

## HAZARD DEFINITIONS

NATURAL HAZARDS	TECHNOLOGICAL HAZARDS	HUMAN-RELATED HAZARDS
<p>Weather Hazards:</p> <ul style="list-style-type: none"> <li>▪ Thunderstorms, including Hail &amp; Lightning</li> <li>▪ Severe Winter Weather, including Ice, Sleet, &amp; Snow</li> <li>▪ Severe Winds</li> <li>▪ Tornadoes</li> <li>▪ Extreme Temperatures</li> <li>▪ Fog</li> </ul> <p>Hydrological Hazards:</p> <ul style="list-style-type: none"> <li>▪ Riverine/Urban Flooding</li> <li>▪ Great Lakes Shoreline Hazards</li> <li>▪ Dam Failures</li> <li>▪ Drought</li> </ul> <p>Ecological Hazards:</p> <ul style="list-style-type: none"> <li>▪ Wildfire</li> <li>▪ Invasive Species</li> </ul> <p>Geological Hazards:</p> <ul style="list-style-type: none"> <li>▪ Earthquakes</li> <li>▪ Subsidence</li> <li>▪ Celestial Impact</li> </ul>	<p>Industrial Hazards:</p> <ul style="list-style-type: none"> <li>▪ Structural Fires</li> <li>▪ Scrap Tire Fires</li> <li>▪ HAZMAT – Fixed Site</li> <li>▪ HAZMAT – Transportation</li> <li>▪ Nuclear Power Plant Emergencies</li> <li>▪ Petroleum &amp; Natural Gas Pipeline Accidents</li> <li>▪ Oil &amp; Natural Gas Well Accidents</li> </ul> <p>Infrastructure Problems:</p> <ul style="list-style-type: none"> <li>▪ Infrastructure Failures</li> <li>▪ Energy Emergencies</li> <li>▪ Transportation Accidents, including Air, Rail, Highway &amp; Marine</li> </ul>	<ul style="list-style-type: none"> <li>▪ Catastrophic Incidents (National Emergencies)</li> <li>▪ Civil Disturbances</li> <li>▪ Nuclear Attack</li> <li>▪ Public Health Emergencies</li> <li>▪ Terrorism and Similar Criminal Activities</li> </ul>

### **1.0 NATURAL HAZARDS**

#### **1.01 CELESTIAL IMPACT**

*An impact or threatened impact from a meteorite, asteroid, comet, satellite, space vehicle, space debris, solar storm, or similar phenomena that may cause physical damages or other disruptions.*

**Summary:** This hazard is addressed by the Michigan Hazard Mitigation Plan to increase awareness among emergency responders, public safety officials, and community leaders. The following hazard description is only a portion of the information contained within the state plan, which can be referenced for additional information. The most likely effect of celestial impacts appears to be “space weather” generated by the sun. This is considered relevant for its potential to disrupt complex modern communication systems (i.e. satellites, television, radio, GPS, power supply networks), as well as the extensive human and technological infrastructure that rely upon those communication and utility networks. Physical collision of an object on the Earth’s surface, although potentially devastating or even catastrophic, is considered to be significantly less likely.

#### **1.02 DROUGHT**

*A water shortage caused by a deficiency of rainfall, generally lasting for an extended period of time.*

**Summary:** The West Michigan shoreline is adjacent to the world’s fifth largest body of fresh water, yet is still vulnerable to drought. Droughts experienced in Michigan can cause significant economic losses and increase the likelihood of brush and forest fires. The gradual and unpredictable onset and recession of a drought, combined with the relative impacts it may have from location to location, complicate mitigation efforts for this hazard.

#### **1.03 EARTHQUAKE**

*A shaking or trembling of the crust of the earth caused by the breaking and shifting of rock beneath the surface.*

**Summary:** The earthquake hazard is low for the West Michigan region. The United States Geological Survey predicts a 2% probability of an earthquake occurring in the next 50 years of a magnitude capable of a peak acceleration of 4% g (gravity). This might cause damage and possible collapse of buildings constructed before 1940.

#### **1.04 EXTREME TEMPERATURES**

*Prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions.*

**Summary:** The West Michigan region enjoys a relatively stable and comfortable climate year-round, thanks to the moderating influence of nearby Lake Michigan. Even so, significant temperature extremes are realized every year. High humidity in summer and high winds in winter exacerbate the effects of temperature extremes and increase the risk of harm on human health and property, while prolonged periods of extreme temperatures can pose life-threatening problems for residents. Public education about extreme temperature hazards, early notification of impending extremes, and the availability of cooling and warming shelters are all beneficial actions in mitigating the impacts of these hazards upon people. Although quite different from each other in terms of conditions and impacts, the two hazards share a commonality in that they both pose particular problems for the most vulnerable segments of society: the elderly, children, impoverished persons, and persons in poor health. Extreme temperatures can also negatively impact livestock, crops, wildlife, and infrastructure.

#### **1.05 FLOODING: RIVERINE/URBAN**

*The overflowing of rivers, streams, drains and lakes due to excessive rainfall, rapid snowmelt or ice.*

**Summary:** Annual flood losses amount to several billion dollars per year nationwide, along with over 140 fatalities on average. In Michigan, as well as across the nation, the leading cause for disaster declarations by the Governor or the President is flooding.

There are a number of rivers and streams in the West Michigan region whose flows occasionally exceed their banks. The area is drained by a number of watercourses, which ultimately drain towards Lake Michigan. In addition, the area has watercourses that are prized for their natural scenery, historic sites, and outstanding recreational attributes such as paddling and fishing. The recreational nature of these waters must be considered along with issues involving development in and adjacent to floodplains.

#### **1.06 FOG**

*Condensed water vapor in cloud-like masses close to the ground and limiting visibility.*

**Summary:** Historically, fog has not been considered as a significant hazard in West Michigan. However, this hazard is addressed by the Michigan Hazard Mitigation Plan, and is therefore considered for this area as well. Potential impacts include transportation hazards and instances of “freezing fog.”

#### **1.07 GREAT LAKES SHORELINE HAZARDS**

*High or low water levels that cause flooding or erosion, and other threatening shoreline conditions, including storm surges, rip currents, and shoreline recession.*

**Summary:** With nearly 100 miles of Lake Michigan coastline, much of the WMSRDC region is at risk from Great Lakes shoreline hazards. Shoreline flooding and erosion are natural processes that occur constantly, regardless of water levels. However, during periods of high water, the effects of flooding and erosion are more evident, causing serious damage to homes and businesses, roads, water and wastewater treatment facilities, and other structures in coastal communities. Low water levels can also present hazards, such as shallow shipping and recreation channels or increased exposure of polluted lake-bottom debris. Other shoreline hazards include severe winds, seiches, and rip currents. These conditions can be life-threatening for boaters and swimmers, and are often exacerbated by the presence of structures, such as breakwalls, and river mouths.

#### **1.08 HAIL**

*Conditions where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth.*

**Summary:** Hail is a hazard that often coincides with thunderstorms and may occur simultaneously with other hazards such as lightning, severe winds, tornadoes, and heavy rains. The impacts of hail on humans and property may be somewhat mitigated in rural areas. However, crops in the area are certainly susceptible to damage from hail. It is incumbent upon public safety officials and county residents to monitor forecasts from the National Weather Service, and to heed severe thunderstorm watches and warnings to minimize the effects on people and property.

## 1.09 INVASIVE SPECIES

*A species that has been introduced by human action to a location where it did not previously occur naturally, becomes capable of establishing a breeding population in the new location without further intervention by humans, and becomes a pest by threatening the local biodiversity and causing human health impacts, significant economic costs, and/or ecological effects.*

**Summary:** Historically, invasive species has not been considered as a significant hazard in West Michigan. However, this hazard is discussed by the Michigan Hazard Mitigation Plan and is addressed here to increase awareness among emergency responders, public safety officials, and community leaders.

Much of the West Michigan region is covered by agriculture, forests, and natural vegetation, and is therefore susceptible to a wide range of exotic species that may threaten the natural environment. Invasive aquatic species also pose a threat to water features. In addition, the region welcomes a significant number of visitors each year to recreate in the wilderness, thereby increasing the opportunities for accidental importation of non-native species. The most likely effects of invasive species appear to be from agricultural and forest pests, as well as aquatic invaders.

## 1.10 LIGHTNING

*Discharge of electricity from within a thunderstorm.*

**Summary:** Lightning is a hazard produced by thunderstorms, and may occur simultaneously with other hazards such as hail, severe winds, tornadoes, and heavy rains. It is virtually impossible to provide complete protection to individuals and structures from lightning, therefore this hazard will continue to be a risk. However, lightning deaths, injuries, and property damage can be reduced through a combination of public education, human vigilance, technology, proper building safety provisions, and simple common sense. It is incumbent upon public safety officials and county residents to monitor forecasts from the National Weather Service, and to heed severe thunderstorm watches and warnings to minimize the effects on the population.

## 1.11 SEVERE WINDS

*Non-tornadic winds of 58 miles per hour or greater.*

**Summary:** Severe winds are generally produced by thunderstorms or by strong weather systems. Severe winds are the most common thunderstorm hazard to cause damage in West Michigan and may occur simultaneously with other hazards such as lightning, hail, tornadoes, and heavy rains. Advanced warning and weather monitoring are effective ways to mitigate the effects of severe winds. Therefore, it is incumbent upon public safety officials and county residents to monitor forecasts from the National Weather Service, and to heed severe thunderstorm and high wind watches and warnings to minimize the effects on people and property.

## 1.12 SUBSIDENCE

*The lowering or collapse of the land surface caused by natural or human-induced activities that erode or remove sub-surface support.*

**Summary:** In Michigan, the primary cause of subsidence is underground mining. Overall, subsidence is not considered a significant threat in West Michigan. Because residents and visitors to the county depend on groundwater as the primary potable water source, excessive groundwater withdrawal might be considered the greatest subsidence threat to the area. The use of groundwater for agriculture may also contribute to this threat.

## 1.13 TORNADES

*An intense rotating column of wind that extends from the base of a severe thunderstorm to the ground.*

**Summary:** Although relatively few tornadoes have touched down in West Michigan, tornadoes occur in Michigan every year with grim regularity. Tornado damages can range from minor to devastating. Deaths and property loss are frequent by-products of these events. Improved public education in tornado safety, through community efforts and media coverage, has increased the public's awareness of potential hazards from tornadoes and their response to those hazards. The National Weather Service has improved warning lead times from six to thirteen minutes. Local TV stations can also provide advanced warning with Doppler radar. Education and early awareness need to be continually improved to mitigate tornado hazards. Injuries can also occur during rescue and clean-up efforts after a tornado strikes.

## 1.14 WILDFIRE

*An uncontrolled fire in grass lands, brush lands, or forested areas.*

**Summary:** Most Michigan wildfires occur close to where people live and recreate, which puts people, property, and the environment at risk. Development within and around rural forested areas often increases the potential for loss of life and property from wildfires, since most fires are caused by human activities, such as outdoor burning. The region's forest cover is a boon for both industry and recreation. However, it also makes many areas potentially vulnerable to wildfires. Throughout the region, private developed lands can be found adjacent to or scattered within forested lands. In addition to these "wildland-urban interface" areas, there are also wooded areas of higher risk where fairly steep slopes exist. Of particular concern are the high dwelling density areas located in the wooded areas of the shoreline townships, many of which lack proper access for fire equipment because of narrow drives and extreme topography.

## 1.15 WINTER STORMS

*Severe winter weather hazards include snowstorms, blizzards, and ice and sleet storms.*

**Summary:** Severe winter hazards include snowstorms, blizzards, sleet, and ice storms. Winter-like storms are possible from late October through April; however they are most likely from mid November through early April. As a northern state, Michigan is vulnerable to all of these hazards as the result of arctic air interaction with any number of meteorological factors. It is not unusual for an area to experience any combination of these hazards in a given winter storm, thereby enhancing their effects. In addition, the region is susceptible to significant lake effect snow accumulations due to its close proximity to Lake Michigan. Annual costs of snow plowing, snow removal, vehicle damage from snow and ice-caused accidents, and damage from ice storms have a significant economic impact on the county.

## 2.0 TECHNOLOGICAL HAZARDS

### 2.01 DAM FAILURE

*The uncontrolled release of impounded water resulting in downstream flooding.*

**Summary:** Dams can fail as a result of both natural and human influences. Either case may result in downstream flooding with the potential to harm people, property, and the environment. The relatively sudden increase of downstream flow can have a similar effect as a flash flood; and impacts may also be incurred upstream, as well as downstream from a failed dam.

### 2.02 ENERGY EMERGENCIES

*An actual or potential shortage of gasoline, electrical power, natural gas, fuel oil, or propane of sufficient magnitude and duration to potentially threaten public health and safety, and/or economic and social stability.*

**Summary:** Energy emergencies have not been considered as a significant hazard in West Michigan. This hazard is discussed by the Michigan Hazard Mitigation Plan and is discussed locally to increase awareness among emergency responders, public safety officials, and community leaders. Energy supplies in the region are largely at the mercy of events beyond the county's borders, as well as greater regional and national trends. This hazard is addressed in order to raise awareness of this vulnerability and highlight the fact that energy needs are closely connected to statewide and national issues.

### 2.03 FIRE: SCRAP TIRES

*A large and uncontrolled fire that burns scrap tires being stored for recycling/re-use.*

**Summary:** Scrap tire fires produce a slew of complications, including toxic smoke and groundwater contamination, and require significant resources to extinguish. In addition, scrap tire piles pose a threat to public health by providing shelter and breeding grounds for mosquitoes and small animals.

### 2.04 FIRE: STRUCTURAL

*A fire, of any origin, that ignites one or more structures, causing loss of life and/or property.*

**Summary:** Every 23 seconds, a fire department responds to a fire somewhere in the nation. A structural fire occurs at the rate of one every 65 seconds, and in particular a residential fire occurs every 85 seconds. In 2011, structure fires represented 34.9% of all fires across the United States. In terms of average annual loss of life and property, structural fires – often referred to as the "universal hazard" because they occur in virtually every

community – are by far the most common hazard facing most communities in Michigan and across the country. In West Michigan, there are small concentrations of historic buildings that would not meet today’s standards for fire protection. Therefore, in addition to the risk of residential and wildland fires, there is a risk of conflagration in many local communities.

**2.05 HAZARDOUS MATERIAL INCIDENTS: FIXED SITE** (including industrial accidents)

*An uncontrolled release of hazardous materials from a fixed site capable of posing a risk to life, health, safety, property, or the environment.*

**Summary:** The potential release of hazardous materials exists wherever that material may be located. Hazardous materials are chemical substances which, if released or misused, can pose a threat to people, property, or the environment. These chemicals are used in industry, agriculture, medicine, research, and consumer goods. As many as 500,000 products pose physical or health hazards and can be defined as "hazardous chemicals." Each year, over 1,000 new synthetic chemicals are introduced.

**2.06 HAZARDOUS MATERIAL INCIDENTS: TRANSPORTATION**

*An uncontrolled release of hazardous materials during transport, capable of posing a risk to life, health, safety, property or the environment.*

**Summary:** The transportation of hazardous materials along roadways is a common occurrence in the region; both passing through the area along highways, and directly to sites. Hazardous materials may be transported to developed or rural areas of the area. The most likely incident involving the transportation of hazardous materials would occur along a roadway, with the risk of such an event increasing during inclement driving conditions.

**2.07 INFRASTRUCTURE FAILURES**

*The failure of critical public or private utility infrastructure resulting in a temporary loss of essential functions and/or services.*

**Summary:** As reported in a 2009 study by the National Academy of Sciences, an electrical blackout “has the potential to affect virtually all sectors of society: communications, transportation, banking and finance, commerce, manufacturing, energy, government, education, health care, public safety, emergency services, the food and water supply, and sanitation.” Power loss is the most common form of infrastructure failure in the region, often occurring as a result of natural hazards.

**2.08 NUCLEAR POWER PLANT EMERGENCIES**

*An actual or potential release of radioactive material at a nuclear power plant or other nuclear facility, in sufficient quantity to constitute a threat to the health and safety of the off-site population.*

**Summary:** The nearest nuclear power plants are more than 50 miles away from West Michigan, well beyond the facilities’ Emergency Planning Zones. Nuclear power plant emergencies are therefore not considered a significant threat to the region.

**2.09 OIL AND NATURAL GAS WELL ACCIDENTS**

*An uncontrolled release of oil or natural gas, or the poisonous by-product hydrogen sulfide, from production wells.*

**Summary:** There are a number complications and hazards that may be associated with oil and gas wells, highlighted by the potential for uncontrolled releases of hydrogen sulfide. West Michigan contains a number of oil fields, however there are no known incidents that have occurred locally.

**2.10 PIPELINE ACCIDENTS**

*An uncontrolled release of petroleum or natural gas, or the poisonous by-product hydrogen sulfide, from a pipeline.*

**Summary:** Utility natural gas is a common source of heating fuel throughout the West Michigan region. There are numerous natural gas transmission lines throughout, as well as sour gas pipelines that connect to a sweetening plant in Manistee County.

## 2.11 TRANSPORTATION ACCIDENTS

*A crash or accident involving an air, land or water-based commercial passenger carrier.*

**Summary:** Minor transportation accidents along the county's road network are frequent and inevitable; especially during inclement weather and along roads that are in disrepair. The primary emphasis this hazard description, however, is placed upon commercial and larger-scale modes of transportation. Possible accidents involving commercial passenger transportation school buses, public mass transit, tour buses, passenger ferries, and commercial airplanes. Natural weather hazards, as well as high traffic volumes, occasionally increase the risk of accident involving any of these modes of transportation.

## 3.0 HUMAN RELATED HAZARDS

### 3.01 CATASTROPHIC INCIDENTS (National Emergencies)

*A large-scale event that has severe effects upon large numbers of persons, across a wide area, and immediately overwhelms State, tribal, and local response capabilities. Such incidents are likely to require coordination activities from many states, including Michigan, even if the event took place in a distant location.*

**Summary:** Many hazards may achieve "catastrophe" status. Inclusion of catastrophic incidents as a stand-alone hazard is intended to highlight the extraordinary circumstances that such events produce, with the hope that it will assist planners and analysis in further developing mutual aid arrangements at all levels, to accommodate a wider variety of needs, and to suggest some possible repercussions that may not have previously been considered in existing planning and exercise scenarios.

### 3.02 CIVIL DISTURBANCES

*Collective behavior that results in a significant level of lawbreaking, perceived threat to public order, or disruption of essential functions and quality of life.*

**Summary:** No recent major civil disturbances are known to have happened within the region. Although future incidents are certainly possible, civil disturbance is not considered to be a significant hazard. A civil disturbance in the region would most likely stem from a festival or similar gathering at a location.

### 3.03 NUCLEAR ATTACK

*A hostile act taken against the United States which involved nuclear weapons and results in destruction of property and/or loss of life.*

**Summary:** The possibility of a nuclear attack is a serious and grim consideration. The effects of such an occurrence on United States' soil would have a wide range of social, economical, political, and environmental impacts well beyond the immediate location of detonation.

### 3.04 PUBLIC HEALTH EMERGENCIES

*A widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well being of the public.*

**Summary:** The public health emergencies category includes a wide range of potential causes, from naturally occurring epidemics; to failure of infrastructure; to malicious releases of harmful agents. Such events pose threats to individuals' health and well-being of the population, as well as the economy and delivery of services. In the event of a widespread public health emergency, medical facilities may be strained, requiring the assistance of resources from outside the area.

### 3.05 TERRORISM AND SIMILAR CRIMINAL ACTIVITIES

*Terrorism: "...activities that involve violent... or life-threatening acts... that are a violation of the criminal laws of the United States or of any State and... appear to be intended (i) to intimidate or coerce a civilian population; (ii) to influence the policy of a government by intimidation or coercion; or (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping" Federal criminal code. 18 U.S.C. §2331*

**Summary:** Terrorism is the use of violence by individuals or groups to achieve political goals by creating fear. The political motives of terrorism distinguish it from ordinary crime. Terrorism is carried out for a cause; not for financial gain, personal revenge, or a desire for fame.