement: evaluate resource requirements for NFIP enforcement; expand local building inspector training awareness programs; develop procedures and definitions to clarify the enforcement of substantial improvement requirements; and propose legislation to require identification of flood prone parcels on title abstracts. *Lead Agency: FEMA, MDNR, MSP/EMHSD, Michigan Department of Labor-Construction Code Division and Code Officials Association.*

Hazard Mitigation Strategy for Federal Disaster #1181: 1997 Southeast Michigan Tornadoes and Flooding

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful.

To assist communities in southeast Michigan in their recovery from the severe storms that struck the area on July 2, 1997, (so that the rebuilt environment is safer and has a reduced risk from wind and flood damage), the following objectives must be accomplished: acquisition and relocation or retrofitting and floodproofing (including elevation) of substantially-damaged structures located in special flood hazard areas; structural retrofitting of wind-damaged structures with wind clips, fasteners and other bracing materials; structural modifications to water and sewer infrastructure to prevent flood damage; and urban forestry education.

Every effort should be made to include structural wind retrofitting in the repairs and reconstruction done under the Temporary Housing Program, the Individual and Family Grant Program, and the Public Assistance Grant Program. In addition, home and business owners should be strongly encouraged to use the available funding under the Small Business Administration's Disaster Loan Program to incorporate structural wind mitigation measures in the repair/reconstruction of their damaged structures. Appropriate flood mitigation measures should also be undertaken on those public facilities and infrastructure that incurred damage from flooding. All of these programs have the ability to institute immediate, permanent mitigation measures on damaged structures and public infrastructure.

The mitigation strategy for promoting and achieving mitigation of the hazards from this disaster will be focused in the following areas:

- Community mitigation education and outreach.
- Coordination with other disaster assistance programs.
- Community-administered structural retrofitting education and grant programs.
- Enhancement of urban forestry programs and practices.
- Mitigation project development.
- National Flood Insurance Program mitigation opportunities and promotion.

Community mitigation education and outreach

- Provide mitigation information in Disaster Recovery Information Centers.
- Provide mitigation information by mail (upon request) as a follow-up to the Disaster Recovery Information Centers (on-going).
- Coordinate mitigation activities with the ongoing Community Relations Outreach Program (on-going).
- Coordinate with professional associations for groups such as building code officials and insurance companies for development of wind resistant building codes.

Coordination with other disaster assistance programs

- Coordinate with Individual Assistance (IA) Program staff to ensure that appropriate structural wind engineering measures are allowed and specified for homes being repaired under the Minimal Repair Program.
- Coordinate with IA Program staff to ensure that appropriate mitigation measures are allowed and specified for recipients of IFG grants to prevent further damage to their homes from wind (such as removing trees that are in danger of falling onto the structure, providing additional bracing or tarping for damaged roofs and walls, etc.).
- Coordinate with SBA staff to ensure that appropriate structural wind engineering measures are allowed and specified for homes being repaired under the SBA Disaster Loan Program (using the 20% mitigation provision).
- Coordinate with appropriate state and local officials to ensure that structural wind engineering measures are allowed and being implemented for homes being repaired under voluntary agency disaster relief and recovery programs.
- Coordinate with Public Assistance (PA) Program staff to ensure that appropriate structural wind engineering and floodproofing measures are allowed and specified for public buildings and infrastructure being repaired under the Public Assistance Grant Program.

Community-administered structural retrofitting education and grant program

- Invite communities to establish and administer a locally-based structural retrofitting program that would provide public education on proper wind engineering techniques and components, and provide grants to individual home and business owners

wishing to retrofit their structures to reduce future wind damage. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and prorating on program status to the State.

Enhancement of urban forestry programs and practices

- Develop and provide guidance materials to forestry, public works, utility and other appropriate local departments on proper urban forestry techniques and practices.
- Conduct workshops for home and business owners, design professionals and other interested parties, on proper tree selection and urban forestry techniques and practices.
- In communities without an urban forestry program, encourage local officials to establish a program.

Mitigation project development

- Information from the Preliminary Damage Assessment (PDA) will be used to help identify and select the communities which should be contacted concerning the possibility of mitigation opportunities under the Hazard Mitigation Grant Program (HMGP) and other state and federal programs.
- Review the potentially damaged structure inventory from the PDA, concentrating primarily on those structure that may have been substantially damaged.
- Review the NFIP State Coordinator's information concerning the flood hazard identification and participation status of communities in the NFIP.
- Coordinate with the Michigan Jobs Commission and other appropriate state agencies concerning communities with a substantial investment of state financial resources.
- Whenever possible, incorporate mitigation projects into larger, ongoing or planned community projects (as long as the larger project will be completed in a timely manner and mitigation benefits can be fully retained) (on-going).

Upon identification of communities suitable for mitigation, local officials will be contacted to determine the level of local interest in partnering toward recovery that will reduce the community's risk to future severe storms and flooding. The Mitigation Team will be activated and conduct site visits with communities the commit to development of projects and implementation of appropriate mitigation measures. The Mitigation Team will function as a technical resource to the community to help identify the problem that should be addressed by the mitigation measure and identify financial assistance opportunities through Federal, State and private-sector programs.

NFIP Mitigation Opportunities and Promotion

- MDEQ staff will provide technical assistance to local floodplain administrators as needed (on-going).
- MDEQ staff will, as needed, conduct NFIP briefings to inform local floodplain administrators of NFIP responsibilities (on-going).
- FEMA will mail letters to affected communities regarding immediate substantial damage determinations (not applicable for this disaster).
- FEMA will identify priorities for possible enforcement actions (on-going).
- MDEQ, EMD, and FEMA will review repetitive loss data for potential acquisition sites.

Hazard Mitigation Strategy for Federal Disaster #1226: 1998 West Michigan Windstorm

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful To assist communities in Michigan in their recovery from the straight-line winds that struck across Michigan on May 31, 1998, so that the rebuilt environment is safer and has a reduced risk from wind and flood damage, the following objectives must be accomplished.

The initial mitigation opportunities and recommendations identified during the damage assessment process in many of the affected communities include: retrofitting of wind-damaged structures with wind clips, fasteners and other bracing materials, urban forestry education, building code enforcement, acquisition and relocation or retrofitting and floodproofing (including elevation) of substantially-damaged structures located in special flood hazard areas, and structural modifications to water and sewer infrastructure to prevent flood damage.

The mitigation strategy for promoting and achieving mitigation of the hazards from this disaster will be focused in the following areas:

- Life safety measures.
- Community mitigation education and outreach.
- Coordination with other disaster assistance programs.
- Community-administered structural retrofitting education and grant programs.
- Enhancement of urban forestry programs and practices.
- Mitigation project development.
- National Flood Insurance Program mitigation opportunities and promotion.

Life Safety Measures

- Assist community officials in identifying deficiencies in weather warning systems and come up with solutions that will ensure public safety is enhanced.

Community mitigation education and outreach

- Coordinate with professional associations for groups such as building code officials and insurance companies for development of wind resistant building codes.

Coordination with other disaster assistance programs

- Coordinate with SBA staff to ensure that appropriate structural wind engineering measures are allowed and specified for homes being repaired under the SBA Disaster Loan Program (using the 20% mitigation provision).
- Coordinate with appropriate state and local officials to ensure that structural wind engineering measures are allowed and being implemented for homes being repaired under voluntary agency disaster relief and recovery programs.
- Coordinate with Public Assistance (PA) Program staff to ensure that appropriate structural wind engineering and floodproofing measures are allowed and specified for public buildings and infrastructure being repaired under the Public Assistance Grant Program.

Community-administered structural retrofitting education and grant program

- Invite communities to establish and administer a locally-based structural retrofitting program that would provide public education on proper wind engineering techniques and components, and provide grants to individual home and business owners wishing to retrofit their structures to reduce future wind damage. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and prorating on program status to the State.

Enhancement of urban forestry programs and practices

- Develop and provide guidance materials to forestry, public works, utility and other appropriate local departments on proper urban forestry techniques and practices.
- Conduct workshops for home and business owners, design professionals and other interested parties, on proper tree selection and urban forestry techniques and practices.
- In communities without an urban forestry program, encourage local officials to establish a program.

Mitigation project development

- Information from the Preliminary Damage Assessment (PDA) will be used to help identify and select the communities which should be contacted concerning the possibility of mitigation opportunities under the Hazard Mitigation Grant Program (HMGP) and other state and federal programs.
- Review the potentially damaged structure inventory from the PDA, concentrating primarily on those structure that may have been substantially damaged.
- Review the NFIP State Coordinator's information concerning the flood hazard identification and participation status of communities in the NFIP.
- Coordinate with the Michigan Jobs Commission and other appropriate state agencies concerning communities with a substantial investment of state financial resources.
- Whenever possible, incorporate mitigation projects into larger, ongoing or planned community projects (as long as the larger project will be completed in a timely manner and mitigation benefits can be fully retained) (on-going).

NFIP Mitigation Opportunities and Promotion

- MDEQ staff will provide technical assistance to local floodplain administrators as needed (on-going).
- MDEQ staff will, as needed, conduct NFIP briefings to inform local floodplain administrators of NFIP responsibilities (on-going).
- FEMA will mail letters to affected communities regarding immediate substantial damage determinations (not applicable for this disaster).
- FEMA will identify priorities for possible enforcement actions (on-going).
- MDEQ, EMD, and FEMA will review repetitive loss data for potential acquisition sites.

Hazard Mitigation Strategy for Federal Disaster #1237: 1998 Detroit Area Windstorm

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful. To assist communities in Michigan in their recovery from the straight-line winds and rain storms that struck Wayne and Macomb Counties on July 21-22, 1998, so that the rebuilt environment is safer and has a reduced risk from wind and flood damage, the following objectives must be accomplished:

1. Mitigation opportunities will be identified and selected;
    1. A rebate program for local residents to buy NOAA weather radios.
    2. Community outreach and education to promote urban forestry practices.
    3. Community outreach to promote wind resistant construction techniques.
    4. Burying utility lines where appropriate and technically feasible.
    5. Building code enforcement.
    6. Acquisition and relocation or retrofitting and flood proofing (including elevation) of substantially damaged structures located in special flood hazard areas.

2. Financial resources, including disaster assistance programs, HMGP, and the funds from state and federal programs, will be maximized.

3. Long-term mitigation will be ensured through comprehensive and prudent life saving measures, urban forestry practices, local building practices, and floodplain management.

The mitigation strategy for promoting and achieving mitigation of the hazards from this disaster will be focused in the following areas:

- Life safety measures.
- Community mitigation education and outreach.
- Coordination with the Public Assistance Grant Program.
- Community-administered structural retrofitting education and grant programs.
- Enhancement of urban forestry programs and practices.
- Mitigation project development.
- National Flood Insurance Program mitigation opportunities and promotion.
- Building and Infrastructure Design and Construction.

Life safety measures

- Assist community officials in identifying deficiencies in weather warning systems and come up with solutions that will ensure public safety is enhanced.

Community mitigation education and outreach

- Coordinate with professional associations for groups such as building code officials and insurance companies for development of wind resistant building codes and practices.

Coordination with the Public Assistance Grant Program

- Coordinate with the Public Assistance Grant Program (PAPG) staff to ensure that appropriate structural wind engineering and flood proofing measures are allowed and specified for public buildings and infrastructure being repaired under the Public Assistance Grant Program.
- Coordinate with the Public Assistance Grant Program staff in creating mitigation measures that will reduce debris clearance.

Community-administered structural retrofitting education and grant program

- Invite communities to establish and administer a locally-based structural retrofitting program that would provide public education on proper wind engineering techniques and components, and provide grants to individual home and business owners wishing to retrofit their structures to reduce future wind damage. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and providing program status to the State.

Enhancement of urban forestry programs and practices

- Develop and provide guidance materials to forestry, public works, utility and other appropriate local departments on proper urban forestry techniques and practices.
- Conduct workshops for home and business owners, design professionals and other interested parties, on proper tree selection and urban forestry techniques and practices.
- In communities without an urban forestry program, encourage local officials to establish a program.

Mitigation project development

- Information from the Preliminary Damage Assessment (PDA) will be used to help identify and select the communities which should be contacted concerning the possibility of mitigation opportunities under the Hazard Mitigation Grant Program (HMGP); and other state and federal programs.
- Review the potentially damaged structure inventory from the PDA, concentrating primarily on structures that may have been substantially damaged.
- Review the NFIP State Coordinator's information concerning the flood hazard identification and participation status of communities in the NFIP.
- Coordinate with the Michigan Jobs Commission, the Michigan State Housing Development Authority, and other appropriate state agencies concerning communities with a substantial investment of state financial resources.
- Whenever possible, incorporate mitigation projects into larger, ongoing or planned community projects (as long as the larger project will be completed in a timely manner and mitigation benefits can be fully retained) (on-going).

NFIP mitigation opportunities and promotion

- MDEQ staff will provide technical assistance to local floodplain administrators as needed (on-going).
- MDEQ staff will, as needed, conduct NFIP briefings to inform local floodplain administrators of NFIP responsibilities (on-going).
- FEMA will mail letters to affected communities regarding immediate substantial damage determinations (not applicable for this disaster).
- FEMA will identify priorities for possible enforcement actions (on-going).
- MDEQ, EMD, and FEMA will review repetitive loss data for potential acquisition, elevation or flood proofing sites.

Building and Infrastructure Design and Construction

- Enhance building codes to ensure public and private structures are more structurally sound to handle severe wind events.
- Promote burying of utility lines in communities where it is appropriate and technically feasible (Only public and non-profit utility companies are eligible for grant funding).

Hazard Mitigation Strategy for Federal Disaster #1346: 2000 Detroit Area Urban Flooding

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful. To assist communities in Michigan with mitigative efforts, so that the environment is safer and has a reduced risk from disaster damage, the following objectives must be accomplished.

The initial mitigation opportunities and recommendations identified during the damage assessment process in many of the affected communities include the following:

- Apply the best methods to reduce or eliminate sewer backup incidents.
- Community outreach and education to promote flood proofing methods.
- Acquisition and relocation or retrofitting and flood proofing of substantially damaged structures located in flood prone areas.

Financial resources, including disaster assistance programs such as the HMGP, PAGP, and the funds from other state and federal programs, will be maximized:

- Under the Individual and Family Grant Program and Temporary Housing Minimal Repair Program, inspectors will make every effort to include mitigation measures in restoring damaged properties.
- Under the Small Business Administration, low interest loans can be acquired for repairs and mitigation upgrades to damaged structures.

Long term mitigation will be insured through comprehensive and prudent life saving measures, local building practices, and floodplain management.

The mitigation strategy for promoting and achieving mitigation of the hazards from this disaster will be focused in the following areas:

- Life safety measures.
- Community mitigation education and outreach.
- Coordination with the Individual and Family Grant Program and the Temporary Housing Minimal Repair Program.
- Community-administered flood proofing measures.
- Mitigation project development.
- National Flood Insurance Program mitigation opportunities and promotion.
- Promoting disaster resistant communities through Project Impact.

Life safety measures

- Assist community officials in identifying deficiencies in storm sewer design and develop solutions that will ensure public health and safety. The Michigan Hazard Mitigation Coordinating Council has a representative from the MDEQ. Issues pertaining to this disaster will be discussed by the MHMCC and suggestions taken from the MDEQ representative.

Community mitigation education and outreach

- Coordinate with public and private agencies in the development of flood resistant building practices.
- Two Disaster Recovery Centers (DRCs) have been opened for this disaster—one in Taylor and one in Dearborn. The DRCs are staffed by FEMA-trained Disaster Assistance Employees (DAEs) knowledgeable of the NFIP and mitigation of sewer backups.

Coordination with the Individual and Family Grant Program

- Coordinate with the Individual and Family Grant Program and the Temporary Housing Minimal Repair Program staff to ensure that appropriate flood proofing measures are allowed and specified for homes, businesses, and infrastructure being restored under these two programs.

Community-administered floodproofing measures

- Invite communities to establish and administer a locally-based floodproofing program that would provide public education on proper floodproofing techniques, and provide grants to individual home and business owners wishing to retrofit their structures to reduce flood damage. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, which would be responsible for disbursing grants, monitoring work, providing technical assistance, and providing program status to the State.

- Flood proofing methods could include the following: installation of standpipes, sewer backflow (check) valves, or revised plumbing to include an ejector or sump pump for basements; raise electrical system components including service panels, meters, switches, and outlets that may easily be damaged by floodwaters; raise or relocate HVAC equipment, water heater, and washer/dryer.

Mitigation project development

- Information from the Preliminary Damage Assessment (PDA) will be used to help identify the communities that should be contacted concerning the possibility of mitigation opportunities under the Hazard Mitigation Grant Program (HMGP); and other state and federal programs.
- Review the potentially damaged structure inventory from the PDA, concentrating primarily on structures that may have been substantially damaged.
- Review the NFIP State Coordinator's information concerning the flood hazard identification and participation status of communities in the NFIP.
- Coordinate with the Michigan Economic Development Corporation, the Michigan Department of Career Development, the Michigan State Housing Development Authority, and other appropriate state agencies concerning communities with a substantial investment of state financial resources.
- Whenever possible, incorporate mitigation projects into larger, ongoing or planned community projects (as long as the larger project will be completed in a timely manner and mitigation benefits can be fully retained) (on-going).
- Upon identification of communities suitable for mitigation, local officials will be contacted to determine the level of local interest in partnering towards recovery that will reduce the communities risk to future severe storms and flooding. The Mitigation Team will be activated and conduct site visits with communities, as necessary, to gain commitment in developing projects and implementing appropriate mitigation measures. The Mitigation Team will function as a technical resource to the community to help identify problems that should be addressed by the mitigation measure and identify financial assistance opportunities through federal, state and private sectors programs.
- If a mitigation component is established within the Disaster Field Office (DFO), and MSP/EMHSD will supply staff, as appropriate, to support the DFO mitigation efforts.
- The Mitigation Team will evaluate the mitigation projects proposed within Michigan and select those projects that will be funded under the Hazard Mitigation Grant Program.

NFIP mitigation opportunities and promotion

- MDEQ staff will provide technical assistance to local floodplain administrators as needed (on-going).
- MDEQ staff will, as needed, conduct NFIP briefings to inform local floodplain administrators of NFIP responsibilities (on-going).
- FEMA has ordered three sets of NFIP maps for the declared area.
- FEMA will mail letters to affected communities regarding immediate substantial damage determinations (not applicable for this disaster).
- FEMA will identify priorities for possible enforcement actions (on-going).
- MDEQ, MSP/EMHSD, and FEMA will review repetitive loss data for potential acquisition, elevation or flood proofing sites.

The NFIP State Coordinator has indicated that the Village of Lake Angelus in Oakland County is the only NFIP sanctioned community in the two-county disaster area.

Hazard Mitigation Strategy for Federal Disaster #1413: 2002 Central and Western Upper Peninsula Flooding

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful. To assist communities in Michigan with mitigation efforts, so that the environment is safer and has a reduced risk from disaster damage, the following objectives must be accomplished.

The initial mitigation opportunities and recommendations identified during the damage assessment process in many of the affected communities include the following:

A. Acquisition and relocation or retrofitting and flood proofing (including elevation) of substantially damaged structures located in flood prone areas.
B. Community outreach and education to promote flood proofing methods in residential and commercial structures, focusing on elevation and/or relocation of utilities and mechanical systems in basements or other vulnerable areas.
C. Applying the best methods to properly anchor and/or elevate or floodproof fuel oil tanks in home basements.
D. Floodproofing roads, bridges, culverts and other public facilities located in floodplains or other flood prone areas.
E. Armoring erosion prone streambanks to prevent sedimentation and to otherwise ensure maximum hydraulic capacity is maintained.
F. Assessing the need for initial or revised flood hazard mapping in selected communities.

Financial resources, including disaster assistance programs such as the HMGP and PAGP, and the funds from other state and federal programs, will be maximized:

- Under the Public Assistance Grant Program, inspectors will make every effort to include appropriate mitigation measures in restoring damaged public facilities (on every project)—including the removal of disaster-caused debris from culverts and streambeds to ensure maximum hydraulic capacity.
- Under the Federal Highway Administration (FHWA) Emergency Relief Program, inspectors will make every effort to include appropriate mitigation measures in restoring damaged Federal-Aid roads and bridges.
- Under the Small Business Administration, low interest loans can be acquired for repairs and mitigation upgrades to damaged structures.
- Under the Natural Resource Conservation Service (NRCS) Emergency Watershed Program, appropriate mitigation measures will be implemented to remove any and all threats (urgent and compelling) resulting from sudden watershed impairment. In addition, supplemental funding will be requested to implement appropriate mitigation measures at other damaged, impacted or threatened sites (not considered urgent and compelling) that do not fall under the purview of the FEMA Public Assistance Grant Program or other programs.
- The maximum seven-percent (7%) allotment of available HMGP funds will be earmarked by the State to facilitate the development of local hazard mitigation plans in the declared disaster area and in other communities in the region.
- Under the HMGP, funds will be earmarked to acquire/relocate substantially damaged structures located in flood prone areas. In addition, FEMA will be requested to make available PAGP funds to cover the demolition and debris removal costs associated with these acquisitions.
- Under the Pre-Disaster Mitigation Program (PDMP), funds will be made available as appropriate (at the discretion of the State) to support mitigation planning efforts in the declared area.
- Voluntary organizations (i.e., Red Cross, Salvation Army, etc.) will be requested to provide (as appropriate and in keeping with their organizational mission) financial and other resources to promote and facilitate the implementation of mitigation measures in individual damaged homes.

Long-term mitigation will be ensured through comprehensive and prudent public health and safety measures (i.e., floodproofing utilities, mechanical systems, and basement fuel oil tanks in residences and businesses), local building practices, and floodplain management.

The mitigation strategy for promoting and achieving hazard mitigation in this disaster will be focused on the following areas:

- Public health and safety measures.
- Community mitigation education and outreach.
- Coordination with the FEMA PAGP, the FHWA Emergency Relief Program, and the NRCS Emergency Watershed Program.

- Community administered floodproofing measures.
- Mitigation project development.
- National Flood Insurance Program promotion and flood hazard identification.
- Promoting disaster resistant communities through the Pre-Disaster Mitigation Program and through local mitigation plan development.

Public health and safety measures

- Assist community officials and residents in identifying appropriate floodproofing solutions for basement fuel oil tanks, utilities and other mechanical systems that will ensure public health and safety. The Michigan Hazard Mitigation Coordinating Council has a representative from the Michigan Department of Environmental Quality (MDEQ). Public health and safety issues pertaining to the flood damages in individual homes and businesses related to this disaster can be discussed at an upcoming MHMCC meeting and suggestions taken from the MDEQ representative. In addition, FEMA Disaster Assistance Employees (DAEs) can provide written guidance materials directly to individual homeowners through community outreach at a Disaster Recovery Center (DRC), through the media, or through other appropriate avenues.

Community mitigation education and outreach

- Coordinate with public and private agencies in the development of flood resistant building practices and a multi-hazard mitigation plan for each declared county.
- FEMA should consider partnering with the SBA to provide information on the National Flood Insurance Program (NFIP) and floodproofing techniques for residential and commercial structures. This could be done at the SBA's Loan Assistance Office at the DFO and/or through one-on-one meetings with applicants and community officials.
- Conduct workshops on the DMA 2000 planning requirements and mitigation plan development with regional and local planning agencies.

Coordination with the Public Assistance Grant Program and other active relief programs

- Provide guidance to PAGP applicants that promotes mitigation and specifies the types of measures that are potentially eligible for funding under the PAGP.
- Coordinate with FEMA PAGP inspectors to ensure that appropriate mitigation measures are allowed and specified for damaged roads, bridges, culverts and other public facilities – including the removal of disaster-caused debris from culverts and streambeds to ensure maximum hydraulic capacity. This is best achieved by having FEMA Mitigation DAEs (preferably) and/or state mitigation staff (as a backup) be part of the PAGP inspection teams sent out to survey damaged sites. In addition, FEMA Mitigation DAEs (preferably) and/or state mitigation and PAGP staff should review each damage report written by the PAGP inspectors to ensure that mitigation measures have been considered on every project. The FEMA Deputy Coordinating Officer (FCO) for Mitigation should also review the PAGP inspection report trends (i.e., the percent of all PAGP projects that have specified mitigation measures) to ensure that mitigation measures are being specified in all appropriate circumstances and for all appropriate types of projects.
- Coordinate with FHWA inspectors to ensure that appropriate mitigation measures are being considered for damaged Federal-Aid roads and bridges being repaired under the FHWA Emergency Relief Program. This is best achieved by having the Michigan Department of Transportation (MDOT) representative in (or reporting to) the DFO to monitor and evaluate the decisions being made by FHWA inspectors in the field. If mitigation measures are not being considered, the FEMA Deputy FCO for Mitigation should contact the FHWA and request that mitigation be considered where appropriate and cost-effective.
- Coordinate with NRCS inspectors to ensure that appropriate mitigation measures are being considered on all sites being restored under the NRCS Emergency Watershed Program and other activated programs. This is best achieved by having state mitigation staff monitor and evaluate the decisions being made by NRCS inspectors in the field and central office program staff in Lansing. If mitigation measures are not being considered, the FEMA Deputy FCO for Hazard Mitigation should contact the NRCS and request that mitigation be considered where appropriate and cost-effective.
- Coordinate with the U.S. Army Corp of Engineers (USACE) on the possible development of flood control projects within or benefiting the declared area.

Community-administered floodproofing measures

- Invite communities to establish and administer a locally based floodproofing program that would provide public education on proper floodproofing techniques, and provide grants to individual home and business owners wishing to retrofit their structures to reduce flood damage. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and providing program status to the State. Note: floodproofing methods could include the following:
  - Acquire and demolish/relocate flood-prone structures.
  - Elevate flood-prone structures above the base flood level (1% annual chance of occurrence).

- Securely mount basement fuel oil tanks to prevent tank ruptures during flooding.
- Installation of standpipes, sewer backflow (check) valves, or revised plumbing to include an ejector or sump pump for basements.
- Raise electrical system components including service panels, meters, switches, and outlets that may easily be damaged by floodwater.
- Raise or relocate HVAC equipment, water heater, and washer/dryer.

Mitigation project development

- Information from the Preliminary Damage Assessment (PDA) will be used to help identify the communities that should be contacted concerning the possibility of mitigation opportunities under the Hazard Mitigation Grant Program (HMGP) and other state and federal programs.
- Review the potentially damaged structure inventory from the PDA, concentrating primarily on structures that may have been substantially damaged.
- Review the NFIP State Coordinator's information concerning the flood hazard identification and participation status of communities in the NFIP.
- Coordinate with the Michigan Economic Development Corporation, Michigan Department of Career Development, Michigan State Housing Development Authority, and other appropriate state agencies concerning communities with a substantial investment of state financial resources.
- Whenever possible, incorporate mitigation projects into larger, ongoing or planned community projects (as long as the larger project will be completed in a timely manner and mitigation benefits can be fully retained). (Ongoing)
- Upon identification of communities suitable for mitigation, local officials will be contacted to determine the level of local interest in partnering towards recovery that will reduce the community's risk to future flooding. The Mitigation Team will be activated and conduct site visits with communities, as necessary, to gain commitment in developing projects and implementing appropriate mitigation measures. The Mitigation Team will function as a technical resource to the community to help identify problems that should be addressed by the mitigation measure and identify financial assistance opportunities through federal, state and private sector programs.

NFIP promotion and flood hazard identification

- FEMA will collect and assess flood map upgrade needs data using the NFIP's Map Needs Update Support System database. Where no NFIP maps are available, the map needs data collection process shall include a community-wide assessment of flood damage potential according to NFIP standards. FEMA shall coordinate with the United States Geological Survey (USGS), the MDEQ, and the NFIP Regional Engineer to determine the need for collection of high water data. In addition, FEMA shall coordinate with PAGP inspection staff to determine where floodplain map data would enhance benefit-cost analysis for potential mitigation-induced project enhancements and prepare hydrologic and hydraulic analyses as required. Working in consultation with the NFIP State Coordinator, FEMA will identify areas where flood damage has occurred to residential or commercial building stock and prepare flood recovery maps as required to assist in rebuilding efforts that comply with minimum state and federal flood damage prevention standards.
- MDEQ staff will provide technical assistance to local floodplain administrators as needed. (Ongoing)
- MDEQ staff will, as needed, conduct NFIP briefings to inform local floodplain administrators of NFIP responsibilities. (Ongoing)
- FEMA will mail letters to affected communities regarding immediate substantial damage determinations. (Ongoing)
- FEMA will identify (with MDEQ input) priorities for possible enforcement actions. (Ongoing)
- MDEQ, EMD/MSP and FEMA will review repetitive loss data for potential acquisition, elevation or floodproofing sites.
- There is one NFIP sanctioned community (L'Anse Township) in the five-county disaster area. This community has applied to join the NFIP and should be eligible shortly.

Promoting disaster resistant communities through the Pre-Disaster Mitigation Program

- Coordinate the use of PDMP funds, as appropriate, to promote mitigation plan development to ensure less disaster damage in the future.

Hazard Mitigation Strategy for Federal Disaster #1527: 2004 Southern Michigan Severe Storms / Flooding

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone property, structural retrofitting, mitigation education of community officials and residents, wise land use and land development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, to name just a few measures that have been successful. To assist communities in Michigan with mitigation efforts so that the environment is safer and has a reduced risk from disaster damage, the following objectives must be accomplished:

The initial mitigation opportunities and recommendations identified during the damage assessment process in many of the affected communities include the following (not listed in any particular order):

- Acquisition and relocation or retrofitting and floodproofing (including elevation) of substantially damaged structures located in flood prone areas.
- Applying the best methods to properly anchor and/or elevate or floodproof fuel oil tanks or propane gas tanks at homes and businesses.
- Floodproofing roads, bridges, culverts and other public facilities located in floodplains or other flood prone areas.
- Armoring erosion prone streambanks to prevent sedimentation and to otherwise ensure maximum hydraulic capacity is maintained.
- Community outreach and education to promote flood proofing methods in residential and commercial structures, focusing on elevation and/or relocation of utilities and mechanical systems in basements or other vulnerable areas. Resource packets of information about flood mitigation will be put together and mailed out to 858 state and university libraries in Michigan. The information packets will be publicized by press release so that the public knows the information is available for review. Additionally, a FEMA flood proofing flyer will be posted on the Emergency Management Division web site with a link to additional information on FEMA's web site.
- Completion of all-hazard mitigation plans as required under the federal Disaster Mitigation Act of 2000.
- Retrofitting of public and private facilities to reduce future wind damage through the application of proper structural wind engineering measures or construction of "safe rooms" and shelters.
- Vegetation management, with an emphasis on the establishment and/or improvement of community urban forestry measures.
- Community outreach and education to promote wind resistant building practices, the construction of "safe rooms" and community shelters, and proper urban forestry techniques and practices. Resource packets of information about wind mitigation will be put together and mailed out to 858 state and university libraries in Michigan. The information packets will be publicized by press release so that the public knows the information is available for review.

Financial resources, including disaster assistance programs such as the HMGP, and funds from other state and federal programs, will be maximized:

- If the minimum threshold for the Federal Highway Administration (FHWA) Emergency Relief Program is met, inspectors will make every effort to include appropriate mitigation measures in restoring damaged Federal-Aid roads and bridges.
- Under the Small Business Administration (SBA) disaster loan program, low interest loans will be made available for repairs and mitigation upgrades to damaged structures.
- Under the Natural Resource Conservation Service (NRCS) Emergency Watershed Protection Program, appropriate mitigation measures will be implemented to remove any and all threats (urgent and compelling) resulting from sudden watershed impairment. In addition, supplemental funding will be requested to implement appropriate mitigation measures at other damaged, impacted or threatened sites (not considered urgent and compelling) in the absence of funding under the FEMA Public Assistance Grant Program.
- Under the U.S. Army Corps of Engineers (USACE), Continuing Authorities Program (CAP) and other post-flood damage and shoreline erosion (Section 14) mitigation/protection authorities and programs, appropriate mitigation may be implemented to assist the affected local governments in reducing or eliminating future damage and impacts caused by flooding and/or shoreline erosion.
- At the State's discretion, up to seven percent (7%) of available HMGP funds will be earmarked to facilitate the development of local hazard mitigation plans in the declared disaster area and in other communities in the region.
- Under the HMGP, funds will be earmarked as appropriate to acquire and relocate substantially damaged structures located in flood prone areas.
- Under the Pre-Disaster Mitigation Program—Competitive (PDMP-C), funding opportunities may be made available to support mitigation efforts in the declared area and elsewhere throughout the State of Michigan.

- Under the Flood Mitigation Assistance Program (FMAP), funds will be made available to eligible applicants as appropriate (at the discretion of the State) to support mitigation planning as well as projects designed to acquire and demolish / relocate repetitive flood loss structures under the National Flood Insurance Program (NFIP).
- Voluntary organizations (i.e., Red Cross, Salvation Army, etc.) will be requested to provide (as appropriate and in keeping with their organizational mission) financial and other resources to promote and facilitate the implementation of mitigation measures in individual damaged homes.
- Long-term mitigation will be ensured through comprehensive and prudent public health and safety measures (i.e., floodproofing utilities, mechanical systems, and fuel oil / propane tanks at residences and businesses), local building practices, and floodplain management.

The mitigation strategy for promoting and achieving hazard mitigation in this disaster will be focused on the following areas (not listed in any particular order):

- Public health and safety measures.
- Coordination with the FEMA HMGP and ONA, the FHWA Emergency Relief Program, the NRCS Emergency Watershed Protection Program, and the USACE Advance Measures Program and other flood repair and mitigation authorities.
- Community administered floodproofing measures.
- Mitigation project development.
- National Flood Insurance Program promotion and flood hazard identification.
- Promoting disaster resistant communities through the Pre-Disaster Mitigation Program, Flood Mitigation Assistance Program, the NFIP Community Rating System, and through local mitigation plan development.
- Community mitigation education and outreach.

Public health and safety measures

- Assist community officials and residents in identifying appropriate floodproofing solutions for furnaces, water heaters, fuel oil and propane tanks, utilities and other mechanical systems that will ensure public health, safety and general welfare. FEMA Mitigation Disaster Assistance Employees (DAEs) can provide written guidance materials directly to individual homeowners through community outreach at Disaster Recovery Centers (DRCs), through the media, through the dissemination of information packets being made available at 858 Michigan libraries, or through other appropriate avenues.
- Assist community officials and residents in identifying appropriate structural wind engineering and vegetation management solutions that will reduce future wind damage to homes, businesses and community facilities. FEMA Mitigation DAEs can provide written guidance materials directly to individual homeowners through community outreach at Disaster Recovery Centers (DRCs), through the media, through the dissemination of information packets being made available at 858 Michigan libraries, or through other appropriate avenues.
- The MHMCC will meet on August 18, 2004 to discuss issues associated with this disaster and possible opportunities to mitigate threats to public health and safety through the grant programs administered by the EMD/MSP. The MHMCC has a representative from the Michigan Department of Environmental Quality (MDEQ) floodplain management program. Public health and safety issues pertaining to the flood damages in individual homes and businesses related to this disaster can be discussed and suggestions taken from the MDEQ representative. The MHMCC has a representative from the Michigan Department of Natural Resources (MDNR), which administers the statewide urban forestry program. Public safety issues related to tree damage within public rights-of-way from this disaster can be discussed and suggestions taken from the MDNR representative. The MHMCC can also solicit suggestions pertaining to structural wind engineering measures from the Michigan Department of Labor and Economic Growth (MDLEG), which oversees the statewide implementation of the State Construction Code.

Coordination with the other active relief programs

- Coordinate with FHWA inspectors to ensure that appropriate mitigation measures are being considered for damaged Federal-Aid roads and bridges being repaired under the FHWA Emergency Relief Program. This is best achieved by having the Michigan Department of Transportation (MDOT) Emergency Manager monitor and evaluate the decisions being made by FHWA inspectors in the field. If mitigation measures are not being considered, the FEMA Deputy FCO for Mitigation should contact the FHWA and request that mitigation be considered where appropriate and cost-effective.
- Coordinate with NRCS inspectors to ensure that appropriate mitigation measures are being considered on all sites being restored under the NRCS Emergency Watershed Protection Program and other activated programs. This is best achieved by having state mitigation staff monitor and evaluate the decisions being made by NRCS inspectors in the field and central office program staff in Lansing. If mitigation measures are not being considered, the FEMA Deputy FCO for Hazard Mitigation should contact the NRCS and request that mitigation be considered where appropriate and cost-effective.

- Coordinate with the U.S. Army Corp of Engineers (USACE) on the possible development of flood control projects within or benefiting the declared area.

Community-administered floodproofing and structural retrofitting measures

- Invite communities to establish and administer a locally based floodproofing program that would provide public education on proper floodproofing techniques, and provide grants to individual home and business owners wishing to retrofit their structures to reduce future flood damage. This is best achieved by encouraging communities to develop such a program by participation in the local hazard mitigation planning process. Appropriate projects identified in the plan (or in some instances, for participation in 1527-DR-MI HMGP, FY04 FMAP, or FY04/05 PDM-C, before the plan is complete) may be proposed under future grant cycles of the HMGP, FMAP, and PDM-C. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and providing program status to the State.

Note: floodproofing methods could include but are not limited to the following:

- ✓ Acquisition and demolition / relocation of floodprone structures.
- ✓ Elevation of floodprone structures above the base flood level (1% chance of occurrence).
- ✓ Elevation and secure mounting (as appropriate) of basement fuel oil tanks to prevent tank ruptures during flooding.
- ✓ Elevation and secure mounting (as appropriate) of backyard propane tanks to prevent tank ruptures during flooding.
- ✓ Installation of standpipes, sewer backflow (check) valves, or revised plumbing to include an ejector or sump pump for basements.
- ✓ Elevation of electrical system components including service panels, meters, switches, and outlets that may easily be damaged by floodwater.
- ✓ Elevation or relocation of HVAC equipment, water heater, and washer / dryer.

- Invite communities to establish and administer a locally based structural retrofitting program that would provide public education on proper wind engineering techniques and components, and provide grants to individual home and business owners wishing to retrofit their structures to reduce future wind damage. This is best achieved by encouraging communities to develop such a program by participation in the local hazard mitigation planning process. Appropriate projects identified in the plan may be proposed under future grant cycles of the HMGP, FMAP, and PDM-C. The program could be implemented and administered by an existing local department, such as the building, planning or public works department, who would be responsible for disbursing grants, monitoring work, providing technical assistance, and providing program status to the State.

Mitigation project development

Information from the PDA, the Michigan Hazard Mitigation Plan (MHMP) and local mitigation plans the NFIP, and other state agencies will be used to help identify the communities that should be contacted concerning the possibility of mitigation opportunities under the HMGP and other state and federal programs.

- FEMA Mitigation DAEs will review the PDA damaged structure inventory to identify structures that may have been substantially damaged. Those structures will be (at the State's discretion) specifically targeted for mitigation assistance.
- Acquisition of substantially damaged structures will be the top priority mitigation project type under the HMGP for this disaster. Based on information provided by local units of government on substantially damaged structures, state mitigation staff and/or FEMA Mitigation DAEs will coordinate with communities to determine interest in the HMGP and, where appropriate, help to develop project applications for acquisition of substantially damaged structures. The MHMCC and state mitigation staff will immediately review and evaluate proposed mitigation projects for the acquisition of substantially damaged structures and submit them to FEMA for funding consideration under the HMGP for this disaster.
- The MHMCC will coordinate with the Michigan Economic Development Corporation, the Michigan State Housing Development Authority, and other appropriate state agencies concerning communities with a substantial investment of state financial resources, in order to determine if additional mitigation partnering opportunities are available.
- Upon identification of communities particularly suitable for mitigation, federal and state time and resources permitting, local officials will be contacted to determine the level of local interest in developing a partnership to reduce the community's future risk from flooding and severe storms. FEMA Mitigation DAEs and/or state mitigation staff will conduct site visits with interested communities, at the State's discretion and within available personnel resources, to gain commitment in developing projects and implementing appropriate mitigation measures. The DAEs and/or state mitigation staff will function as a technical resource to the community to help identify problems that should be addressed by each mitigation measure, and financial assistance opportunities through federal, state and private sector programs.

- For HMGP funds not allocated to projects for the acquisition of substantially damaged structures, the MHMCC and state mitigation staff will review, evaluate, and prioritize proposed mitigation projects and select those projects that will be submitted to FEMA for funding consideration under the HMGP for this disaster.
- To ensure that the State has appropriate administrative mechanisms in place to implement the HMGP in a timely manner, FEMA will make an initial review of Michigan's existing HMGP State Administrative Plan (approved for 1413-DR-MI) to identify areas that may require an update due to recent changes in federal laws, regulations, rules, policies, and program guidance. FEMA should also consider recent audit findings within the region that may be important to consider during the plan update.

NFIP promotion and flood hazard identification

- FEMA Mitigation DAEs and the Michigan Department of Environmental Quality (MDEQ) will review the NFIP participation status of the declared counties in order to determine if additional NFIP promotion opportunities exist.
- Six of the listed affected counties (Berrien, Kent, Macomb, Oakland, Ottawa, and Wayne) are currently undergoing county wide flood insurance map reviews for updating and new map production under Michigan's business plan for the current FEMA Map Modernization initiative. Six other affected counties (Cass, Genesee, Livingston, Sanilac, St. Clair, and St. Joseph) are identified as priority counties for conducting flood insurance reviews, studies and updates. Agency coordination will occur through consultation with the NFIP State coordinator when flood damaged areas are identified and that information should be considered during the current and future county wide studies under the Map Modernization initiative. Additional coordination between FEMA and the state will occur when flood damaged areas are identified and need to be considered during plan development activities under the federal Disaster Mitigation Act of 2000, project development activities under the HMGP, FMAP, and PDMP-C, and disaster rebuilding efforts that comply with minimum state and federal flood damage prevention standards.
- FEMA will identify (with MDEQ input) priorities for possible enforcement actions regarding floodplain management under the NFIP.
- MDEQ, EMD/MSP and FEMA will review repetitive flood loss data for potential acquisition, elevation or floodproofing sites.
- There are four communities located in the 19-county disaster area that have special flood hazard areas identified but either have withdrawn from or are not participating in the NFIP. Those communities are: Village of Stevensville (Berrien County); Township of LaGrange (Cass County) – withdrawn from program; Village of Silver Creek (Cass County) – withdrawn from program; Village of New Lothrop (Shiawassee County). The FEMA Mitigation DAEs and the MDEQ will contact these communities to inquire about their interest in joining the NFIP.

Promoting disaster resistant communities through the PDMP-C, FMAP, CRS and mitigation plan development

- State mitigation staff and the MHMCC will coordinate the use of PDMP-C funds, as appropriate, to promote mitigation plan development and project development in the declared counties to reduce future risk from flooding and severe storms.
- State mitigation staff and the MHMCC will coordinate the use of FMAP funds, as appropriate, to promote mitigation plan development and project development in the declared counties to reduce future risk from flooding.
- The MDEQ will coordinate and promote community participation in the NFIP Community Rating System program to reduce future risk from flooding.
- State mitigation staff and the MHMCC will coordinate and promote the development of local mitigation plans (that are compliant with the federal Disaster Mitigation Act of 2000 and the FMAP) to reduce future risk from flooding and severe storms.
- State mitigation staff and the MHMCC will coordinate the development of the Michigan Hazard Mitigation Plan (MHMP) and ensure that it is compliant with the federal Disaster Mitigation Act of 2000 to reduce the State's overall risk from flooding, severe storms and other natural hazards.
- As staff time, resources, and DAE expertise allows, FEMA Mitigation DAEs will support the state and local mitigation planning efforts by collecting / compiling risk assessment data for flooding and severe storm hazards for the 19-county declared area, sufficient to meet the risk assessment planning requirements for state mitigation plans found in Sections 201.4 / c / 2 / ii and iii of the Disaster Mitigation Act of 2000.
- For the purposes of promoting hazard mitigation in general, FEMA Mitigation DAEs will develop mitigation "success stories" associated with this disaster. The FEMA Mitigation DAEs will work with state mitigation staff to identify communities in the declared area that have implemented mitigation measures in the past which may have prevented damage during this disaster. The DAEs will then interview local officials and/or visit those communities to collect relevant information and write success stories about the mitigation activities.

Community mitigation education and outreach

- FEMA Mitigation DAEs should consider partnering with the SBA to provide information on the NFIP and appropriate floodproofing techniques for residential and commercial structures. This could be done at the DFO and/or through one-on-one meetings with applicants and community officials.

- State mitigation staff and the MHMCC will continue to conduct coordination meetings and provide technical assistance on the federal Disaster Mitigation Act of 2000 planning requirements and mitigation plan development with regional and local planning agencies.
- If a mitigation component is established within the Disaster Field Office (DFO), the EMD/MSP will supply staff, as appropriate and within personnel limitations, to support the DFO mitigation efforts and to monitor disaster-related mitigation activities.

The State of Michigan recommends the following work priorities for the FEMA Mitigation DAEs assigned to this disaster (listed in order of priority):

Immediate Priorities (to be completed or substantially completed by 7/30/04)

- Review the PDA damaged structure inventory to identify structures that may have been substantially damaged. Mail letters to those affected communities regarding immediate substantial damage determinations.
- Review Michigan's existing HMGP State Administrative Plan (approved for 1413-DR-MI) to identify areas that may require an update due to recent changes in federal laws, regulations, rules, policies, and program guidance. FEMA should also consider recent audit findings within the region that may be important to consider during the plan update.

High Priorities (to be completed or substantially completed by 8/31/04, after the Immediate Priorities have been addressed)

- Provide guidance to applicants, other community residents, and community officials (through DRCs, the media and other appropriate avenues) that identifies and promotes mitigation measures for individual homes, businesses and community facilities to reduce or eliminate future flood and wind damage. Topics should include:
- If possible, collect and compile risk assessment data for flooding and severe storm hazards for the 19-county declared area, sufficient to meet the risk assessment planning requirements for state mitigation plans found in Sections 201.4/c/2/ii and iii of the Disaster Mitigation Act of 2000.
- Upon identification of communities particularly suitable for mitigation, contact local officials to determine the level of local interest in developing a partnership to reduce the community's future risk from flooding and severe storms. Conduct site visits with interested communities to gain commitment in developing projects and implementing appropriate mitigation measures.

With the assistance of the Michigan Department of Environmental Quality, promote NFIP participation among non-participating communities located within the declared area.

Hazard Mitigation Strategy for Federal Disaster #1777: 2008 Severe Storms and Flooding

The objective of mitigation is to reduce future disaster losses through acquisition and relocation of hazard-prone structures, structural retrofitting, mitigation education of community officials and residents, wise land use and development practices, prudent use of resources and funding, and encouragement of National Flood Insurance Program (NFIP) implementation and compliance, among other measures. Mitigation measures can also be implemented on public facilities through the use of Section 406 mitigation under the PA program.

Action	Lead Agency	Date Due
Prioritize and select projects that meet the goals and requirements of the HMGP for 1) non-funded Fiscal Year 2008 PDM projects and 2) the declared counties 3) non-declared counties.	MSP	7/14/2009
FEMA will provide technical assistance on HMGP applications throughout the grant application cycle.	FEMA	7/14/2009
State mitigation staff will update the State Administrative Plan for 1777-DR-MI in accordance with new FEMA management cost rules.	MSP	9/30/2008
Brief the MCCERCC on the proposed HMGP strategy and seek approval of the proposed priorities.	MSP	8/19/2008

Action	Lead Agency	Date Due
Promotion of Section 406 mitigation throughout affected counties through community outreach at Applicant Briefings and community questions to lead agencies	MSP/FEMA	ongoing
The Mitigation Branch will provide technical guidance to the PA Branch as requested for Section 406 Mitigation Issues	FEMA	ongoing

Action	Lead Agency	Date Due
Promote adoption of Local Mitigation Plans (LMP) in affected communities that meet requirements but have not been formally adopted through community outreach	MSP	12/31/2008
Promote adoption of LMPs throughout State of Michigan	MSP	12/31/2008
Analyze the necessity of updates to LMPs in counties with plans expiring within the next two years	MSP	12/31/2008
Meet with Osceola County to facilitate the completion of their local hazard mitigation plan.	MSP	8/1/2008
Provide technical / direct planning assistance to Osceola County, as required, to aid in the completion of a federally-approvable and DMA 2000 compliant hazard mitigation plan for the county.	MSP	12/31/2008

Action	Lead Agency	Date Due
Coordinate mitigation activities with on-going External Affairs Outreach Program	FEMA	On-going
Document success stories, as requested by the state, to promote mitigation activities.	FEMA	12/15/2008

Hazard Mitigation Strategy for Federal Disaster #4121: 2013 Central and Southern Michigan Flooding

TASK/ACTION	RESPONSIBLE AGENCIES	SCHEDULE	Task Number
Provide technical assistance on Local Hazard Mitigation Planning. Outreach to potential HMGP sub-applicant communities whose HM plans have expired or will expire.	MSP/EMHSD; FEMA	Ongoing	1
Expedite any pending FEMA reviews of Local Hazard Mitigation Plans.	FEMA	Ongoing	2
The State may use up to 7% of HMGP funds for local hazard mitigation planning grants, and will assist communities with application development. FEMA will work with the State to expedite Local Hazard Mitigation Planning Grant awards.	MSP/EMHSD; FEMA	Ongoing	3
Coordinate with GIS to review and validate geospatial and attribute data for State-owned critical facilities.	FEMA/ Michigan Dept. of Technology, Management and Budget/MSP/EMHSD	On Going	4
Resolve NEMIS access issue for the State, install most current NEMIS software, and provide refresher on NEMIS data entry	FEMA IT/FEMA HMA	July 2013	5
Coordinate the delivery of L276 Benefit Cost Analysis, a 2-day training session for local community, State and FEMA staff.	FEMA; MSP/EMHSD	TBD	6
Coordinate the delivery of L212 Unified Hazard Mitigation Assistance (HMA): Developing Quality Application Elements, a 3-day training session for local community, State and FEMA staff.	FEMA; MSP/EMHSD	TBD	7
Coordinate the delivery of L214 Unified HMA: Project Implementation and Programmatic Closeout, a 2-day training session for local community, State and FEMA staff.	FEMA; MSP/EMHSD	TBD	8
Provide technical assistance to state and local communities regarding Sandy Reform and Improvement Act (SRIA) policy changes and HMA Guidance.	MSP/EMHSD; FEMA	Ongoing	9
Solicit and review HMGP pre-applications.	MSP/EMHSD	Ongoing	10

TASK	RESPONSIBLE AGENCIES	SCHEDULE	TASK NUMBER
Update HMGP State Administrative Plan to reflect current policies and procedures and to ensure compliance with 206.437 for DR-4121-MI.	MSP/EMHSD	July 2013	11
FEMA review and approval of HMGP State Administrative Plan	FEMA	July 2013	12
Provide State with an initial estimate of Management Costs in accordance with 44 CFR 207.	FEMA	July 2013	13
Coordinate with GIS to review and validate geospatial and attribute data for State-owned critical facilities.	FEMA/ Michigan Department of Technology, Management and Budget/MSP/EMHSD	On Going	14
Identify and contact non-participating and sanctioned communities using letters and materials that encourage participation in the NFIP	FEMA	July 2013	15
Write letters to affected communities on Substantial Damage provisions.	FEMA	July 2013	16
Provide outreach to insurance agents to promote a better understanding of the NFIP	FEMA	July 2013	17
Provide outreach to Tribes in Michigan to promote hazard mitigation plans and NFIP participation.	FEMA	July 2013	18
Provide two advanced floodplain training modules: Post-disaster Responsibilities, and Substantial Improvement, Substantial Damage to MI Districts.	MDEQ/FEMA	July – August 2013	19
Encourage local officials from declared counties to participate in Emergency Management Institute course, *L273: Managing Floodplain Development Through the National Flood Insurance Program*.	MDEQ/FEMA	July – August 2013	20

HPA will utilize quantitative methodology to produce a loss avoidance report concerning completed mitigated properties. This report will demonstrate the value inherent in flood mitigation involving either elevation or acquisition of flood-prone structures. MSP has identified several projects in the declared area to investigate for inclusion in the study: Robinson Township, Ottawa County (9 homes acquired); Plainfield Township, Kent County (9 homes acquired); City of Wyoming, Kent County (3 homes acquired); and Ada Township, Kent County (1 home acquired). A FEMA Reservist will be deployed to complete this task.

TASK	RESPONSIBLE AGENCIES	SCHEDULE	TASK NUMBER
Develop loss avoidance reports for identified communities in the declared area using Region V benefit-cost methodology.	FEMA; MSP/EMHSD	August 30, 2013	22

TASK	RESPONSIBLE AGENCIES	SCHEDULE	
Provide 406 technical assistance and/or training, upon request, to maximize hazard mitigation opportunities	FEMA	Ongoing	23
Provide limited support for event frequency assessments (primarily of rural streams) at the request of PA, to assist BCA computations	FEMA; MDEQ USGS	August-September 2013	24

Hazard Mitigation Strategy for Federal Disaster #4195: 2014 Metro Detroit Severe Storms and Flooding

I. FLOODPLAIN MANAGEMENT & INSURANCE PRIORITIES

A very effective means of achieving long-term mitigation is through consistent enforcement of comprehensive local floodplain management regulations, as past experience has shown in Michigan. Thorough enforcement of local floodplain regulations and aggressive hazard mitigation projects for acquisition and relocation of flood prone structures have significantly reduced the exposure to flood damage. Local community officials, who are responsible for enforcing the local floodplain ordinances, deserve credit for the value of these activities. In support of these local officials' important work, Michigan Department of Environmental Quality (MDEQ) and FEMA will provide technical assistance and training to affected communities in meeting NFIP requirements. Targeted outreach will be conducted to reduce myths about flood insurance availability and coverage. Workshops and outreach materials will also be developed to educate insurance agents about basement flooding and provide information about the differences in coverage between flood insurance, homeowners insurance and sewer backup insurance.

GOAL 1: Provide technical assistance to the State of Michigan and communities for post-disaster NFIP compliance and insurance issues and opportunities.

Objective 1.1 — Assist state and local efforts regarding post-disaster NFIP compliance

- Provide technical assistance to local communities with substantial damage and use of the Substantial Damage Estimator program.
- Participate in public meetings in impacted communities to orient local officials and the public to NFIP compliance requirements and insurance opportunities.
- Support the State's community education efforts ("NFIP 101") in the designated area and provide similar training to staff of other branches within the Joint Field Office and Disaster Recovery Centers.

Objective 1.2 — Target insurance outreach to the needs of affected individuals and communities in the designated area.

- Assist the State in providing targeted outreach to insurance agents and the public in the designated area.
- Coordinate the timing and location of agent and lender training by NFIP insurance training subject matter experts to target impacted areas that may be underserved by agents writing flood insurance.
- Coordinate insurance outreach when possible with Region V Biggert-Waters outreach strategy and using supported workshops and webinars when appropriate.
- Coordinate insurance outreach with the State Coordinator, Michigan Department of Insurance and Financial Services, and insurance industry groups when possible.

Objective 1.3 — Provide FEMA training for local officials responsible for administering local floodplain management ordinances

- Field-deploy L273 "Managing Floodplain Development through the NFIP" to the JFO or another location in Michigan (in coordination with the State) to train local floodplain administrators.

Objective 1.4 — Assist interested communities to enhance their floodplain management activities through the NFIP Community Rating System (CRS) program.

- Coordinate timing and location of State and FEMA Floodplain Compliance Visits in communities in the designated areas.

II. GRANTS AND PLANNING

GOAL 2: Partner with the State of Michigan to assist communities in the development of cost effective and technically feasible mitigation projects.

Objective 2.1- Assist the State in solicitation of quality Hazard Mitigation Assistance applications from eligible communities by conducting training, seminars and technical assistance.

- FEMA will provide the initial estimate of State Management Costs to Michigan State Police, Emergency Management and Homeland Security Division (MSP/EMHSD), who will submit a request for State Management Costs in accordance with 44 CFR Section 207.
- MSP/EMHSD will update and submit an HMGP State Administrative Plan for DR-4195-MI and FEMA will review and approve that plan. This will include appropriate elements from The Sandy Recovery and Improvement Act (SRIA) of 2013, directing FEMA to streamline HMGP activities and implement the program in a timelier manner.

- At the request of the State of Michigan, FEMA will coordinate the delivery of the full suite of available HMA Grants Management training, post JFO, to allow for more complete HMGP applications to be submitted to the State. Courses will include L212 Introduction to Unified Hazard Mitigation Assistance, L213 Application Review and Evaluation, L214 Project Implementation and Programmatic Closeout, and L276 Benefit Cost Analysis.
- MSP/EMHSD will solicit Notices of Intent (to apply) from eligible applicants throughout the state. MSP/EMHSD will review HMGP Notices of Intent. FEMA will provide technical assistance to state and local officials to administer HMGP using the FY2013 Unified HMA Guidance, as requested.
- FEMA and MSP/EMHSD will work together to explore what actions would be eligible as a 5% HMGP state-designated priority application to update the Michigan Repetitive Loss data base with property specific data including pictures, first floor elevations, and base flood elevations.
- Provide assistance to the MSP/EMHSD with application process from development through submission.

Objective 2.2 – Conduct outreach and prioritize planning projects for designated communities regarding Hazard Mitigation planning.

- FEMA and MSP/EMHSD will contact jurisdictions statewide lacking current Hazard Mitigation plans, or at risk of current plans expiring, to encourage participation in the planning process.
- FEMA and MSP/EMHSD will determine the best method of providing technical assistance to those counties in the State without plans, or that have plans that will expire within the next 2 years.
- FEMA and MSP/EMHSD will visit those communities in the designated area, that do not have plans, or that have plans that will expire within the year, to provide technical assistance as needed.

III. COMMUNITY EDUCATION & OUTREACH PRIORITIES

GOAL 3: Promote effective hazard mitigation through community education, outreach, training, and coordination with the public and private sectors.

Objective 3.1 – Explore various methods of delivery of the mitigation message to the citizens of Michigan.

- Capture and develop Best Practice story opportunities, including those based on past Hazard Mitigation projects implemented in designated areas that performed well.
- Identify and provide Hazard Mitigation resources and/or staff to support functional needs groups.
- Coordinate with Michigan Voluntary Organizations Active in Disasters (MIVOAD) to incorporate mitigation methods and techniques in rebuilding and repair of damaged structures.

Objective 3.2 – Offer outreach information on insurance and mitigation measures that may be taken to minimize damage from future disasters at commonly visited locations during the recovery period.

- Provide staffing and resources to deliver hazard mitigation and NFIP information to visitors at all Disaster Recovery Centers (DRCs).
- Develop and implement a plan to staff mitigation tables at various home improvement and other retail stores and special events across the disaster area to make additional contact with residents in impacted areas.
- Provide staffing and resources to deliver hazard mitigation and NFIP information to visitors at all Disaster Survivor Assistance (DSA) sites as needed.

IV. HAZARD PERFORMANCE ANALYSIS

GOAL 4: Partner with the State to provide technical assistance on Hazards Performance Analysis.

Objective 4.1 – Coordinate with Public Assistance (PA) in providing and advocating technical assistance on Section 406 Mitigation Opportunities for implementation on all appropriate PA Projects.

- Determine if the State is interested in a Section 406 Mitigation Briefing as part of the Public Assistance Training at the JFO.
- Support Public Assistance in the identification and review of mitigation opportunities on PA Projects.

Objective 4.2 – Provide technical assistance on issues related to levees, floodplain mapping, and the mitigation Best Practices initiative as needed.

- Attend public meetings, in coordination with the State, where the potential exists for questions concerning levees, floodplain mapping, or other engineering concerns.

Hazard Mitigation Strategy for Federal Disaster #4326: 2017 Saginaw Bay Area Severe Storms and Flooding

I. FLOODPLAIN MANAGEMENT AND INSURANCE

Long-term mitigation can best be achieved through consistent enforcement of comprehensive local floodplain management regulations. In support of local officials' important work, the Michigan Department of Environmental Quality (MDEQ) and FEMA will provide technical assistance and training to affected communities in meeting NFIP requirements. FEMA-targeted outreach will be conducted to reduce myths about flood insurance availability and coverage. FEMA will reach out to educate insurance agents about basement flooding and provide information about the differences in coverage between flood insurance, homeowners insurance and sewer backup insurance.

GOAL 1: FEMA will provide technical assistance to the State of Michigan and communities for post-disaster NFIP compliance and insurance issues and outreach opportunities

Objective 1.1 - FEMA will assist state and local efforts regarding post-disaster NFIP compliance.

- FEMA will conduct NFIP outreach to non-participating communities, including the Saginaw Chippewa Tribe.
- FEMA and MDEQ will provide Michigan-specific floodplain management training for state and local officials. This activity will occur sometime in 2018.
- FEMA and MDEQ will provide technical assistance to communities for NFIP substantial damage requirements. A Community Assistance Contact will be conducted with the City of Midland as part of this effort.

Objective 1.2 - FEMA will target insurance outreach to the needs of affected individuals, insurance agents, and communities in the affected area.

- The FEMA Region V Flood Insurance Liaison and Michigan NFIP State Coordinator will contact the Michigan State Insurance Commissioner's office to discuss identified insurance trends from this event and to develop a coordinated Federal/State agent outreach plan for flood insurance in Michigan.
- FEMA will assist the State in providing targeted outreach to insurance agents and the public in the designated area. This activity will include messaging on flood insurance availability, Preferred Risk Policies, and basement coverage.
- FEMA will provide insurance data and analysis, as requested, to state, local and tribal agencies.
- FEMA will support a September 2017 Emergency Preparedness Month outreach event to encourage the purchase of flood insurance in Midland County.

II. GRANTS AND PLANNING

GOAL 2: FEMA will partner with the State of Michigan to assist communities in the development of hazard mitigation plans and projects

Objective 2.1 - FEMA will implement the HMGP with the Michigan State Police/Emergency Management and Homeland Security Division (MSP/EMHSD).

State Responsibilities:

- Submit the HMGP Administrative Plan.
- Provide technical assistance on HMGP for local officials using the 2015 Hazard Mitigation Assistance Guidance.
- Perform the initial review of the HMGP applications to ensure that all information and documentation is provided.
- Submit SF 424 and Assurances for the Disaster.

FEMA Responsibilities:

- Review and approve the HMGP Administrative Plan.
- Provide technical assistance to the State, as necessary.
- Provide State with 30-day and 6-month estimate, and 1-year lock-in amounts.
- Review and approve eligible and complete applications submitted by the State.

Objective 2.2 - FEMA will assist the State in solicitation of quality Hazard Mitigation Assistance applications from eligible communities by conducting training and providing technical assistance.

- FEMA will provide the initial estimate of State Management Costs to MSP/EMHSD, who will submit a request for State Management Costs in accordance with 44 CFR Section 207.

- At the request of the State of Michigan, FEMA will coordinate the delivery of the full suite of available Hazard Mitigation Assistance (HMA) Grants Management training, post JFO, to allow for more complete HMA applications to be submitted to the State.
- FEMA will meet with the Michigan Citizen-Community Emergency Response Coordinating Council (MCCERCC) to discuss hazard mitigation and HMA applications, which is aligned with their mission to "reduce, prevent, and prepare for emergencies or disasters."
- FEMA will pilot an analysis of repetitive loss and severe repetitive loss data within the designated counties for MSP/EMHSD's use in planning for and prioritizing Hazard Mitigation Assistance applications. The small scale of the event lends itself to this opportunity.
- MSP/EMHSD will solicit Notices of Intent (to Apply) from eligible applicants. MSP/EMHSD will review HMGP Notices of Intent.
- FEMA will provide support to MSP/EMHSD in establishing processes and procedures for soliciting interest from eligible sub-applicants to apply for HMGP and other HMA funds.
- FEMA and MSP/EMHSD will coordinate efforts to ensure potential HMA sub-applicants are able to take advantage of both pre- and post- disaster grant programs wherever possible in an organized fashion that maximizes mitigation opportunities.
- FEMA staff will assist MSP/EMHSD with limited on-site assessments of potential HMA projects.
- FEMA will provide assistance to MSP/EMHSD with the application process from development through submission.

Objective 2.3 - FEMA will assist the State in prioritizing planning projects and supporting local hazard mitigation plan development.

- MSP/EMHSD will contact counties statewide that currently lack a mitigation plan, or will have a plan expire in the next two years, to provide HMA application information on planning grants to finance mitigation plan development.
- FEMA and MSP/EMHSD will provide technical assistance to counties developing mitigation plans as needed (may include in-person training, webinars, and/or guidance).
- FEMA will provide support and technical assistance to MSP/EMHSD as needed for update of the State Hazard Mitigation Plan that will expire in April 2019.

Objective 2.4 - FEMA will provide nation-to-nation technical assistance to the Saginaw Chippewa Tribe with respect to hazard mitigation planning and projects.

- FEMA will assist the Saginaw Chippewa Tribe in scoping the possibilities for a hazard mitigation plan.
- FEMA will provide HMA application information to the Saginaw Chippewa Tribe on planning grants to finance mitigation plan development.
- FEMA will provide technical assistance to the Saginaw Chippewa Tribe and guidance on 44 CFR 201.7 tribal planning regulations.
- FEMA will provide information and outreach on opportunities for hazard mitigation projects and application development.

III. COMMUNITY EDUCATION AND OUTREACH (CEO)

GOAL 3: FEMA will promote effective hazard mitigation through community education, outreach, training and coordination with individuals, communities, and non-governmental organizations.

Objective 3.1 - FEMA will assist the State in the creation of products to deliver the mitigation message to the citizens of Michigan.

- FEMA and MSP/EMHSD will capture and develop Best Practice and Success Stories including a Bay County detention basin and a Midland County acquisition and demolition—both HMA projects implemented in the designated areas that performed well in DR-4326.
- FEMA and MSP/EMHSD will disseminate Best Practices through the FEMA and MSP/EMHSD websites, Michigan Hazard Mitigation Success Stories (Publication 106a), and/or direct transmission to potential HMA sub-applicants.

Objective 3.2 - FEMA will offer direct outreach and education on insurance and mitigation measures that may be taken to minimize damage from future disasters.

- FEMA will develop and implement a plan to staff mitigation tables at six home improvement stores across the disaster area, focusing on the areas hit hardest by the storm, to make additional contact with residents in impacted areas.

- FEMA Hazard Mitigation will coordinate with FEMA External Affairs to disseminate information on flood insurance to the public in the designated area.
- FEMA will provide staffing and resources to deliver information on hazard mitigation topics relevant in DR-4326, such as the installation of sewer backflow valves, NFIP (and Preferred Risk) flood insurance policies, sewer backup insurance riders, and the elevation of basement utilities to visitors at the following sites:

Site	Address	City	County
Disaster Recovery Center 1	1407 West Carpenter Street	Midland	Midland
Disaster Recovery Center 2	4855 East Blue Grass Street	Mount Pleasant	Isabella
Disaster Recovery Center 3	4101 Wilder Road	Bay City	Bay
Disaster Recovery Center 4	555 West Cedar Road	Gladwin	Gladwin
Midland County Fair	6905 Eastman Avenue	Midland	Midland
Home Improvement Store 1	3128 Jefferson	Midland	Midland
Home Improvement Store 2	4615 Encore Drive	Mt. Pleasant	Isabella
Home Improvement Store 3	2864 East Wilder Road	Bay City	Bay
Home Improvement Store 4	630 North Silverleaf Street	Gladwin	Gladwin
Home Improvement Store 5	1100 Joe Mann	Midland	Midland
Home Improvement Store 6	5650 East Prickard Road	Mt. Pleasant	Isabella
Business Recovery Center*	220 West Main Street	Midland	Midland

<u>Objective 3.3</u> - FEMA will conduct training and informational sessions on pressing mitigation issues to JFO staff.

- FEMA Hazard Mitigation will conduct training to Individual Assistance staff in the JFO on the role of mitigation in a disaster, placing emphasis on the connections between Individual Assistance and Hazard Mitigation.
- FEMA Hazard Mitigation will coordinate with FEMA Individual Assistance to provide a briefing to Michigan Voluntary Organizations Active in Disasters to incorporate mitigation methods and techniques in rebuilding and repair of damaged structures.
- FEMA Hazard Mitigation will offer an informational session to JFO Leadership on NFIP Community status definitions and Hazard Mitigation planning deadlines and important disaster-related implications.

IV. HAZARD PERFORMANCE ANALYSIS (HPA)

GOAL 4: FEMA will provide engineering and technical data to enable communities affected by this disaster to become less vulnerable to future events

<u>Objective 4.1</u> - FEMA will develop a *Best Available Flood Hazard Data Executive Summary* to specifically identify and describe all available flood hazard mapping products in the designated counties.

- HPA will create a *Best Available Flood Hazard Data Executive Summary* as soon as possible and provide it to the State of Michigan, local jurisdictions, and all other federal recovery programs (Appendix 6). This summary will enable stakeholders to make informed rebuilding decisions during the recovery process.

Best Available Flood Hazard Data

Bay County			
Community	**Effective FIRM Date**	**Preliminary FIRM Date**	**Ongoing Study**
Bay Countywide	9/17/2010		
Bay City LOMR	3/10/2017		
Coastal Communities		TBD	Lake Huron Coastal Project; Draft Workmaps Planned for May 2018
Gladwin County			
Community	**Effective FIRM Date**	**Preliminary FIRM Date**	**Ongoing Study**
Gladwin Countywide	6/20/2018 (Projected)	3/27/2015	90 Day Appeals Period for Revised Preliminary FIRM held July – October 2016
Hay Township	9/22/1999		
Isabella County			
Community	**Effective FIRM Date**	**Preliminary FIRM Date**	**Ongoing Study**
Isabella Countywide	5/4/2009		None
Midland County			
Community	**Effective FIRM Date**	**Preliminary FIRM Date**	**Ongoing Study**
Midland Countywide	5/4/2009		None
Multi-panel Revision	1/6/2013		
City of Midland Revision	2/4/2014		

Hazard Mitigation Strategy for Federal Disaster #4381:
2018 Upper Peninsula Severe Storms, Flooding, Landslides and Mudslides

- **FLOODPLAIN MANAGEMENT AND INSURANCE**

Long-term mitigation can best be achieved through consistent enforcement of comprehensive local floodplain management regulations. In support of local officials' important work, the Michigan Department of Environmental Quality (MDEQ) and FEMA will provide technical assistance and training to affected communities in meeting NFIP requirements. FEMA targeted outreach will be conducted to reduce myths about flood insurance availability and coverage.

GOAL 1: FEMA will provide technical assistance to the State of Michigan and communities for post-disaster NFIP compliance and insurance issues and outreach opportunities

Objective 1.1 - FEMA will assist state and local efforts regarding post-disaster NFIP compliance.

- FEMA and MDEQ will provide NFIP support to participating communities to ensure continued compliance with minimum NFIP regulations.
- FEMA will conduct Community Assistance Contacts (CACs) in coordination with MDEQ in the 21 participating communities within the three declared counties, in person or via telephone.
- FEMA and MDEQ will conduct substantial damage education to participating communities during CACs and follow up with phone calls and visits where requested/necessary.
- FEMA, in coordination with MDEQ, will provide printed materials in person or by mail to non-participating/never mapped communities regarding how the NFIP works and how to join the program, to be completed by end of September 2018.

Objective 1.2 - FEMA will target insurance outreach to the needs of communities in the affected area.

- MDEQ will send information letters to non-participating communities highlighting the benefits of the NFIP and the process of joining.
- FEMA will visit the three sanctioned communities within the declared counties to encourage NFIP participation.
- FEMA will send information letters to sanctioned communities explaining what it means to be a sanctioned community and the process to join or re-enroll in the NFIP.
- FEMA will provide insurance data and analysis, as requested, to state, local and tribal agencies.

- **GRANTS AND PLANNING**

GOAL 2: FEMA will partner with the State of Michigan to assist communities in the development of hazard mitigation plans and projects

Objective 2.1 - FEMA will implement the HMGP with the Michigan State Police/Emergency Management and Homeland Security Division (MSP/EMHSD).

State Responsibilities:

- Submit the HMGP Administrative Plan.*
- Provide technical assistance on HMGP for tribal and local officials using the 2015 Hazard Mitigation Assistance Guidance.
- Perform initial review of the HMGP applications for project eligibility and completeness to ensure that all information and documentation is provided.
- Submit HMGP applications to FEMA within 12 months of the date of declaration.
- Submit SF 424 and Assurances for the Disaster.*

*Needs to be submitted/approved before any obligations occur.

FEMA Responsibilities:

- Review and approve the HMGP Administrative Plan.
- Provide technical assistance to the State, as necessary.
- Provide State with 30-day and 6-month estimates, and 1-year lock-in amount.
- Review and approve eligible, complete, technically feasible, and cost-effective applications submitted by the State.

<u>Objective 2.2</u> - FEMA will partner with the State to identify mitigation opportunities and solicit quality Hazard Mitigation Assistance (HMA) applications from eligible sub-applicants.

- FEMA will provide Areas of Mitigation Interest (AOMI) data and information collected from the initial discovery stage of the Risk MAP cycle.
- The State will review their HMGP priorities as defined in the state hazard mitigation plan by end of September 2018.
- The State will solicit input from County Emergency Management Coordinators, MDOT, MDEQ, and MDNR regarding HMGP project opportunities. This effort will specifically seek information regarding known at-risk areas that were not damaged from this event, to be completed by end of November 2018.
- FEMA will provide support to the State in soliciting interest from eligible sub-applicants to apply for HMGP and other HMA funds, to include distribution of HMA materials as well as in-person meetings with community officials as needed, to be completed by end of November 2018.
- FEMA and the State will explore the use of Advance Assistance to develop mitigation strategies and/or obtain data to prioritize, select, and develop complete HMGP sub-applications. This effort will focus on: the potential acquisition and demolition of homes that were destroyed or suffered major damage; and the mitigation of flooding that has affected storm water drains and culverts, streams and natural drainage ways, and historical railroad grade crossings in areas where steep ravines exist. To be completed by end of October 2018.
- At the request of the State of Michigan, FEMA will coordinate the delivery of the full suite of available HMA Grants Management training (to include application development workshop and benefit-cost analysis training) post-JFO, to allow for more complete HMA applications to be submitted to the State. To be completed by end of March 2019.
- FEMA and the State will coordinate ongoing efforts to ensure potential HMA sub-applicants are able to take advantage of both pre- and post- disaster grant programs wherever possible in an organized fashion that maximizes mitigation opportunities.
- The State will solicit and review HMGP Notices of Intent (to Apply) from eligible sub-applicants by end of February 2019.

<u>Objective 2.3</u> - FEMA will partner with the State to assist in the development of hazard mitigation plans.

- FEMA will identify those communities without a mitigation plan, as well as those set to expire within 24 months, statewide.
- FEMA will identify communities that have not yet adopted their local hazard mitigation plan.
- FEMA and the State will develop a draft letter to send to communities that have not yet adopted their local mitigation plan by end of September 2018.
- FEMA and the State will provide HMA application information on grants to finance mitigation plan development by end of November 2018.
- FEMA and the State will provide technical assistance (may include in-person training, tools, outreach, etc.) as requested to help communities develop and update mitigation plans.

- **HAZARDS AND PERFORMANCE ANALYSIS (HPA)**

GOAL 3: FEMA will provide engineering and technical data to enable communities affected by this disaster to become less vulnerable to future events

<u>Objective 3.1</u> - FEMA will develop a memorandum to specifically identify and describe all available flood hazard data and products in the designated counties.

- HPA will create a memorandum, *Guidance for Use of Available Information in Complying with 44 CFR § 9 and Executive Order 11988 (Floodplain Management)*, and provide it to the State of Michigan and those involved in recovery programs by end of October 2018 in order to enable stakeholders to make informed rebuilding decisions during the recovery process.

Hazard Mitigation Strategy for Federal Disaster #4547: May 2020 Flooding and Dam Failures in Five Counties

The strategy includes short and long-term efforts to reduce the impact of damage from future disasters through the implementation of HM programs. Post-disaster, this is accomplished through comprehensive efforts authorized by the Stafford Act, as amended by the Disaster Mitigation Act of 2000, the National Flood Insurance Act, the Flood insurance Reform Act, and Executive Orders.

Goal 1: Provide technical assistance to help identify mitigation opportunities/assist communities in the development of cost-effective and technically feasible mitigation projects by providing the following resources to applicable stakeholders:

Objective 1.1 – Provide the most recently updated Available Flood Hazard Information Memo.

Objective 1.2 – Provide the Dam Safety Incident-Specific Technical Assistance Study.

Objective 1.3 – Provide other regulatory and nonregulatory flood risk products to supplement other resources, current and future flood risk awareness, emergency response planning, and floodplain management regulation.

Goal 2: Maximize financial resources, including the HMGP, PA Section 406 Mitigation, and other applicable state and federal programs (i.e., HHPD). Resources would be used for the following HMPG priorities/objectives (to include acquisition/demolition and floodproofing mitigation measures):

Objective 2.1 - Acquisition and demolition of repetitive loss and severe repetitive loss properties in the declared counties and affected communities.

Objective 2.2 - Acquisition and demolition of the substantially damaged properties in the floodplain of the declared counties and affected communities.

Objective 2.3 - Acquisition and demolition of properties in the floodway/flood fringe in the declared counties and the affected communities.

Objective 2.4 - Acquisition of flood-prone properties outside the floodway/flood fringe in the declared counties and the affected communities.

Objective 2.5 - Other mitigation projects such as minor flood control projects (e.g., detention ponds and storm sewer improvements); protection of utilities; etc. in the declared counties and the affected communities.

Objective 2.6 - Acquisition and demolition of any flood prone properties statewide.

Objective 2.7 - Development or update of local all-hazards mitigation plans.

Objective 2.8 - Other mitigation projects such as: minor flood control projects (e.g., detention ponds and storm sewer improvements); protection of utilities; etc. statewide.

Goal 3: Promote the NFIP/effective floodplain management through outreach, education, and technical assistance.

Objective 3.1 - Provide floodplain management compliance information and technical assistance to state, county, and community officials.

Objective 3.2 – Enforcement of local floodplain management programs.

Goal 4: Utilize virtual outreach methods to inform the public about ways to reduce risk of flood damage and encourage awareness and preparedness for future events.

Objective 4.1 - Promote and market messaging on mitigation best practices and activities.

Objective 4.2 - Coordinate with HQ, other regions, external affairs, and Individual Assistance to utilize the latest virtual practices to bring mitigation messaging to affected areas.

Appendix 15: Executive Actions for Flood Mitigation

EXECUTIVE DIRECTIVE No. 2001 - 5

STATE FLOOD HAZARD MITIGATION

DATE: September 11, 2001

TO: All Directors and Agency Heads

FROM: Governor John Engler (signed)

SUBJECT: State Flood Hazard Mitigation

Recent flood events in Michigan are serious reminders that economic losses from flood damage can occur regardless of season and in spite of the current low Great Lakes water levels. Last September's flooding in southeast Michigan resulted in the most expensive Presidential Disaster Declaration in the history of the state of Michigan. The federal and state governments have expended more than $200 million responding to this flood event.

The state of Michigan has extensive and continuous programs for the construction of buildings, roads and other facilities, which influence patterns of commercial, residential and industrial development in flood-prone areas. State agencies play an important role in avoiding the uneconomic, hazardous or unnecessary use of floodplains for activities that impair the beneficial functions of such areas. Furthermore, state agencies, leading by example, can provide local government and the public with a model that allows for optimum floodplain management and the mitigation of existing flood hazards.

Therefore, I direct the Department of Environmental Quality ("DEQ"), as the lead agency, to develop a statewide, inter-agency, flood mitigation strategy to assure compliance with the State Flood Hazard Mitigation Plan. In many respects, this strategy will involve the implementation of aspects of the State Flood Hazard Mitigation Plan, which was originally developed pursuant to the provisions of Executive Order 1977-4 issued by Governor William G. Milliken. The Michigan Hazard Mitigation Coordinating Council, an entity created by Executive Order 1998-5, currently assists in the development, maintenance and implementation of the State Flood Hazard Mitigation Plan.

The DEQ shall develop this strategy in cooperation with the Department of State Police, the Department of Consumer and Industry Services ("CIS"), the Department of Management and Budget ("DMB"), the Department of Transportation, and the Michigan Hazard Mitigation Coordinating Council. Other state departments and agencies shall cooperate in the development of the strategy as requested by DEQ.

In addition to general provisions implementing the State Flood Hazard Mitigation Plan, the mitigation strategy shall specifically include the following:

1. A review of administrative rules promulgated by DEQ found in Part 13 – Floodplains and Floodways, of the DEQ's Water Resources Protection rules, located at R. 323.1311 et seq. of the Michigan Administrative Code. This review shall determine if current regulations adequately prevent state activities that cause the loss of water storage capacity in the state's floodplains. Additionally, the review shall determine if current regulations provide adequate flood resistant construction standards for state riverine and inland lake floodplain construction activities. The strategy shall recommend changes in the applicable regulations when necessary and appropriate to assure compliance with the State Flood Hazard Mitigation Plan.

2. A review of administrative rules promulgated by DEQ entitled Great Lakes Shorelands located at R. 281.21 et seq. of the Michigan Administrative Code. This review shall determine if current regulations include adequate measures to assure flood resistant construction standards apply to state construction activities in Great Lakes floodplains. The strategy shall recommend changes in the applicable regulations when necessary and appropriate to assure compliance with the State Flood Hazard Mitigation Plan.

3. A review of administrative rules promulgated by the Department of Consumer and Industry Services ("CIS") addressing Land Divisions (R. 560.101 et seq.), Condominium Development (R. 559.101 et seq.) and Mobile Home Park Development (R. 325.3311 et seq.). This review shall determine if current regulations include adequate measures to prevent state development that would cause the state to incur flood damages for floods up to and including a 100-year flood. The strategy shall recommend changes in the applicable regulations when necessary and appropriate to assure compliance with the State Flood Hazard Mitigation Plan.

4. A review of the provisions of the Single State Construction Code Act, Act No. 245 of the Public Acts of 1999, being Section 125.1501 et seq. of the Michigan Compiled Laws, and any administrative rules promulgated by CIS under the act (R. 408.30101 et seq.). This review shall determine if state development in floodplain areas complies with the provisions of the Act and the administrative rules adopted pursuant to the Act. The strategy shall recommend changes in the applicable regulations when necessary and appropriate to assure compliance with the State Flood Hazard Mitigation Plan.

5. The establishment of a coordination mechanism between DMB and DEQ to assure that the construction of buildings and other state facilities avoids the use of flood-prone lands whenever possible and to assure that new state facilities are designed to minimize potential flood damage when necessary and appropriate.

6. The preparation and implementation of an educational program for the general public and local units of government focusing on the need to reduce flood damages.

Flood damage prevention is of great importance to the safety, health and welfare of our citizens. I am confident that state departments and agencies can and will assist in the development of a more effective flood mitigation strategy and thereby minimize the likelihood that state property will be damaged during future flood events.

Thank you for your cooperation.

STATE OF MICHIGAN
Executive Office * Lansing

EXECUTIVE ORDER 1977-4

STATE FLOOD HAZARD MITIGATION PLAN

WHEREAS, uneconomic uses of the State's flood plains are occurring and potential flood losses are increasing; and

WHEREAS, the State has extensive and continuing programs for the construction and reconstruction of buildings, roads, and other facilities and annually disposes of hundreds of land parcels that may be flood prone, all of which activities significantly influence patterns of commercial, residential, and industrial development; and

WHEREAS, State land use planning programs are determining factors in the utilization of lands; and

WHEREAS, the Federal Flood Disaster Protection Act of 1973 (P. L. 93-234) and the National Flood Insurance Program requires a state management plan;

NOW, THEREFORE, I, WILLIAM G. MILLIKEN, Governor of the State of Michigan, pursuant to the authority vested in me by the Michigan Constitution, laws of the State of Michigan, and the applicable provisions of P. L. 93-234, hereby order the following:

1. The Department of Natural Resources, Water Management Division is hereby designated as the state agency to supervise and administer the state flood hazard management program. Requests for information or technical assistance to implement the provisions of this Order shall be directed to the Water Management Division.

2. The heads of the State agencies shall provide leadership in encouraging a broad and unified effort to prevent uneconomic uses and development of the State's flood plains and, in particular, to lessen the risk of flood losses in connection with State lands and installations and State financed or supported improvements.

3. To implement this mandate, it is hereby ordered that:

    a) All State agencies directly responsible for the construction of State buildings, structures, roads, or other facilities shall evaluate flood hazards when planning the location of new facilities and, as far as practicable, shall preclude the uneconomic, hazardous, or unnecessary use of flood plains in connection with such facilities.

    b) With respect to existing State owned properties which have suffered flood damage or which may be subject thereto, the responsible agency head shall require conspicuous delineation of past and probable flood heights so as to assist in creating public awareness of the knowledge about flood hazards. Whenever practical and economically feasible, flood proofing measures shall be applied to existing facilities in order to reduce flood damage potential.

    c) All State agencies responsible for the disposal of State lands or properties shall evaluate flood hazards in connection with lands or properties proposed for disposal to non-State public instrumentalities or private interests and, as may be desirable in order to minimize future public expenditures for flood protection and flood disaster relief and as far as practicable, shall attach appropriate restrictions with respect to uses of the lands or properties by the purchaser and his successors and may withhold such lands or properties from disposal.

d) All State agencies responsible for programs which entail land use planning shall take flood hazards into account when evaluating plans and shall encourage land use appropriate to the degree of hazard involved.

4. All flood hazard evaluations shall be based upon a base flood that has a 1% chance of being equaled or exceeded in any given year, commonly known as a 100-year flood.

5. Proposals for new construction, substantial improvements or other developments or alteration within a flood hazard area shall be guided by the following standards:

   a) Encroachments within the floodway of a stream that would result in any increase in flood stage shall be prohibited unless approved by the Department of Natural Resources.

   b) All new construction and substantial improvements shall have the lowest floor (including basement) elevated to or above the base flood level. Non-residential construction may be designed with attendant utility and sanitary facilities so that below the base flood level, the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capacity of resisting hydrostatic and hydrodynamic loads and effects of buoyance. Any utilization of flood proofing techniques shall require a certification from a registered engineer or architect that the flood proofing methods are adequate to withstand the flood depths, hydrostatic pressures, velocities, impact, and uplift pressures associated with the base flood. All certificates indicating the elevation at mean sea level datum to which such structures are flood proofed shall be kept on record within the State agency responsible for the structure.

6. Requests for appropriations for State construction of new buildings, structures, roads, or other facilities shall be accompanied by a statement by the head of the agency on the findings of his agency's evaluation and consideration of flood hazards in the development of such requests. If the construction is in a flood prone area, the statement shall contain a letter of non-objection from the Department of Natural Resources.

7. The State agencies shall proceed immediately to develop such procedures, regulations, and information as are provided for in, or may be necessary to carry out, the provisions of this Order.

Given under my hand and the Great Seal of the State of Michigan this Thirteenth day of May in the Year of Our Lord, One Thousand Nine Hundred and Seventy-Seven and of the Commonwealth One Hundred Forty-One.

(signed by William G. Milliken)
GOVERNOR

BY THE GOVERNOR:

(signed by Richard H. Austin)
Secretary of State

APPENDIX 16: Review Sheets and Standards

FEMA: State Hazard Mitigation Plan Review Tool
(Appendix B from "State Mitigation Plan Review Guide," March 2015)

MSP/EMHSD: Review Sheets for Local Hazard Mitigation Plans

EMAP: Selected Guidance for Emergency Management Accreditation Program Compliance

NOTE: The State Review Sheet for Local Hazard Mitigation Plans is included here because it contains a few additional elements that are not present on the FEMA "Crosswalk" review sheet for local hazard mitigation plans, including elements encouraging the coordination of local and state hazard mitigation plans.

APPENDIX B: STATE MITIGATION PLAN REVIEW TOOL

This section is organized as follows:

B.1 Plan Review Tool Summary
B.2 Standard State Mitigation Plan Regulation Checklist
B.3 Enhanced State Mitigation Plan Regulation Checklist
B.4 Strengths and Opportunities for Improvement

FEMA uses the State Mitigation Plan Review Tool ("**Plan Review Tool**") to document how the state mitigation plan meets the regulation. If plan requirements are not met, FEMA informs the state of the changes it needs to make in each of the Required Revisions sections.

The **"Strengths and Opportunities for Improvement"** summary offers FEMA an opportunity to provide more comprehensive feedback to the state.

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The FEMA Plan Approver must reference the *State Mitigation Plan Review Guide* when completing the *Plan Review Tool*. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.'

The **"Required Revisions"** summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate number, where applicable. Requirements for each Element and sub-element are described in detail in the *State Mitigation Plan Review Guide*.

FEMA will provide a narrative summary of the review findings that includes a discussion of "**Strengths and Opportunities for Improvement"** as a means to offer more comprehensive feedback to the state to acknowledge where the plan exceeds minimum requirements as well as provide suggestions for improvements. FEMA will describe the strengths that are demonstrated and highlight examples of best practices.

FEMA may provide suggestions for improvement as part of the *Plan Review Tool* or in a separate document. FEMA's suggestions for improvement are not required to be made for plan approval.

Required revisions from the Regulation Checklist are not documented in the "**Strengths and Opportunities for Improvement"** section.

B.1 Plan Review Tool Summary

State:	Title and Date of Plan:	Date of Submission:
State Point of Contact (Name / Title): **Address** : **Agency** : **Phone Number** : **E-Mail** :		

Date Received in FEMA Region:	
FEMA Reviewer (Planning – Name / Title):	**Date:**
FEMA Reviewer (HMA – Name / Title):	**Date:**
FEMA Reviewer (Name / Title):	**Date:**
FEMA Reviewer (Name / Title):	**Date:**
FEMA Approver (Name / Title):	**Date:**
Plan Status (Not Approved, Approvable Pending Adoption, Approved):	**Date:**

SUMMARY	**YES**	**NO**
STANDARD STATE MITIGATION PLAN		
Does the plan meet the standard state mitigation plan requirements?		
REPETITIVE LOSS STRATEGY		
Does the plan include a Repetitive Loss Strategy? [see S6 / RL1; S8 / RL2; S9 / RL3; S10 / RL4; S13 / RL5; and S15 / RL6]		
ENHANCED STATE MITIGATION PLAN		
Does the plan meet the enhanced state mitigation plan requirements?		

B.2 Standard State Mitigation Plan Regulation Checklist

REGULATION CHECKLIST – STANDARD PLAN *M=Met; NM=Not Met	Location in Plan	M / NM*
STANDARD (S) STATE MITIGATION PLAN		
Planning Process		
S1. Does the plan describe the planning process used to develop the plan? [44 CFR §§201.4(b) and (c)(1)]		
S2. Does the plan describe how the state coordinated with other agencies and stakeholders? [44 CFR §§201.4(b) and (c)(1)]		
Required Revisions:		
Hazard Identification and Risk Assessment		
S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state? [44 CFR §201.4(c)(2)(i)]		
S4. Does the risk assessment provide an overview of the probabilities of future hazard events? [44 CFR §201.4(c)(2)(i)]		
S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S6. Does the risk assessment include an overview and analysis of the vulnerability of jurisdictions to the identified hazards and the potential losses to vulnerable structures? [44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S7. Was the risk assessment revised to reflect changes in development? [44 CFR §201.4(d)]		
Required Revisions:		

Mitigation Strategy and Priorities		
S8. Does the mitigation strategy include goals to reduce / avoid long-term vulnerabilities from the identified hazards? [44 CFR §201.4(c)(3)(i)]		
S9. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment? [44 CFR §§201.4(c)(3)(iii) and (iv)]		
S10. Does the plan identify current and potential sources of funding to implement mitigation actions and activities? [44 CFR §201.4(c)(3)(iv)]		
S11. Was the plan updated to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities? [44 CFR §201.4(d)]		
Required Revisions:		
State Mitigation Capabilities		
S12. Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment? [44 CFR §201.4(c)(3)(ii)]		
Required Revisions:		

REGULATION CHECKLIST – STANDARD PLAN *M=Met; NM=Not Met	Location in Plan	M / NM*
Local Coordination and Mitigation Capabilities		
S13. Does the plan generally describe and analyze the effectiveness of local and tribal, as applicable, mitigation policies, programs, and capabilities? [44 CFR §201.4(c)(3)(ii)]		
S14. Does the plan describe the process to support the development of approvable local and tribal, as applicable, mitigation plans? [44 CFR §§201.3(c)(5) and 201.4(c)(4)(i)]		
S15. Does the plan describe the criteria for prioritizing funding? [44 CFR §201.4(c)(4)(iii)]		
S16. Does the plan describe the process and timeframe to review, coordinate and link local and tribal, as applicable, mitigation plans with the state mitigation plan? [44 CFR §§201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)]		
Required Revisions:		
Plan Review, Evaluation, and Implementation		
S17. Is there a description of the method and schedule for keeping the plan current? [44 CFR §§201.4(c)(5)(i) and 201.4(d)]		
S18. Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§201.4(c)(5)(ii) and 201.4(c)(5)(iii)]		
Required Revisions:		
Adoption and Assurances		
S19. Did the state provide documentation that the plan has been formally adopted? [44 CFR §201.4(c)(6)]		
S20. Did the state provide assurances? [44 CFR §201.4(c)(7)]		
Required Revisions:		
Repetitive Loss (RL) Strategy		
RL1. Did Element S6 (risk assessment) address RL and SRL properties? [44 CFR §§201.4(c)(2)(ii), 201.4(c)(2)(iii), and 201.4(c)(3)(v)]		

RL2. Did Element S8 (mitigation goals) address RL and SRL properties? [44 CFR §§201.4(c)(3)(i) and 201.4(c)(3)(v)]		
RL3. Did Element S9 (mitigation actions) address RL and SRL properties? [44 CFR §§201.4(c)(3)(iii) and 201.4(c)(3)(v)]		
RL4. Did Element S10 (funding sources) address RL and SRL properties? [44 CFR §§201.4(c)(3)(iv) and 201.4(c)(3)(v)]		
RL5. Did Element S13 (local and tribal, as applicable, capabilities) address RL and SRL properties? [44 CFR §§201.4(c)(3)(ii) and 201.4(c)(3)(v)]		
RL6. Did Element S15 (prioritizing funding) address RL and SRL properties? [44 CFR §§201.4(c)(4)(iii) and 201.4(c)(3)(v)]		
Required Revisions:		

B.3 Strengths and Opportunities for Improvement

STRENGTHS AND OPPORTUNITIES FOR IMPROVEMENT

INSTRUCTIONS: The purpose of the "**Strengths and Opportunities for Improvement**" section is for FEMA to provide more comprehensive feedback on the state mitigation plan to help the state advance mitigation planning. The intended audience is the state staff responsible for the mitigation plan update. FEMA will address the following topics:

1. Plan strengths, including specific sections in the plan that are above and beyond the minimum requirements; and
2. Suggestions for future improvements.

FEMA will provide feedback and include examples of best practices, when possible, as part of the *Plan Review Tool,* or, if necessary, as a separate document. The state mitigation plan elements are included below in italics for reference but should be deleted as the narrative summary is completed. FEMA is not required to provide feedback for each element.

Required revisions from the **Regulation Checklist** are not documented in the **Strengths and Opportunities for Improvement** section.

Results from the **Strengths and Opportunities for Improvement** section are not required for Plan Approval, but may inform discussions during the Program Consultation.

Describe the mitigation plan strengths, including areas that may exceed minimum requirements, and areas for future improvements to the mitigation plan.

Describe areas for future improvements to the mitigation plan. (con't from previous page)

CONDENSED HAZARD MITIGATION PLAN REVIEW SHEETS MI Dec. 2018 ed. PAGE 1

Name and date/edition of plan_____ reviewed by _____ on _____

Type of plan: __Single jurisdiction; __Multijurisdictional; Update of previously approved plan? _____; FEMA grant_____

(% estimates are given below for required planning elements, based on the amount of work that each item probably involves) *FEMA review item # follows*

Section One – Planning Preliminaries (Preparation, Participation, Process), Items 1-4 = 25% possible. Review total = _____%

General explanation: The plan must have been developed through the coordination of multiple agencies, providing opportunities for stakeholders (and the general public) to evaluate draft materials and contribute to the plan's refinement. Each community that seeks to gain grant eligibility for hazard mitigation projects must have participated in the plan's development. Review item #1 requires these participating communities to be clearly listed and described in the plan. Item #2 requires descriptions of the plan development process to be included in the plan. Items #3-4 require the inclusion (and description) of efforts to involve various stakeholders, the general public, and existing documents/resources in the development of the plan. It is estimated that about a quarter of the overall work involved in developing the plan will be related to activities such as finding and contacting stakeholders, organizing and conducting meetings, amending the draft plan to include new information and feedback from participants, and writing descriptions of such activities.

_____ 1. **(1%)** *A1* **MULTIJURISDICTIONAL PLANS ONLY:** Does the plan indicate the specific jurisdictions represented in (participating and requesting grant eligibility from) the multi-jurisdictional plan? Pages _____

1a. **Updated plans only:** Does the updated plan specify each jurisdiction's status as (1) a new participant, (2) a continuing participant, or (3) a non-participant in the updated plan? Pages_____

_____ 2. **(9%)** *A1* Does the plan provide a narrative description of the process followed to prepare it?
Pages _____

2a. Does the plan indicate who was involved in the planning process? (For example, who led the plan development process? Were any consultants involved? Who represented local participating jurisdictions, served on a planning committee, responded to surveys, etc.?) Pages _____

2b. Does the new or updated plan describe how the [each] jurisdiction participated in the plan's development?
Pages _____

2c. **Updated plans only:** Does the updated plan document [generally describe] how the planning team reviewed and analyzed each section of the plan and whether/how each section was revised as part of the update process?
Pages _____

_____ 3. **(10%)** *A2* Does the plan discuss the opportunity for the following parties to be involved in the planning process?
(1) Neighboring communities, (2) local and regional agencies involved in hazard mitigation activities, (3) agencies that have the authority to regulate development, and (4) other interests (businesses, academia, nonprofits, etc.)?
Pages _____

3a. *A3* Does the plan indicate how the public was involved in the planning process during the drafting stage, prior to plan approval? (Did they have sufficient opportunity to attend at least one open meeting and comment on the plan?)
Pages _____

_____ 4. **(5%)** *A4* Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information? Pages _____

Additional reviewer comments: _____

_____

Section Two – Hazard Analysis Section, Items 5-12 = 40% possible. Review total = %

General explanation: The plan must include descriptions of all natural hazards that may affect the jurisdiction(s) in its planning area. The reasoning process involved in evaluating these hazards should be clear. The plan must present information that is specific to the local communities in its planning area, in addition to the kind of general information that is already available in state and federal-level sources. By considering past occurrences and known sources of risk, the plan should note locations that have greater vulnerability, describe the types of hazard impacts that could occur (and their extent), and use this information to provide estimates of the chance or frequency of future hazard occurrence, and descriptions of potential impacts and identified community vulnerabilities. Item #12 refers specifically to "repetitive loss properties" on a list maintained by the NFIP (please inquire for more information). The most serious and well-documented hazards are normally analyzed to a greater extent than less-serious hazards that have little documentation. Natural hazards must be explicitly considered—weather, hydrological, ecological, geological, and pandemic illness. Other hazards are optional. This analysis is estimated to involve about 40% of the total planning work.

_____ 5. **(3%)** *B1* Does the plan include a description of all the types of natural hazards that affect each jurisdiction? Pages _____

_____ 6. **(7%)** *B1* Does the plan include descriptions or maps of the location (i.e. geographic area affected) of hazards and vulnerabilities for each jurisdiction? Pages _____

_____ 7. **(5%)** *B1* Does the plan include descriptions of the extent (i.e. magnitude or severity) of all (measurable) natural hazards that affect each jurisdiction? Pages _____

_____ 8. **(7%)** *B2* Does the plan provide information on previous occurrences of each type of hazard, for each jurisdiction? Pages _____

_____ 9. **(4%)** *B2* Does the plan provide information on the probability of future hazard events (i.e. estimated chance or frequency of occurrence) for each jurisdiction? Pages _____

_____ 10. **(6%)** *B3* Does the plan include descriptions of each identified hazard's impact (i.e. actual damages and effects) on the involved jurisdictions? Pages _____

_____ 11. **(5%)** *B3* Does the plan include an overall summary of each jurisdiction's vulnerability (potential future damages and effects)? Pages _____

_____ 12. **(3%)** *B4* Does the plan address NFIP-insured structures that have been repetitively damaged by floods within the jurisdiction(s)? (i.e. if they are present, describing the number and type of repetitive loss properties in each jurisdiction, without revealing confidential addresses or claim information, and how damages to these properties might be reduced) Pages _____

Additional reviewer comments: _____

Section Three – Action Plan Section, Items 13-17 = 30% possible; review total = _____%

General explanation: The hazard analysis needs to lead to specific community actions in order to be truly useful. Any community vulnerabilities that had been identified should lead to relevant hazard mitigation strategies being considered, evaluated, selected, and prioritized. For item #13a, express some actions in terms of how specific resources, capabilities, programs, and authorities would be used or expanded to reduce hazard impacts or risks. Item #13 requires enough community details to be described so that hazard mitigation actions can be framed in terms of these capabilities (or reducing any gaps in the capabilities). Hazard mitigation activities need to include a reference to (1) NFIP participation or compliance (item #14 and #14a), and (2) the integration of hazard mitigation into other community plans and processes (part of item #17 but also all of item #18 in the next section). NFIP information for item #14 can be found online in FEMA's "Community Status Book." The overall plan must include concrete hazard mitigation actions (not just preparedness activities). Each participating jurisdiction endorses at least one action.

_____ 13. **(7%)** *C1* Does the plan describe each jurisdiction's existing authorities, policies, programs, and resources available to accomplish hazard mitigation? Pages _____

13a. Does the plan describe how these existing authorities, policies, programs, and resources could be expanded on and improved, to accomplish hazard mitigation? *C1* Pages _____

_____ 14. **(4%)** *C2* Does the plan describe each jurisdiction's current NFIP participation status (plus the availability and use of a digital Flood Insurance Rate Map)? Pages _____

14a. *C2* Does the plan describe each jurisdiction's floodplain management program for continued NFIP compliance (or the reasons why jurisdictions are not participating in the NFIP)? Pages _____

_____ 15. **(2%)** *C3* Does the plan include hazard mitigation goals to reduce/avoid long-term vulnerabilities to the identified hazards? (GOALS are long-term, represent what the community wants to achieve, such as "eliminate flood damage," and are based on the risk assessment findings.) Pages _____

_____ 16. **(7%)** *C4* Does the plan identify and analyze a comprehensive range of potential mitigation actions and projects that are being considered by each jurisdiction to mitigate its hazards, including an emphasis on both new and existing buildings and infrastructure (and including elements that are appropriate for FEMA hazard mitigation grant funding)?
Pages _____

_____ 17. **(10%)** *C5* Does the plan contain an action plan that includes how specific identified actions are prioritized (i.e. the process and criteria used, including cost-benefit considerations), implemented (location, method, use of existing and/or potential resources), and administered (i.e. responsible department, time-frame) by each jurisdiction, to try to reduce hazard effects upon both new and existing buildings and infrastructure? Pages _____

17a. *D1* **Updated plans only:** Has the updated plan been revised to reflect any changes in local land use/development?
Pages _____

17b. *D2* **Updated plans only:** Does the updated plan identify the completed, deleted, or deferred hazard mitigation actions from the previous plan, and explain why any unchanged activity ideas have not been changed since the previous plan?
Pages _____

17c. *D2* **Updated plans only:** Does the updated plan describe progress in local hazard mitigation efforts since the previous plan had been completed? Pages _____

17d. *D3* **Updated plans only:** Does the updated plan explain any changes in priorities since the previous plan had been completed? Pages _____

Additional reviewer comments: _____

Section Four – Plan Maintenance/Implementation and State Requirements, Items 18-23 = 5% possible. Review total = ____%

General explanation: The plan needs to describe activities that will occur after its completion. Although most of these items need to be included in the plan itself, the local adoption process (item #21) is assumed to take place after the main body of the plan has been completed, reviewed, and found to meet all other requirements. Therefore, plan adoption is not included in the % estimate of work involved in developing the plan itself.

_____ 18. **(1%)** *C6* Does the plan describe a process by which local government(s) will integrate hazard mitigation into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Pages _____

18a. **Updated plans only:** Does the updated plan explain how the local government(s) incorporated the previous plan's hazard mitigation strategies and other information (e.g. risk assessment) into other planning mechanisms (especially community master plans), when appropriate? Pages _____

_____ 19. **(1%)** *A5* Does the plan explain how the community(ies) will continue public participation as part of a plan maintenance process? (For example: periodic presentations to community groups or at public meetings, internet and social media postings, or the use of questionnaires and surveys) Pages _____

_____ 20. **(1%)** *A6* Does the plan describe the method and schedule for keeping the plan current? (i.e. monitoring, evaluating, and updating the plan within a 5-year cycle, including the criteria used and the department responsible)?
Pages _____

_____ 21. *E1/E2* Does the plan include documentation that it has been formally adopted by the jurisdiction(s) seeking approval of the plan (and seeking the project grant eligibility that results)? Pages _____

_____ 22. **(2%) STATE REQUIREMENT:** *F1* Does the plan describe or map current warning system coverage (especially outdoor sirens) within the planning area? Pages _____

23. **PROPOSED; NOT YET REQUIRED**: *F2* Does the plan describe how consideration was given, during the plan development or update process, to the hazard mitigation goals, priorities, and information contained in the most current edition of the Michigan Hazard Mitigation Plan? Pages _____

Additional reviewer comments (including a list of communities participating in a multijurisdictional plan): _____

_____

_____

_____

_____

_____

_____

ARE MORE REVIEWER NOTES ADDED ON ADDITIONAL PAGES? No: ____, Yes: _____

TOTAL OF ESTIMATED PERCENT VALUES (APPROXIMATE AMOUNT OF WORK COMPLETED): _____%

Is EMHSD willing to recommend plan approval to FEMA? ____Yes; ____Yes – but revisions are recommended before submission; ____Not yet – revisions are required before approval can be recommended; ____No – this was a preliminary review of draft materials

Emergency Management Accreditation Program

Excerpts from 2016 Standards

Source: https://emap.org/index.php/root/about-emap/96-emap-em-4-2016/file

Chapter 4: Emergency Management Program Elements

Overview
An Accredited Emergency Management Program encompasses the following elements: prevention, preparedness, mitigation, response and recovery.

4.1: Hazard Identification, Risk Assessment and Consequence Analysis

Overview
An Accredited Emergency Management Program has a Hazard Identification, Risk Assessment (HIRA) and Consequence Analysis.

4.1.1 The Emergency Management Program identifies the natural and human-caused hazards that potentially impact the jurisdiction using multiple sources. The Emergency Management Program assesses the risk and vulnerability of people, property, the environment, and its own operations from these hazards.

4.1.2 The Emergency Management Program conducts a consequence analysis for the hazards identified in Standard 4.1.1 to consider the impact on the following:

(1) public;
(2) responders;
(3) continuity of operations including continued delivery of services;
(4) property, facilities, and infrastructure;
(5) environment;
(6) economic condition of the jurisdiction; and
(7) public confidence in the jurisdiction's governance.

4.1.3 The Emergency Management Program has a method and schedule for evaluation, maintenance, and revision of its Hazard Identification, Risk Assessment (HIRA) and Consequence Analysis identified in Standard 4.1.1.

4.2: Hazard Mitigation

Overview
An Accredited Emergency Management Program has a mitigation program that regularly and systematically utilizes resources to mitigate the effects of emergencies/disasters associated with the risks identified in the HIRA.

4.2.1 The Emergency Management Program has a plan to implement mitigation projects and sets priorities based upon loss reduction. The plan:

(1) is based on the natural and human-caused hazards identified in Standard 4.1.1 and the risk and consequences of those hazards;
(2) is developed through formal planning processes involving Emergency Management Program stakeholders; and
(3) establishes interim and long-term strategies, actions, goals and objectives.

4.2.2 The Emergency Management Program documents project ranking based upon the greatest opportunity for loss reduction and documents how specific mitigation actions contribute to overall risk reduction.

4.2.3 The Emergency Management Program has a process to monitor overall progress of the mitigation activities and documents completed initiatives and their resulting reduction or limitation of hazard impact on the jurisdiction.

4.2.4 The Emergency Management Program, consistent with the scope of the mitigation program, does the following:

(1) provides technical assistance in implementing applicable mitigation codes and ordinances;
(2) identifies ongoing opportunities and tracks repetitive loss; and
(3) participates in applicable jurisdictional, inter-jurisdictional and multi-jurisdictional mitigation efforts.

4.2.5 The Emergency Management Program has a method and schedule for evaluation, maintenance, and revision of the plan identified in Standard 4.2.1.

4.3: Prevention

Overview
An Accredited Emergency Management Program encompasses prevention responsibilities, strategies and procedures.

4.3.1 The Emergency Management Program has a process(es) to coordinate prevention activities, to monitor the identified threats and hazards, and to adjust the level of prevention activity commensurate with the risk. Prevention processes are based on the following:

(1) hazard information obtained from Standard 4.1.1;
(2) intelligence activities;
(3) threat assessments;
(4) alert networks and surveillance programs; and
(5) other sources of information obtained from internal and external stakeholders.

4.3.2 The Emergency Management Program has procedures to prevent incidents from hazards identified in Standard 4.1.1. Procedures include a process to exchange information among internal and external Emergency Management Program stakeholders.

4.3.3 The Emergency Management Program has a method and schedule for evaluation, maintenance, and revision of the procedures identified in Standard 4.3.2.

4.4: Operational Planning and Procedures

Overview
An Accredited Emergency Management Program has operational plans and procedures that are developed, coordinated and implemented among all stakeholders. The plans and procedures describe emergency response; continuity of operations; continuity of government; and recovery from emergencies/disasters.

4.4.1 The Emergency Management Program, through formal planning processes involving stakeholders and addressing all hazards identified in Standard 4.1.1, has developed the following Plans:

(1) Emergency Operations;
(2) Recovery;
(3) Continuity of Operations; and
(4) Continuity of Government.

4.4.2 The Emergency Operations, Recovery, Continuity of Operations and Continuity of Government Plans address the following:

(1) purpose and scope or goals and objectives;
(2) authority;
(3) situation and assumptions;
(4) functional roles and responsibilities for internal and external agencies, organizations, departments and positions;
(5) logistics support and resource requirements necessary to implement the Plans;
(6) concept of operations; and
(7) a method and schedule for evaluation, maintenance, and revision.

4.4.3 The Emergency Operations Plan (EOP) identifies and assigns specific areas of responsibility for performing functions in response to an emergency/disaster. Areas of responsibility to be addressed include the following:

(1) administration and finance;
(2) agriculture and natural resources;
(3) alert and notification;
(4) communications;
(5) critical infrastructure and key resource restoration;
(6) damage assessment;
(7) debris management;
(8) detection and monitoring;
(9) direction, control, and coordination;
(10) donation management;
(11) emergency public information;
(12) energy and utilities services;
(13) evacuation and shelter-in-place;
(14) fatality management and mortuary services;
(15) firefighting/fire protection;
(16) food, water and commodities distribution;
(17) hazardous materials;
(18) information collection, analysis, and dissemination;
(19) law enforcement;
(20) mass care and sheltering;
(21) mutual aid;
(22) private sector coordination;
(23) public health and medical services;
(24) public works and engineering;
(25) resource management and logistics;
(26) search and rescue;
(27) transportation systems and resources;
(28) volunteer management; and
(29) warning.

4.4.4 The Recovery Plan addresses short and long-term recovery priorities. The Plan provides guidance for restoration of identified critical functions, services/programs, vital resources, facilities, and infrastructure to the affected area.

4.4.5 The Emergency Management Program has Continuity of Operations (COOP) Plan(s), that identify the essential program functions and describe how those functions will be continued and recovered. Each organization performing essential program functions has a COOP Plan that identifies the following:

(1) processes and functions that must be maintained;
(2) essential positions;

(3) lines of succession;
(4) how critical applications and vital records will be safeguarded;
(5) communications resources;
(6) priorities for recovery of processes, functions, critical applications and vital records; and
(7) alternate operating capability and facilities.

4.4.6 The Emergency Management Program has a Continuity of Government Plan that identifies how the governing body and the responsibilities identified in its documents containing the fundamental principles by which the jurisdiction is governed will be preserved, maintained, or reconstituted. The Plan includes identification of succession of leadership, delegation of emergency authority, and command and control.

4.4.7 The Emergency Management Program has procedures to implement all Plans identified in Standard 4.4.1. Procedures are applicable to all hazards identified in Standard 4.1.1. Procedures reflect operational priorities including:
(1) life, safety, and health;
(2) property protection;
(3) environmental protection;
(4) restoration of essential utilities;
(5) restoration of essential program functions; and
(6) coordination among appropriate stakeholders.

4.4.8 The Emergency Management Program has procedures to guide situation analysis and damage assessment, situation reporting and incident action planning.

4.4.9 The Emergency Management Program has a method and schedule for evaluation, maintenance, and revision of the procedures identified in Standards 4.4.7 and 4.4.8.

APPENDIX 17: Change Log

July 2022:

Several portions of this 2019 publication were amended to comply with evolving standards required by the High Hazard Potential Dam (HHPD) Grant Program, administered by FEMA. Select language relevant to the HHPD program was inserted into the document in order to retain grant eligibility.

HHPD relevant additions were made to the following pages:

Original Page #	Amended Page #	Section/Area
3	3	Note on Departmental Name Changes
41-42	41-42	Hazard Analysis Summary Table & Summary of Michigan's Estimated Hazard Rankings
58	58	Funding Sources for the Implementation of Hazard Mitigation Projects
60-61	60-61	Project Funding Criteria & Funding Program Acronyms and Terms
69-70	69-71	Amending Objective 2.6 & adding Objective 2.11
78	79	Summary of Target Completion Dates
83	84	Integration with Other Ongoing State Planning Efforts
90	90	Project Tracking, Monitor, and Closeout
94	94	Glossary
123	123	Notes on Funding, Organizational, and Resource Challenges for Hazard Mitigation Activities
154	154	New stand-alone section of Appendix 5: Details of Planning Processes
155-159	155-159	Presidential Declarations in Michigan & Governor's Declaration in Michigan tables
166, 171, 175	166, 171, 175	Updated entries for Gladwin, Midland, and Saginaw Counties
256	256	Federal Hazard Mitigation Funding Sources table
393, 430	393, 430	Adding the Hazard Mitigation Strategy to table/summary for Federal Disaster #457
N/A	453	Adding Appendix 17: Change Log

No other pages saw changes except for ancillary edits or additions made to the title page and table of contents. Other data not necessary for HHPD compliance will be updated when the plan is ordinarily due for full revision in 2024.