HAZARD MITIGATION PLAN

COUNTY OF MARQUETTE, MICHIGAN

Prepared by the Resource Management and Development Department, Planning Division.

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HAZARD MITIGATION PLAN

COUNTY OF MARQUETTE, MICHIGAN

SECTION I INTRODUCTION

CHAPTER 1 THE PLANNING PROCESS

The planning process commenced with meetings with all 22 local units of government in Marquette County via virtual means. Phone, e-mail and Zoom Conferences were the primary modes of communication, as the 5-year update of the plan was influenced by Covid-19 restrictions and precautions. Every city and township confirmed map quality, provided information about hazards in their jurisdictions, and offered lists of capital projects for hazard mitigation.

Information was also collected regarding various hazards from the following sources:

- Internet Research
- Marquette County Planning Commission Files
- Marquette County Central Dispatch
- Michigan Department of Natural Resources
- National Oceanic and Atmospheric Administration
- Local Plans
- Newspaper Articles
- Interviews

Of the 22 local units of government, all were continuing participants from the previous plan in providing input in the planning process. In the 2015 update, 20 local units of government adopted the county's Hazard Mitigation Plan. The goal of the 2020 plan update is for all 22 local units to adopt the plan.

HAZARD MITIGATION PLANNING, MARQUETTE COUNTY

Marquette County has been active in Hazard Mitigation Planning since the early 2000s. The last Hazard Mitigation Plan was adopted by the Planning Commission and the Marquette County Board of Commissioners in 2015. It serves as an extremely detailed resource of hazards in Marquette County.

To ensure a holistic approach to the planning process, meetings and communications were also had with the Local Emergency Planning Committee (LEPC), the County Emergency Preparedness Coordinator, The Climate Adaptation Task Force (CATF), and surrounding counties and planning regions. The LEPC assisted with the review and update of the risk and vulnerability assessments of hazards, as facilitated by the County's Emergency Preparedness Coordinator.

The LEPC consists of representation from the following: Marquette County Emergency Management, Chem-consultant, Occupational Medicine, Marquette County Health Department Emergency Preparedness, Emergency Management and Homeland Security Division (EMHSD), Tri-Media Environmental and Engineering, Marquette City Fire Department, and the Eagle Mine/Humboldt Mill. CATF consists of representation from the following: Northern Michigan University, the Community Foundation of Marquette County, Superior Watershed Partnership, the Marquette County Health Department, the City of Marquette Planning Department, Michigan State University Extension, Michigan Sea Grant, Marquette County Administration, Marquette County Planning Division, Marquette County Emergency Management, and an organized labor representative.

Surrounding counties were given the opportunity to provide input on the plan to ensure a regionally cohesive planning process. All surrounding counties and the Central and Western UP Planning Regions were given notice to review the plan on December 1, 2020. The Central Upper Peninsula Planning and Development Regional Commission (CUPPAD), who assist 4 of the 6 counties in their region, submitted a favorable letter of support.

The public was given the opportunity to review the plan on the County's website with the additional opportunity to e-mail comments to planning staff. A notice was also posted on the Marquette County Planning Division Social Media on November 16th, 2020 to obtain additional public input, in addition to the meetings with local leaders and officials. The Marquette County Planning Commission meeting on December 2nd, 2020 as well as the Marquette County Board of Commissioners Meeting on December 15th, 2020 were hosted virtually and complied with the Open Meetings Act, and were open for public comment. Notices, including meeting agendas, with a link to the draft plan was posted on the county website one week before each meeting. Table 1 displays meeting dates.

Date	Entity/Government	Officials Involved
October 16, 2020	City of Ishpeming	Craig Cugini, City Manager
October 19, 2020	Ely Township	Jeremy Laakso, Supervisor
October 19, 2020	Humboldt Township	Sarah Etelamaki, Clerk
October 19, 2020	Powell Township	Darene Turner, Supervisor
October 19, 2020	Negaunee Township	Nick Leach, Township Manager
October 19, 2020	Marquette Township	Jason McCarthy, Planning/Zoning Administrator
October 20, 2020	Michigamme Township	William Seppanen, Supervisor
October 20, 2020	Ishpeming Township	Jim Nankervis, Supervisor
October 21, 2020	City of Negaunee	Ann Ducoli, Secretary David Nelson, Planning
October 22, 2020	Forsyth Township	Myron Hillock, Emergency Manager
October 28, 2020	Sands Township	Darlene Walch, Supervisor
October 29, 2020	Wells Township	Bob Therrian, Supervisor Josh Hardy, Fire Chief
October 29, 2020	Republic Township	John Ulrich, Supervisor

October 30, 2020	Richmond Township	Scott Mills, Supervisor
October 30, 2020	West Branch Township	Jack Heidtman, Supervisor
October 30, 2020	Champion Township	Larry Arsenault, Supervisor
October 30, 2020	Tilden Township	Lori Kulju, Supervisor
October 31, 2020	Turin Township	Carl Brunngraeber, Supervisor Gary Brunngraeber, Clerk
November 1, 2020	Ewing Township	Thomas Linjala, Supervisor
November 2, 2020	Skandia Township	Art Lauren, Supervisor
November 2, 2020	Chocolay Township	Dale Throenle, Planning and Zoning
November 2, 2020	City of Marquette	Dennis Stachewicz, Director of Community Development; Wendy Larson
November 3, 2020	National Weather Service	Matt Zika, Warning Coordination Meteorologist National Weather Service Marquette
November 4, 2020	Lundin Mining	Derek Dougovito, Lundin Mining
November 6, 2020	Chemical Consultant	Joseph Sabol, Chem Consultant
November 12, 2020	Marquette County Climate Adaptation Task Force Steering Committee	Scott Erbisch, County Administrator; Dr. Robert Kulisheck, Board of Health Chairperson; Dr. Jessica Thompson, NMU; Greg Seppanen, Marquette County Planning Commission and Organized Labor Representative, Tyler Penrod, Superior Watershed Partnership
November 13, 2020	Local Emergency Planning Committee	Teresa Schwalbach, Marquette County Emergency Management Coordinator (Representing LEPC)
November 19, 2020	Marquette County Climate Adaptation Task Force	Brad Neumann, Michigan State University Extension; Dave Stensaas, City of Marquette Planner; Jerry Messana, CEO Marquette County Health Department; Martha Gerig, Michigan State University Extension/ MI Sea Grant; Zosia Eppensteiner, CEO Community Foundation of Marquette County; Dr. Robert Kulisheck, Board of Health Chairperson; Dr. Jessica Thompson, NMU; Greg Seppanen, Marquette County Planning Commission and Organized Labor Representative; Tyler Penrod, Superior Watershed Partnership
December 1, 2020	Central Upper Peninsula Planning and Development Region	Dotty LaJoye, Executive Director of CUPPAD
December 1, 2020	City of Ishpeming	Craig Cugini, City Manager
December 2, 2020	Marquette County Planning Commission	Karen Alholm (County Board Appointee), Charles Bergdahl, Ken Kaiser, Mike Touchinski, Bob Struck, Ryan Diederichsen, Greg Seppanen
December 3, 2020	Ishpeming Township	Jim Nankervis, Supervisor
December 7, 2020	Forsyth Township	Myron Hillock, Executive Director Forsyth Twp Emergency Management
December 15, 2020	Marquette County Board of Commissioners	John Depetro, Joseph Derocha, Stephen Adamini, Gerald Corkin (Chair), Bill Nordeen, Karen Alholm

TABLE 1 MEETING DATES

Emergency Management

Emergency Management consists of four elements: mitigation, preparedness, response, and recovery. The goal of mitigation is to reduce the impact of hazards on people and property. To be effective, mitigation efforts must be coordinated. It is a joint effort of individuals and agencies, programs and initiatives. It requires a pooling of resources, knowledge, and purpose to reduce the risks from natural, human-related, and technological hazards.

Mitigation can be accomplished in a number of ways. People and at-risk infrastructure can be kept away from hazards or hazards can be kept away from people and vulnerable resources. If neither of those alternatives can be easily accomplished, safety measures can be implemented or response capabilities can be improved to reduce the impact of the hazard.

The creation or mitigation of a hazard is often tied directly to development decisions, many of which are controlled at the local level of government. At other times hazard potential is the direct result of operational decisions made by individuals or businesses.

The development of this plan is funded through a grant from the Federal Emergency Management Agency. The grant was awarded to the Michigan State Police Emergency Management and Homeland Security Division (MSP-EMHSD) by the Federal Emergency Management Division, which administers the grant. Funds were sub-awarded to the Marquette County Planning Division.

The MSP-EMHSD assists local units of government in mitigation, preparation, response and recovery efforts. The Michigan Hazard Mitigation Plan identifies the following basic hazard mitigation strategies:

1. *Modification of the Hazard:* Modify the hazard itself, by removing or eliminating it, reducing its size or amount, or controlling the rate of release.
2. *Segregating the Hazard:* Keep the hazard away from people. This technique largely involves redirecting water during flooding events.
3. *Preventing or Limiting Development:* Keep the people away from the hazard. Planning fits well with this strategy, which is aimed at keeping people from putting themselves in harm's way.
4. *Altering Design or Construction:* "Interacting with the hazard," in which an engineering approach is used to reduce the effects of the hazard.
5. *System Capacity, Redundancy, and Back-Up Features:* 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.
6. *Early Warning and Public Education:* Activity in this strategy helps to reinforce the positive effects of the other strategies. Increased public awareness is an important goal of the Hazard Mitigation Plan.

These broad strategies are appropriate strategies for the County of Marquette to adopt and strive for, as elected officials and county employees make decisions regarding development within its boundaries. To make wise decisions however, it is important to understand the physical characteristics of the

county, who its inhabitants are, and the influence prior development is exerting. The remaining part of this chapter will address these physical characteristics and influences.

The Planning Area

Encompassing 1873 square miles (1,198,484 acres) of land area, Marquette is the largest county in Michigan and one of the largest counties east of the Mississippi River, see Figure 1. Marquette County is approximately 390 miles from the State Capital in Lansing. It is 450 miles from Detroit, and 370 miles from Chicago. Its position on the Great Lakes and its latitude offer possibilities for world cargo, see Figure 2. The County contains 19 townships and three cities, see Figure 3.

FIGURE 1 MARQUETTE COUNTY, LOCATION

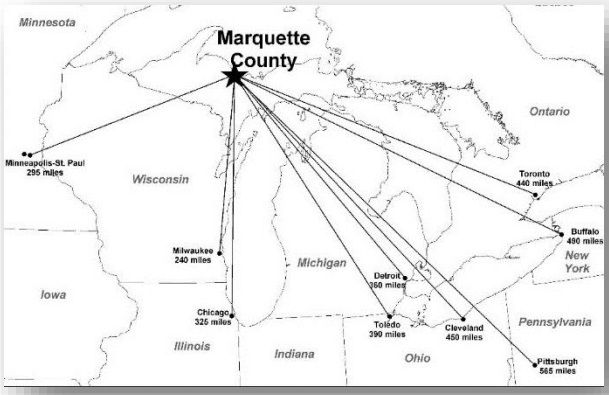


FIGURE 2 MARQUETTE COUNTY'S RELATIVE LOCATION

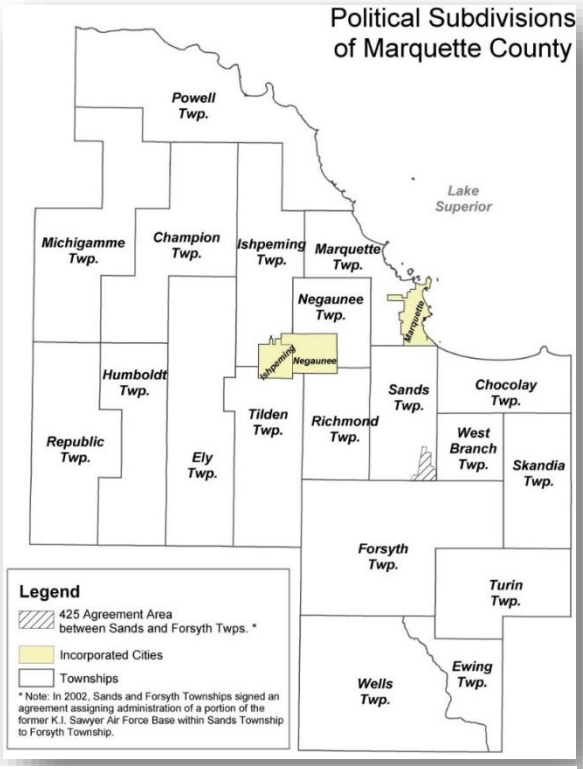


FIGURE 3 POLITICAL SUBDIVISIONS, MARQUETTE COUNTY

Local Unit of Government Structures to Implement Hazard Mitigation

Table 2 shows an overview of structures in place for local governments to implement hazard mitigation projects. Even though each local unit of government has an annual budget, many have budget restrains that don't allow for mitigation projects to become a priority without additional funding assistance. Most municipalities have previously participated in the County's Hazard mitigation planning process to become eligible for FEMA mitigation program funding. It is the intent for this plan to be adopted by all 22 local units of government within Marquette County. Further, all but two of the municipalities have a master plan or another type of comprehensive planning document and administer zoning. Through these regulatory and policy systems, as laid out in the Michigan Planning and Enabling Act, as amended, municipalities can regulate and enforce hazard mitigation strategies to lessen the effects of known hazards.

TABLE 2 MUNICIPAL PLANNING STRUCTURES

Municipality	Annual Budget	Zoning Ordinance	Comprehensive Planning Document	Previous Participation in County's Hazard Mitigation Planning
Champion Township	X	X	X	X
Chocolay Township	X	X	X	X
City of Ishpeming	X	X	X	X
City of Marquette	X	X	X	X
City of Negaunee	X	X	X	X
Ely Township	X	X	X	X
Ewing Township	X			X
Forsyth Township	X	X	X	X
Humboldt Township	X	X	X	X
Ishpeming Township	X	X	X	X
Marquette Township	X	X	X	X
Michigamme Township	X	X	X	X
Negaunee Township	X	X	X	X
Powell Township	X	X	X	X
Republic Township	X	X	X	X
Richmond Township	X	X	X	X
Sands Township	X	X	X	X
Skandia Township	X	X	X	X
Tilden Township	X	X	X	X
Turin Township	X			X
Wells Township	X	X	X	
West Branch Township	X	X	X	

Geography and Geology

First established in 1848, Marquette County's shape has gone through a lengthy metamorphosis of line-changing, once containing most of Alger, Dickinson, Delta, Schoolcraft, Iron, and Baraga counties. The result was a rather distinct shape, quite unlike the county's rectangular counterparts of southern Michigan. Finally, the county is situated in the transition zone where the ancient Precambrian crystalline rocks emerge from beneath the more recently deposited Paleozoic sandstones and limestones of the Michigan Basin. This, coupled with as many as four occurrences of glaciation, created the mountainous landscape in the central and northern regions of the county and the rolling, forested glacial deposits to the south and east. The Natural Features and Resources Chapter of the Marquette County Comprehensive Plan further details the geography and geology of the County.

The U.S. Department of Agriculture has completed a soil survey of Marquette County. It is available in both paper and digital format. Information on slopes and soil suitability is an important tool in evaluating development potential and assessing hazard risks. In addition, the County of Marquette's

Planning Division has also developed a Land Use, Value, and Ownership Chapter of the Marquette County Comprehensive Plan, which inventories existing land cover and use.

Climate

The topography of Marquette County and proximity to Lake Superior affects its climate. The lake effect continues to be minimized at higher elevations and further inland. In some years, early freezing of the near -shore areas reduces the lake effect. The Lake generally increases cloudiness and snowfall during the fall and winter. Lower elevations and areas along the shore are cooler during late spring and early summer and warmer during the late fall and early winter.

The average heating degree days for January is 1581 while in October is its 576. The average cooling degree-days for July is 106, while May was 16. The average date of the last freezing temperature was May 31 and the average date of first freezing temperature in the fall was September 7. The freeze-free period averages 109 days annually. The prevailing wind is westerly, averaging 9 mph. The strongest one-minute wind speed, 59 mph was recorded in June 1958. The average relative humidity varies from 61% for April to 70% for November and December. The average percent of possible sunshine varies from 25% in December to 64% in July. The annual average is 44%. Summer precipitation is usually in the form of afternoon showers and thundershowers. A list of monthly means can be found on the following page.

CLIMATE NORMALS 1981-2010:

TEMPERATURE:

January Maximum (‘06)	49°F
July Maximum (‘88)	99°F
January Minimum (’94, ’96)	-27°F
July Minimum (’86, ’89, ’00)	36°F

TEMPERATURE EXTREMES:

Maximum Temp (07.1988)	99°F
Warmest Monthly Mean (07.1983)	83°F
Minimum Temp (02.1981)	-32°F
Coldest Monthly Mean (01.1982)	-5.6°F

ANNUAL PRECIPITATION:

Highest (1985)	51.59”
Lowest (1994)	24.15”
Mean	35.59”

SNOWFALL:

Calendar Year Highest (2002)	296.2”
Calendar Year Lowest (1994)	112.3”
Mean	203.64”
Season Highest (’02-’03)	319.8”

ANNUAL MEAN TEMPERATURE:

Highest (1998)	43.38°F
Lowest (1989)	37.9°F
Mean	40.2°F

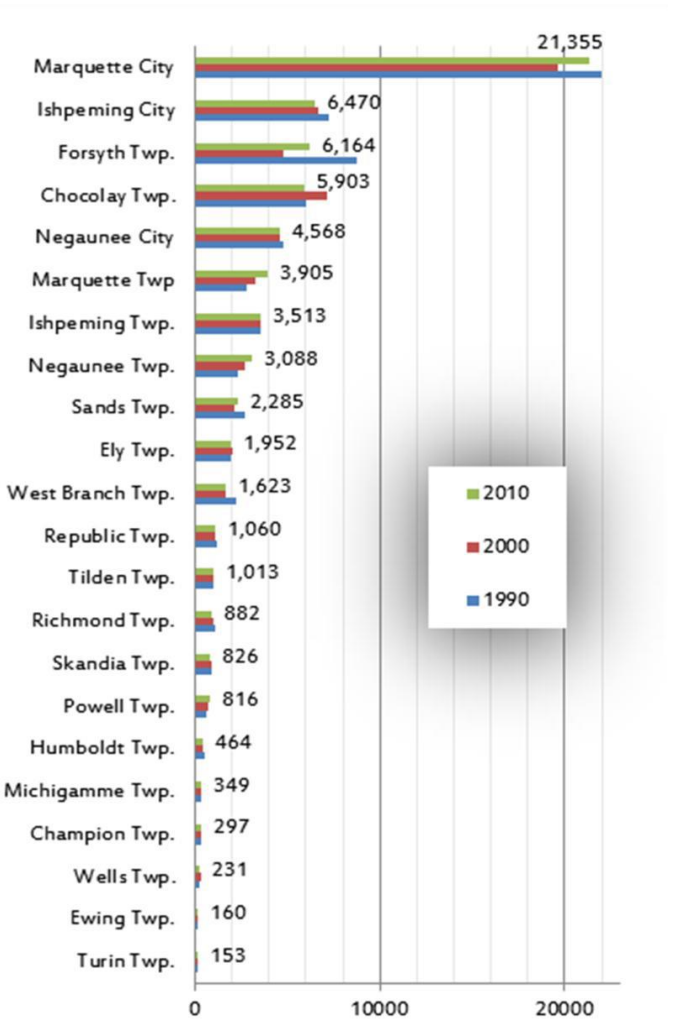


FIGURE 4 POPULATION BY SUBDIVISION

Population

The 2010 U.S. Census placed the population of Marquette County at 67,077, a 3.8% increase from the 2000 U.S. Census total population of 64,629. Figure 4 shows population by local unit of government over the past 30 years and labels the 2010 population figures.

Critical Facilities and Organizations

MEDICAL

As the largest city in the Upper Peninsula, Marquette also became the regional center for health services. UP Health System – Marquette, formerly Marquette General Hospital, has 222 beds with care in more than 65 medical specialties and subspecialties. It is also a training hospital affiliated with numerous colleges and universities throughout the Midwest. Through its collaboration with Northern Michigan University, UP Health System – Marquette also is part of the Upper Michigan Brain Tumor Center, which is conducting primary research on the formation of brain tumors. The hospital employs more than 1,800 people and annually serves 9,000 inpatients, and more than 350,000 outpatients.

UP Health System – Bell, formally Bell Hospital, is a 25 bed critical access hospital located in Ishpeming. A new facility was built in 2008. UP Health System – Bell employs more than 350 people and has more than 90 physicians on its active and consulting medical staff.

The Peninsula Medical Center in Marquette provides private offices for over 120 medical professionals. Other medical centers are the Teal Lake Medical Center in Negaunee, the Upper Great Lakes Family Health Centers located at K. I. Sawyer, Gwinn, and Marquette.

The Medical Facilities in Marquette County are relatively stable, but as presented during the Covid-19 pandemic there are capacity and staffing limitations that are vulnerabilities in extreme situations.

EDUCATION

According to the Census Bureau, of population over 25 years of age, 5% received a high school diploma. percent hold a high school diploma. 31% have had some level of college than a bachelor's degree and 22% hold a bachelor's degree. Nearly 7% hold a graduate or professional degree. In 2019, 18,027 individuals residing in Marquette County were actively enrolled in an educational program. Thirty-six percent were enrolled in programs for preschool through eighth grade. Seventeen percent were in high school and 48% were enrolled in college or graduate school.

All or portions of ten school districts and one charter school are within Marquette County, see Figure 5.

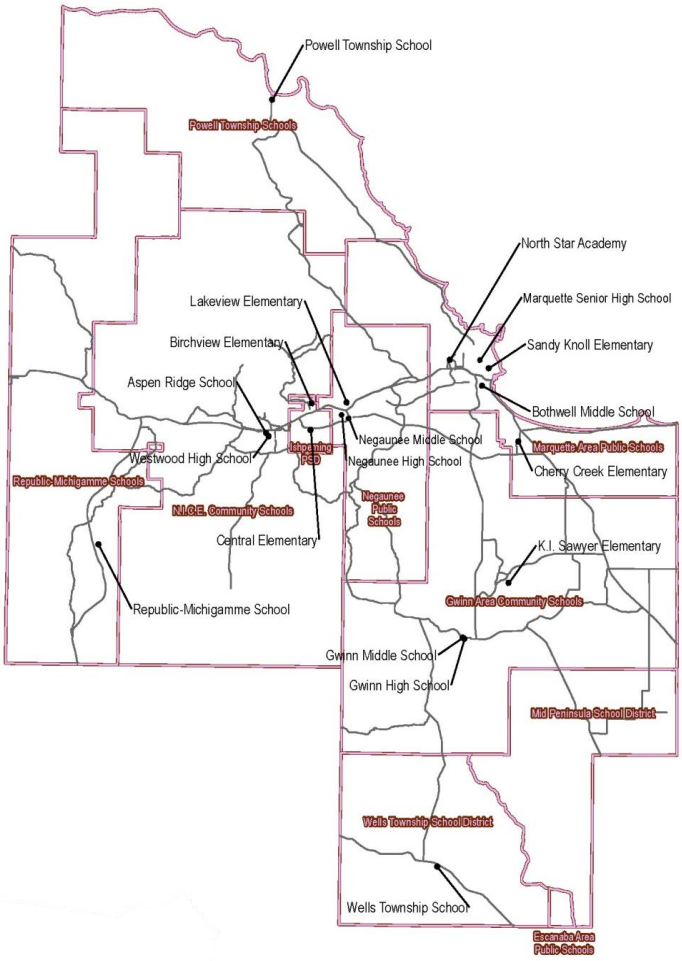


FIGURE 5 SCHOOL DISTRICTS

Northern Michigan University located in Marquette offers 1-, 2- and 4-year degrees and special certifications. The wide variety of technical and vocational programs includes cosmetology, restaurant management, construction trades, and airframe and power and business programs. In addition, custom training is available for area businesses. Additional educational opportunities are available in the Upper Peninsula at Bay de Noc Community College, Gogebic County Community College, Finlandia University, Lake Superior State University, and Michigan Technological University.

ORGANIZATIONS

There are numerous service organizations, such as Rotary, Zonta, Kiwanis and Lions throughout the County. There are also active chapters of many special interest organizations, such as the American Red Cross, American Cancer Society, American Heart Association, the Alzheimer's Association, etc. Key organizations in disaster mitigation, response and recovery include the United Way, American Red Cross, Team Rubicon, Salvation Army, The Great Lakes Conservation Corps and the St. Vincent de Paul Society.

There are 22 local units of government located within Marquette County. Fire, police, and EMS services to these units is provided through a number of means. Services are often joint or contracted with adjacent units. Currently, law enforcement in Marquette County is provided by the Michigan State Police, the Marquette County Sheriff, three city police departments, three township police departments, Northern Michigan University Public Safety, and the Keweenaw Bay Indian Community.

EMERGENCY RESPONSE FACILITIES

Emergency response facilities are shown in Table 3 to the right.

TABLE 3 EMERGENCY RESPONSE FACILITIES

Local Unit of Government	Fire	Police
Champion Township	Y	N
Chocolay Township	Y	Y
City of Ishpeming	Y	Y
City of Marquette	Y	Y
City of Negaunee	Y	Y
Ely Township	Contracted with Ishpeming Twp.	N
Ewing Township	Tri-Township FD	N
Forsyth Township	Y	Y
Humboldt Township	Y	N
Ishpeming Township	Y	Y
Marquette Township	Y	N
Michigamme Township	Y, Joint with Spurr (Baraga Co.)	N
Negaunee Township	Y	N
Powell Township	Y	N
Republic Township	Y	N
Richmond Township	Y, Palmer FD	N
Sands Township	Y	N
Skandia Township	Y, Joint with West Branch Twp.	N
Tilden Township	Contracted with Ishpeming Twp.	N
Turin Township	Y, Tri-Township FD	N
Wells Township	Y	N
West Branch Township	Y, Joint with Skandia Twp.	N

UTILITIES AND INFRASTRUCTURE

Utilities and infrastructure include: roads, bridges, electric service, water, and wastewater treatment among other services. They are essential to the wellbeing and prosperity of Marquette County. Some vulnerabilities of hazards to utilities and infrastructure include damage caused by severe winds causing power or heat outages, water back-ups potentially causing storm water or sewer backups, erosion causing damage to roads and bridges from waves on Lake Superior or storm surges on rivers and streams. Utilities and infrastructure are further addressed in Chapter Six.

HOUSING

Early community settlement patterns in Marquette County developed around iron ore mines. Today many of those communities still exist even though several of the mines have closed. A strong sense of belonging to a community makes those places a desirable place to live and raise a family. However, most must commute long distances to work each day.

There are 34,738 housing units in Marquette County, an increase in over 400 since the year 2010. Of that number, 26,204 are occupied and 8,534 are vacant. The housing market in Marquette County is a reflection of local economic conditions in addition to regional and national occurrences. Housing has a direct impact on the U.S. economy. Less than ten years ago the housing market was a driving force in what was considered a healthy, growing economy. New housing starts were at record numbers both nationally and locally. Existing houses were being bought and sold rapidly and banks were lending money easily. This created jobs in the construction and manufacturing industries along with service jobs such as real estate agents, lawyers, and brokers. The Housing Plan is a chapter of the County's Comprehensive Plan. It further discusses the history and state of the housing stock in the County.

Risks in housing units include the occurrence of fires and the mitigation infrastructure, such as fire alarms and updated wiring, put into place alleviate that risk.

Historic Resources

Mining and logging attracted settlers of Canadian, French, Cornish, Swedish, Finnish, and Irish stock. Hardworking and conservative, together they developed the County. Three early communities, Marquette, Ishpeming and Negaunee developed into cities. Other communities are integral parts of political townships, but have their own identities. Two townships, Chocolay and Marquette are classified as Charter Townships and have additional governmental rights and responsibilities. Just as time and growth can give rise to land use conflicts, they can also give birth and appreciation for places of historic significance. Marquette County has an appreciation of its past -- from the Courthouse to mining buildings and charcoal kilns to residential neighborhoods. There are 47 sites on the national and/or state lists of historic structures.

Museums available to the public:

- Marquette Regional History Center
- Marquette Maritime Museum
- Forsyth Township Historical Museum
- Michigamme Historical Museum
- National Ski Hall of Fame
- U. P Sports Hall of Fame
- Michigan Iron Industry Museum
- Negaunee Historical Museum
- K. I. Sawyer Air Heritage Museum
- Pascoe House Museum, Republic
- NMU Document Archives
- Cliffs Shaft Historic Park (Ishpeming)

Transportation

Transportation of goods and people within Marquette County is of primary importance. While transportation is predominantly by motor vehicle, other modes of transportation play a role in moving goods or people within Marquette County. A discussion of the various modes of transportation follows.

ROADS

There are no interstate highways within Marquette County. The backbone of surface transportation are highways US-41 and M-28. They provide access to and from the east, south, and west. There is a significant amount of local traffic and through traffic, particularly Canadian cross-continental trucking. Other important highway routes are M-94, M-95, M-35, and M-553, which travel in a north-south direction. With relatively few roads in Marquette County and the

vastness of the county, a major hazard risk includes road and bridge damage causing added time for commute in the case of a re-route needed due to impassable roads.

PUBLIC TRANSPORTATION

Most individuals rely on private vehicles for transportation. All of the school districts provide bus service. Airport shuttle service is available. Taxi service is available in Marquette.

Marq-Tran, a publicly operated bus system, serves Marquette County and provides fixed route and door-to-door services. The Marq-Tran facility is also a service center for Indian Trails and is located along the Calumet-Chicago route. Marq-Tran is part of the County's Emergency Response System and participates in emergency simulations and actual emergencies. A limitation with public transportation, is that it does not reach all areas of the county.

RAIL

Three railroad companies have track in Marquette County. Canadian National (CN) Railroad bisects Marquette County as it runs from Escanaba to Houghton. Escanaba is along a line running from Sault Ste. Marie to the western United States. According to the company's website, CN is the only railroad which crosses the continent east-west and north-south, serving ports on the Atlantic, Pacific and Gulf coasts while linking customers to all three NAFTA nations. They also claim to move a more diversified and balanced portfolio of goods including petroleum and chemicals, grain and fertilizers, coal, metals and minerals, forest products, intermodal and automotive. Lake Superior and Ishpeming railroad runs from the central part of the County to the ore dock in the North Marquette harbor. The railway is owned by Cliffs Natural Resources and is used to haul ore from the mining operations to the ore dock located by Presque Isle in the City of Marquette. Escanaba and Lake Superior railroad runs north from Green Bay, Wisconsin through Iron Mountain into Republic Township in southwest Marquette County. Mineral Range Railroad hauls the ore from the Lundin Mill in Humboldt to Ishpeming on the rail spur reopened in 2013. Known vulnerabilities include rail and trestle damage from extreme weather events.

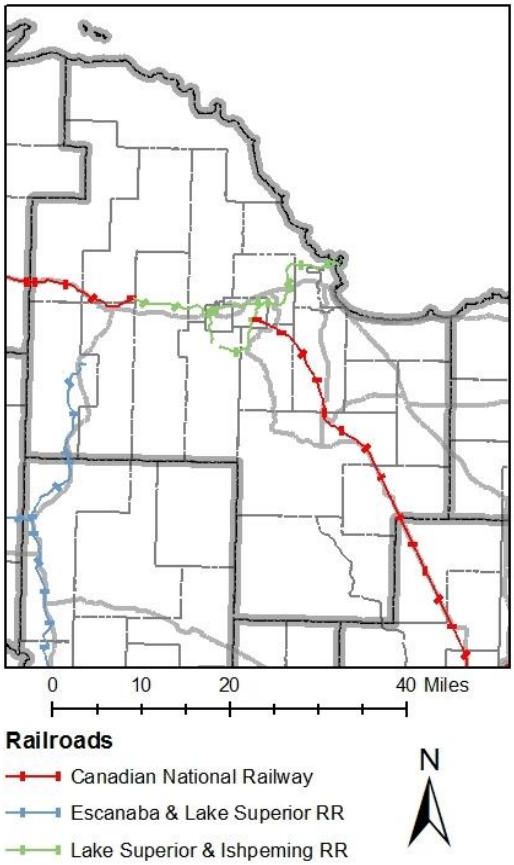


FIGURE 6 RAIL LINES

WATER

There are two ports in Marquette County. The Big Bay Harbor of Refuge is owned by the County of Marquette and is located in the Big Bay Area of Powell Township in northern Marquette County. This port is identified as commercial and recreational. The second port is in the City of Marquette and is identified as a cargo, commercial, and recreational port. Docks in the Upper Harbor include the LS&I Ore Dock, the WE Energies Coal Dock, and the City's Merchandise Dock. The Presque Isle Marina, operated by the City of Marquette, is also located

in the harbor. A break wall protects the harbor. In the Lower Harbor, the Marquette Board of Light & Power maintains a dock at the Shiras Steam Plant. The Fish Dock serves Thill and Son's Fisheries and is used by recreational vessels. An association of recreational boaters also maintains a dock. The City maintains docking facilities along the bulkhead of the Ellwood Mattson Park for large visiting vessels and operates the Cinder Pond Marina.

AIR

Sawyer International Airport located at K. I. Sawyer provides commercial passenger, charter and general aviation services. There is a general aviation terminal and a passenger terminal. The fixed base operator also operates an FAA certified repair station. There are at least eight unpaved, private landing fields**.** In addition, several area lakes are used for aviation.

PIPELINE

Marquette County has two major continental pipelines used for transporting crude oil and natural gas. They are located in Wells Township, which is sparsely populated. There are other smaller regional pipelines located within the County, as well. The newly constructed SEMCO Marquette Connector Pipeline, a 42-mile pipeline completed in 2020, links the existing Northern Natural Gas pipeline with the Great Lakes Gas Transmission system. The pipeline runs north to south through much of Marquette County, from Negaunee Township to near the town of Arnold. Pipelines do cross rivers and streams in Marquette County and a risk involved is the instance of a spill allowing the crude oil or gas causing air and water pollution.

Economic Characteristics

While Marquette County has suffered along with the rest of the country in the recent recession, the effects so far have been less serious than in the rest of Michigan. A combination of strength in mining, lack of dependency on the auto industry, and diversification have help to insulate Marquette County form the worst of the recession. The insulation, however, is relative. Marquette County fared well by Michigan standards, but performed poorly compared to counties in Wisconsin. Additional concerns lie ahead, as Marquette County remains vulnerable to some long-term economic and demographic trends.

Demographic trends, while reversible, represent the greatest current threat to Marquette County's economic well-being. While the entire U.S. population is aging, the effects are more pronounced here. Birth rates have dropped across the Upper Peninsula, to the point that existing populations cannot be sustained without in-migration. International migration to the Upper Peninsula is miniscule, and domestic migration is generally out of the region. Michigan was the only state to suffer a population loss between 2000 and 2010. Mining remains a volatile industry, and is now much more exposed to changes in demand and global competition. Iron mining success through the recent recession has been sustained because of global demand for iron ore from China and India less than by North American demand. Hope for Marquette County can be seen in its consolidation as a regional center. Regional institutions like Northern Michigan University and UP Health Systems—Marquette (formerly Marquette General Hospital) are major employers. The access provided by Sawyer International Airport enhances opportunities for economic growth. Marquette County has only 26 per cent of the Upper Peninsula's population, but Sawyer accounts for 53 per cent of the airline passenger traffic in the region. Additional information can be found in the Economy Chapter of the Marquette County Comprehensive Plan.

SECTION II HAZARD OVERVIEW

CHAPTER 2 RISK ANALYSIS

Hazard Rating

The County's Emergency Management Coordinator obtained feedback from the Local Emergency Planning Committee (LEPC) and met with the Planning Division on November 13th, 2020. Hazards were rated for several criteria and the results were compiled into the Hazard Rating table, see Table 4. The LEPC is a diverse group, made up of doctors, EMS personnel, chemists, and planners. The ranking was done by discussion of the various hazards involved between the County's Emergency Management Coordinator and the LEPC. Hazards were ranked based on scores assigned to several of their characteristics, as noted in the ranking system below.

Chance of Occurrence: The more often a hazard occurs, the more risk it represents. Chance of occurrence was ranked as:

- 10 points: Multiple times a year
- 7 points: Annually
- 5 points: Every 2-3 years
- 3 points: Every decade or so
- 1 point: Low occurrence

Population Affected: How many people will be affected by the hazard, either directly or indirectly?

- 10 points: High impact
- 7 points: Medium impact
- 4 points: Low impact
- 1 point: No impact

Number of Casualties: Casualties significantly raise the risk posed by a hazard.

- 10 points: Many casualties
- 7 points: Some casualties
- 4 points: Few casualties
- 1 point: No casualties

Ability of Mitigate/Predict: The easier it is to mitigate and predict a hazard, the more effective money spent on that effort will be. We are trying to use our resources to change things that we can do something about.

- 10 points: Impossible to mitigate/ predict
- 7 points: Difficult to mitigate/ predict
- 4 points: Possible to mitigate/ predict
- 1 point: Easy to mitigate/ predict

Area Affected: The wider an area that a hazard affects, the greater the risk.

- 10 points: All of Marquette County is affected.
- 7 points: Multiple cities and/or townships are affected.
- 4 points: One city or township is affected.
- 1 point: Hazard is confined to a localized area.

Risk factors were weighted according to their relative importance and the results were tabulated.

TABLE 4 HAZARD RATING

Hazard	Chance of Occurrence	Population Affected	Number of Casualties	Ability to Predict	Ability to Mitigate	Area Affected	Total Weight (Must = 100%)	Rank
Weight	25%	15%	10%	15%	25%	10%	100%	
Infrastructure Failure/Secondary Technological Hazard	10	10	1	7	4	10	7.15	1
Public Health Epidemic	3	10	10	7	7	10	7.05	2
Snowstorms	10	10	4	4	4	10	7	3
Severe Winds	7	7	1	4	10	7	6.7	4
Extreme Temperatures	10	10	4	1	4	10	6.55	5
Wildfires	10	7	1	7	4	7	6.4	6
Structural Fires	10	4	4	10	4	1	6.1	7
Transportation Accident--Passenger	10	4	4	10	4	1	6.1	8
Hazardous Material--Fixed Site Incident	10	4	4	7	4	4	5.95	9
Earthquakes	1	4	1	10	10	10	5.95	10
Drought	5	7	1	4	7	10	5.75	11
Hail	3	4	1	7	10	7	5.7	12
Shoreline Erosion/Flooding	7	4	1	4	7	7	5.5	13
Petroleum/Natural Gas Accident	5	7	4	7	4	7	5.45	14
Ice/Sleet Storms	7	7	1	1	4	10	5.05	15
Sabotage/Terrorism	1	7	4	10	7	1	5.05	16
Civil Disturbance	5	4	1	4	7	7	5	17
Riverine and Urban Flooding	5	4	1	7	4	7	4.7	18
Tornadoes	3	4	1	7	7	4	4.65	19
Dam Failure	3	7	1	7	4	4	4.35	20
Hazardous Material--Transportation Accidents	3	4	1	10	4	4	4.35	21
Subsidence	3	1	1	10	4	1	3.6	22
Lightning	1	4	1	4	7	1	3.4	23
Scrap Tire Fires	1	1	1	10	1	1	2.35	24

The individual hazards will be discussed in more detail in the following chapters. Some hazards were grouped together for the purposes of this plan. All priority hazards are further analyzed and addressed within the plan.

Risk and Vulnerability Assessment

Risk: The goals of risk assessment are to determine where hazards exist, and develop an understanding of how often they will arise and how much harm they will cause. Based on the weighted hazard ranking process recommended in the Michigan Hazard Analysis workbook, a composite of hazards and their relative risk are presented below in Table 5.

> **High Risk**: very likely to occur during hazard mitigation planning horizon of 20 years, and/or effect all of most of the County.
> **Medium Risk**: somewhat likely to occur during hazard mitigation horizon of 20 years, and/or effect a significant are of the County.
> **Low Risk**: not likely to occur, or cover only a limited area of the County.

Vulnerability: This step looks at such points as population concentrations, age-specific population, development pressures, geography, types of housing, presence of agriculture, and other issues that make Marquette County more vulnerable to specific hazard. Basic criteria are listed below.

> **High Vulnerability:** If an event occurred it would have severe impacts over large geographic areas or more densely population areas and have serious financial impact on County residents and businesses.
> **Medium Vulnerability:** If an event occurred it would have confined impacts on the safety of County residents but may still present financial impact on County residents and businesses.
> **Low Vulnerability:** If an event occurred it would have very minimal impact on the safety of County resident and financial impact on County residents and business would also be minimal.

Hazard	*Risk*	*Vulnerability*
Snowstorms	High	High
Extreme Temperatures	High	High
Infrastructure Failure	High	Medium
Ice/Sleet Storms	Medium	Medium
Wildfires	High	Medium
Public Health Epidemic	Medium	High
Hazardous Materials- Fixed Site	Low	Low-Medium
Riverine and Urban Flooding	Medium	Medium
Structure Fires	High	Low
Transportation Accident	High	Low
Drought	Medium	High
Dam Failure	Low	High
Shoreline Flooding/Erosion	High	High
Severe Winds	Medium	High
Hazardous Materials- Transportation	Low	Low-Medium
Tornadoes	Low	Medium

Civil Disturbance	**Medium**	**Medium**
Scrap Tire Fires	**Low**	**Low**
Petroleum/Natural Gas Accident	**Medium**	**Medium**
Lightning	**Medium**	**Low**
Hail	**Medium**	**Medium**
Subsidence	**Medium**	**Low**
Sabotage/Terrorism	**Low**	**Medium**
Earthquake	**Low**	**Low**
Rip Currents	**High**	**Medium**
Environmental Hazards	**High**	**High**

TABLE 5 RISK AND VULNERABILITY ASSESSMENT

CHAPTER 3 NATURAL DISASTERS

In the natural disasters section of this document multiple hazards will be discussed and analyzed. These hazards include: fires, flooding, dam failure, unstable ground, and earthquakes. These hazards vary greatly in their likelihood and severity.

Data for this chapter was gathered through multiples sources. Information was used from the previous Hazard Mitigation Plan as well as assembled from Marquette County Central Dispatch, the Michigan Department of Natural Resources, and the National Oceanic and Atmospheric Administration.

Wildfires

Marquette County's area of 1860 square miles makes it the largest in Michigan. Approximately 85% of the County is covered in forest lands. Woven into this forested landscape is the Upper Peninsula's largest population, primarily focused along the US-41 corridor from Harvey to West Ishpeming. Beyond the corridor, however, dispersed development has led to a large Wildland Urban Interface (WUI). These factors combined in 2013 to trigger more wildfires in Marquette County than in any other county in Michigan. The Marquette County Community Wildfire Protection Plan and MI Department of Natural Resources data will serve as additional information to this section of the Hazard Mitigation Plan.

RISK ANALYSIS

To assess the current wildfire risk, records from the Michigan Department of Natural Resources were used, focusing on "reportable" fires, or fire that could not be contained by local fire departments, triggering a response by the DNR. Wildfire risk analysis is more thoroughly analyzed in the Marquette County Community Wildfire Protection Plan.

Wildfires

Risk: **High**

Vulnerability: **Medium**

Mitigation

Reduction of hazardous fuels

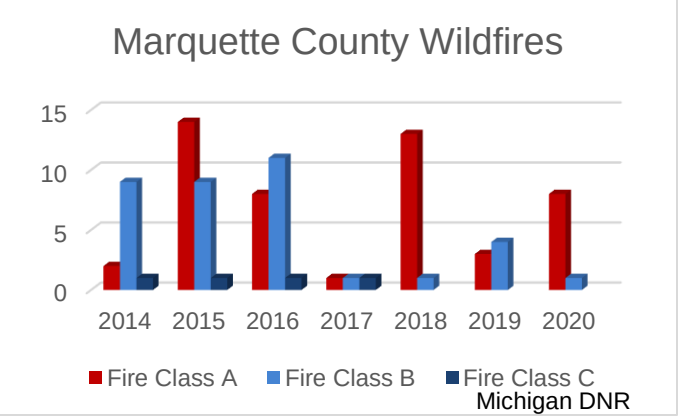
Implement Firewise techniques

Reducing structural ignitability

GIS Mapping of high fire hazard areas

Public notification of high fire risk days

There have been 124 reportable wildfires in Marquette County since 2014, with none of them causing serious damage. The main cause of these fires were campfires, equipment, debris burns, or classified as miscellaneous. No incidents were large enough to be classified in the NOAA storm event database. According to the DNR wildland fire database, these fires did not seem to have any correlation with recent development of any kind, and were more related to drier weather conditions, natural causes, or careless personal activities. See Figure 7 for quantity and size of wildfire since 2014.



Class definitions:

Class A - one-fourth acre or less

Class B - more than one-fourth acre, but less than 10 acres

Class C - 10 acres or more, but less than 100 acres

FIGURE 7 MARQUETTE COUNTY WILDFIRES

With geographical location not specific for recent wildland fires, it could be said that the entire region is equally at risk of a fire during similar dry weather conditions. One area of the county that contains a higher probability for wildfire is the Sands Plains area in the Sands Township/ Forsyth Township area. The Sands Plains contains thousands of acres of Jack Pine, consisting of dry, sandy soils. Change in development patterns and the WUI over the last five years have not been substantial enough to change the regional risk within the county.

Structure Fires

Structure fires are a common hazard facing all communities. According to the FEMA U.S. Fire Administration and the National Fire Protection Association, there were over 1.3 million fires reported in the United States in 2018. Approximately 499,000 of these were structure fires. These fires caused over 25.6 billion dollars in damage. Apartments, student dormitories, and large institution fires are of particular concern in Marquette County. Structure fires may occur anywhere within the county, but are considered localized hazards.

Apartments

Based upon recent fire history, a large portion of structure fires in the County take place in apartments and multi-family units. The most recent structure fire took place July 30, 2019 at the Pine Ridge Complex in the City of Marquette that evacuated dozens of residents from their homes for months, but reported no injuries. Northern Michigan University in the city of Marquette creates a large need for rental housing, thus a large number of rentals exist in the City of Marquette. The Marquette Housing Commission operates Lake Superior Village, with 114 townhouse style units in multiple structures. None of the units at Lake Superior Village are barrier free. Within the City of Marquette are two high rise apartment buildings. Pine Ridge and Snowberry Heights are 9 and 11 stories respectively. Pine Ridge has 140 units with some barrier free units. Snowberry Heights is privately operated. It has 191 units, with some barrier free units located on the first floor. Snowberry heights is reserved for seniors and those who are mobility disabled.

The Ishpeming Housing Commission has 39 units between its Holmes Terrace and Willow Street Complexes. These units are not equipped with sprinklers. Also operated by the Ishpeming Housing Commission is the Pioneer Bluff Apartments. These apartments are reserved for seniors and the disabled. The Pioneer Bluff Complex has 88 apartments. It is not equipped with a sprinkler system. The units have wired smoke alarms with battery back-up. The building is also equipped with strobe light alert system for those with hearing impairments.

The City of Negaunee Housing Commission operates 80 apartments units. These units are all equipped with hardwired smoke detectors that have battery backups. The smoke detectors are also equipped with sound and light strobe for the vision and hearing impaired. The fire alarm system is continuously monitored by an outside company. Sprinklers are installed in the boiler and storage rooms.

Student Dormitories

Most dorm fires are relatively small. Approximately 2/3 of these fires are limited to the area of origin --being suppressed before involving the entire room. Arson, smoking, and cooking are the leading causes of fires within dorms. Unattended candles are another major cause of dorm fires. Northern Michigan University has eight residence halls that are occupied by roughly 2800 students. The University also has seven apartment complexes with approximately 550 occupants. All on campus housing is equipped with smoke alarms and sprinkler systems. Routine fire drills are also held.

Institutions

Bell Memorial Hospital and Marquette General Hospital routinely provide education for staff in evacuation plans and in house drills. Both hospitals are equipped with fire alarm and sprinkler systems. Fire inspections are conducted by the State twice a year. Staff also conducts internal inspections. During an event, hospital patients would be moved to another wing while extended care patients would most likely be sheltered with family.

The D. J. Jacobetti Home located in the City of Marquette is a 294 bed home for veterans. They average about one minor fire per year. There are monthly reviews of fire, bomb, and tornado evacuation practices. Three times per year they conduct in house evacuation drills, moving patients from one area past fire doors into other portions of the facility. Twice a year they conduct drills for other types of disasters. There are smoke detectors and sprinklers in all hazard areas. The State Fire Marshal inspects the property twice yearly and it is inspected by a federal inspector once a year.

The Marquette Branch Prison, in the City of Marquette, had a major fire approximately 20 years ago during which they lost one building and had severe damage to another. Since that time, sprinkler systems, smoke detection and alarm systems, and standpipes have been added. The City of Marquette would be called for a fire that could not be handled internally. All City firefighters tour the facility annually to assure familiarity with the building and special procedures. In the event of a fire, internal evacuation/relocation would take place if needed. Generally, there is minimal mass movement of prisoners. There is a policy of no external evacuation.

Human error is the most common cause of fire in Marquette County. Candles, appliances, and sauna stoves have all caused numerous fires in Marquette County. Although the County's housing stock is old, the older (knob and tube) wiring in these homes has not seemed to have caused significant problems. Marquette County Central Dispatch keeps records on incidents involving all police, fires, and EMS agencies countywide. Central dispatch receives approximately 20,000 9-1-1 calls annually. These reports were reviewed for data and statistics on fires.

RISK ANALYSIS

Fires in residences constructed before 1964 create a problem because of balloon frame construction. Fire spreads by using the wall cavities as chimneys. The fires can be extinguished, but there is always major water damage, sometimes to the point of demolition. Since 1964, laws requiring firestops in wood frame construction have been enforced. However, more than 43% the housing in Marquette County was constructed before enforcement of this law.

Due to a switch in record keeping methods, data on fire instances in Marquette County was only available beginning in 2012. However, the data was not searchable so exact structure fire numbers were not incorporated into this plan.

Structure Fires
Risk: High
Vulnerability: Low

Mitigation

Smoke detector programs

Education and awareness: fire department open houses, residential fire escape plans, smoke detection awareness

Rental inspection programs and ordinances

Encourage sprinkler systems

Fire prevention through building codes

The City of Marquette Fire Department enforces its Rental Fire Safety Code Ordinance with three staff rental inspectors. The City of Ishpeming also has a residential rental inspector who completes inspection on rental units. These inspections ensure safety of rental units and also check for mandatory items such as working smoke detectors. The City of Negaunee also has employs an inspector who enforces rental registration and inspection. The large number of people in apartments, dormitories, and institutes make the hazard potential of a fire at these locations significantly greater. However, these locations most often have safety and preventative measures in place.

Other Fires

Scrap tires fires are especially difficult to extinguish and cause extensive clean up. Marquette County does not have any significant scrap tire piles. However, tire dealers and solid waste transfer stations accumulate tires for recycling and sometimes have a hundred or more tires on site. There is also the possibility of illegal dumping sites.

Explosion incidents can also occur within the County. Two power plants previously operated in the County, the Wisconsin Energy Presque Isle Plant and the Shiras Steam Plant, and were decommissioned in 2019, and 2018 respectively. This brought the addition of a gas fired generating station located in Negaunee Township as well as the Marquette Board of Light and Power Natural Gas plant on Wright Street in the City of Marquette. The Tilden, Empire, and Eagle Mines are all located within the county and use of explosives at these sites in common. Dyno-Nobel, an industrial and mining explosives company, is located in Tilden Township.

In recent years, the manufacturing of meth has become increasingly more common across the nation. There have been several arrests related to methamphetamine in Marquette County. The process of making methamphetamines is extremely dangerous as the ingredients are volatile and often times can

explode or catch fire. Other explosions within the County include those from homemade bombs. These bombs tend to be made with cleaning and other household products.

RISK ANALYSIS

Though there are no known significant scrap tire piles are located within the County there is still a chance that a fire could occur at a recycling facility or dealer or illegal dump site. In the event of a fire, both scrap and new tires could create fire suppression problems. Each tire also can create about 2 gallons of oily residue that can leach into the soil or migrate to streams.

Other Fires
Risk: Low
Vulnerability: Low

Mitigation

Tire collection events and removal from illegal dump sites

Response plans for buildings with hazardous materials

Funding for specialized response teams (UPSET)

The County of Marquette has also experienced explosion incidents. In December 2001, an explosion occurred at Wisconsin Electric's Presque Isle Generating Station in the City of Marquette as a generator was put on line. One death and one injury resulted. The mining industry in Marquette County continues to use explosives on a daily basis. The mines and the Dyno Nobel explosives company are generally isolated from heavily populated areas, but could be threatened by events such as wildfire. Dyno-Nobel maintains their own Hazmat Response Plan.

Other businesses utilize products that could result in explosion if they are mishandled. Unfortunately, there have been several incidents of homemade bombs that utilize cleaning products. Although most homemade bombs tend to be pranks, the result could be tragic. Local police agencies periodically give warnings about blasting caps, fuses, and the like and have taken enforcement action regarding the homemade bombs.

The manufacturing of methamphetamine has been the cause for both explosion and fires in Marquette County. The Upper Peninsula Substance Enforcement Team (UPSET) is a multijurisdictional street narcotics team that covers a large portion of the Upper Peninsula, including Marquette County. The team is responsible for uncovering multiple manufacturing sites and also for many arrests relating to methamphetamines.

Riverine and Urban Flooding

There are approximately 4,000 miles of rivers and creeks and over 1,800 inland lakes in Marquette County. Combined with heavy snow accumulations and a mean annual rainfall of 30 inches, the County of Marquette is susceptible for flood related problems. There are 22 drainage basins within Marquette County, which vary in size greatly (Figure 1-6, Marquette County Watersheds). Four river systems, the Carp, the Pesheeke-Michigamme, the Chocolay, and the Escanaba provide the greatest risk of property damage.

Marquette County Drainage Basins

Big Garlic River	Harlow Creek	Provost Lake
Carp River	Huron River	Rapid River
Chocolay River	Little Garlic River	Salmon Trout River
Compeau Creek	Little Huron River	Sand River
Dead River	Mountain Lake	Whetstone Brook
Escanaba River	Oriana Brook	Whitefish River
Ford River	Pelessier Lake	Yellow Dog River
		Pesheeke-Michigamme River

The main cause of flooding in the Upper Peninsula is usually heavy

rainfall and rapid melting of snow or ice accumulations. By monitoring weather and ice/snow accumulations, short-term flood predictions are possible. Flash floods are short term events, occurring within six hours of the causative event (heavy rain, dam break, levee failure, rapid snowmelt, and ice jams). The two key elements are the intensity of water release and the duration. Topography, soil conditions, and ground cover also play an important role. Flash flooding can occur in narrow gullies and river basins, in shoreline areas following severe storms and in urbanized areas. Impervious surfaces increase run-off two to six times over that occurring on natural land. Streets can become swift moving rivers and basements can become traps as they fill with water.

There is no distinct line between riverine flooding and urban flooding. Storm drains are constructed to collect water from impervious surfaces within a built up area. They can include ditches or a system of catch basins and pipes. While this may prevent local flooding of streets, it moves water more rapidly to the ultimate collection point—usually a stream, river or lake. The decrease in lag time increases the peak discharge. Regardless of the capacity of the receiving body of water, urban flooding occurs when the drain or pipe is inadequately sized or designed to receive all of the water within that portion of the system.

When gutter, ditch or pipes have too little capacity; ponds are created on the road. The most common form of urban flooding is water topping curbs. Improperly designed curb cuts can also channel water along driveways, funneling it into garages and basements. In some instances, the backup of water could be the result of the height of catch basins or the grade of the adjacent street. In others, it could be due to volume exceeding the capacity due to addition of impervious surfaces after construction of the system or elimination of a natural detention area. Lastly, maintenance of the system is an important factor in meeting its design function. Catch basins and culverts clogged with sand or leaves cannot carry their full capacity of water.

NOAA and the United States Geologic Survey (USGS) along with other partners operate steamgages and monitoring throughout the United States. Data from these gages can be found through the USGS and also through NOAA. A streamgage is an active, continuously functioning measuring device in the field for which a mean daily streamflow is computed or estimated and quality assured for at least 355 days of a water year or a complete set of unit values are computed or estimated and quality assured for at least 355 days of a water year. Most USGS streamgages operate by measuring the elevation of the water in the river or stream and then converting the water elevation (called 'stage') to a streamflow ('discharge') by using a curve that relates the elevation to a set of actual discharge measurements. This is done because currently the technology is not available to measure the flow of the water accurately enough directly. There are multiple gages located in Marquette County. Streamgages play an important role in being able to predict and monitoring flood conditions.

RISK ANALYSIS

Marquette County experienced 16 days with recorded flood events from 07/01/2010-01/01/2020. These events consist of floods, flash floods, and lakeshore floods. Though, the County has recorded hundreds of instances of flood damaged properties, most relating to water accumulation in basements. The vast majority of damaged structures are single-family residences, although rental units and commercial buildings have also been affected. Contact with water can cause injury and physical damage due to pressure or saturation. Furniture, drywall or insulation that becomes saturated is generally ruined. Electrical systems are often damaged beyond repair. Damage to automobiles can extend beyond wet upholstery and shorted electrical systems.

Riverine Flooding
Risk: Medium
Vulnerability: Medium
Probability: An average of 1.6 flood events per year.

Mitigation

- Effective flood plain management
- Flood insurance programs implementation and awareness
- Develop waterfront and riparian area zoning districts and regulations
- Additional stream gages for early flood stage alerts
- Culvert installation and replacement
- Updated flood plain maps
- Implement effective stormwater management techniques

With higher velocities associated with flooding, water carries a greater load of suspended particles. Velocities are frequently great enough to carry large particles such as trees and houses. Six inches of fast moving water can move a passenger car. Floating objects can cause serious injury or destruction to anything in their path. Water in fields can damage and destroy crops. Deposits of sediment can also be destructive. Secondary hazards are the pollution of drinking water sources, particularly when wells, septic tanks, and sewage treatment facilities are flooded. Gas, electric, cable, and phone service may be disrupted. Broken lines create hazards of electrocution or explosion. Roads may be closed or unstable. Tertiary effects may include permanent changing of river channels and shoreline, destruction of wildlife habitat or usefulness of land, closure of businesses and loss of jobs, and financial hardship due to repair and replacement expenses.

On 05/14/2006, heavy rain caused flooding at multiple locations in Marquette County. Significant road damage was reported on County Road 550 with damage also occurring to County Road 510. The Chocolay River exceeded flood stage damaging a fishing pier as water inundated a portion of Timber Lane in Harvey and caused flooding of properties. This event caused approximately 100 thousand dollars in damage. On 04/28/2013, the rapid melting of late season snow created a flood event that caused over 600 thousand dollars of damage to areas within the County. The event also prompted the Governor to issue a state of disaster in Marquette County.

The Chocolay River, with its shallow mouth in Chocolay Township, has been a large focus of flooding concern in Marquette County. Ice Blockage at the mouth of the river has been an issue in the past. Storms have also caused sedimentation at the mouth of the river. In the past, the National Guard has used dynamite to clear ice dams from the mouth of the river. The Carp River also has a shallow mouth which makes it susceptible to ice dams and blockages.

A flash flood is characterized by a rapid stream rise with depths of water that can reach well above the banks of the creek. The north and western portion of County are most susceptible to flash flooding. This is due to the "younger" age of the rivers, with narrower channels and steeper gradients, rock outcrops and impermeability of soils.

Shoreline Flooding and Erosion

The United States Geologic Survey defines five forms of coastal change hazards. These hazards include: beach erosion, dune erosion, overwash, inundation and island breaching, and marsh erosion. Beach erosion occurs when waves and currents remove sand from the beach system. Dune erosion is when storm surge elevates waves higher on the beach, allowing them to attack and erode the coastal dune. Overwash occurs when waves exceed the height of the dune. Inundation happens when the beach is submerged in water and marsh erosion when wetlands along coastlines are exposed to open water and eroded by waves.

High-risk erosion areas were established by the State of Michigan in 1978; however in 2012 a recession rate study was conducted and found properties previously designated as high-risk in Marquette County could be de-designated. Though de-designated, Marquette County still has several areas that are subject to erosion. Presque Isle Park, a 323 acre park in the City of Marquette has had many erosion concerns. The heavy traffic, both foot and vehicle, at the park make it especially vulnerable. Another commonly publicized erosion issue within the City of Marquette is the erosion along Lakeshore Boulevard, see Figure 8. The road has been closed multiple times and often for extended periods due to unsafe conditions along the shoreline. As a result of repeated severe erosion from Lake Superior, a portion of Lakeshore Boulevard was moved 300 feet inland in 2020. This project is ongoing, and additional sections are still periodically closed and threatened to surface damage, debris and rocks blocking the roadway, and storm water outflow backups.

Many local municipalities enforce setbacks from water. Regulation of development along shorelines and riparian area overlay zones are other ways municipalities restrict waterfront development. Until January 2014, the Marquette County Soil Conservation District issued Soil Erosion Permits for the entire county. Those responsibilities are now handled by the Marquette County Building Codes Department. That permit is required for construction within 500 feet of water. The State DEQ regulates below the ordinary high water mark.

FIGURE 8 SHORLINE EROSION ON LAKESHORE BOULEVARD IN MARQUETTE

Shoreline Flooding and Erosion
Risk: High
Vulnerability: High

Mitigation

Effective flood plain management

Flood insurance programs implementation and awareness

Develop waterfront and riparian area zoning districts and regulations

Soil and erosion control permits and enforcement

Installation of erosion control measures such as riprap or dune grass in areas prone to erosion

Updated flood maps

RISK ANALYSIS

With approximately 70 miles of Lake Superior shoreline, including islands, Marquette County is certainly susceptible to coastal change hazards. Heavy rains have resulted in widespread flooding in Marquette County in the past. These rains have resulted in washouts along County Road 510 and County Road 550. Rain and high waves produced from storms have been large contributors to erosion issues in the County. This is especially evident with Lakeshore Blvd in the City of Marquette. At Presque Isle Park, the Presque Isle Park Advisory Committee, along with the City of Marquette, has long been looking into the mitigation measures for erosion at the park. Mitigation measures in the City of Marquette were started by the moving of a section of Lakeshore Boulevard 300 feet inland in 2020. Some measures have been implemented but additional long term solutions and mitigation measures are still needed. Even small particles of sand and stone moved by water can cause considerable damage and erosion so monitoring bank and riparian area conditions throughout the County is always important.

Flood Insurance

The inundation area outside the normal boundary of the water body is the floodplain. Flood frequencies can be estimated by studying the yearly maximum discharge of a stream from a gauging station over a long period. By plotting and projecting the discharges over time, the chance of flooding exceeding a specified level can be estimated and maps can be generated that identify the area that would be inundated under those conditions. Using topographic data and historical information regarding river stages, maps can be constructed to show areas that are expected to be covered with water for various discharges. The severity of flooding is referred to by the probable frequency of that level of flooding (i.e. a 10- year, 50-year, and 100-year or 500-year flood). In actuality however, it predicts the chance of receiving that level of water in any given year. A 100-year flood has a 1 in 100 chance of occurring each year. 100-year floods can (and have) been known to occur in consecutive years. On the average, one or two 200-year floods occur each year in the Upper Peninsula. There are no repetitive loss properties in Marquette County.

Flood hazard maps are created to show areas that are susceptible to flooding when the discharge of a stream exceeds the full-bank level. As construction occurs within the drainage basin, it modifies detention areas, channels, rates of flow, run-off paths, vegetation and/or soil absorption rates. Floodplains can change dramatically. Unfortunately, maps are static. In Michigan, the average age of floodplain maps is over 16 years. The Federal Emergency Management Agency hopes to reduce that average to 5 years through upgrades of existing maps and creation of new ones for previously unmapped area.

Before 1968, most property owners were unable to purchase insurance coverage for flood related damage. The potential for enormous claims made private insurance companies reluctant to offer this type of coverage. In 1968 Congress created the National

Compliance Options

Increase elevation: This raises the home or business above the flood elevation level adopted by your community.

Relocation: This moves the home or business out of the floodplain.

Demolition: This tears down and removes flood-damaged buildings.

Flood proofing: This option is available only for non-residential buildings and certain residential buildings in communities certified by FEMA. It involves making a building watertight through a combination of adjustments or additional features that reduce the potential for flood damage.

JURISDICTIONS PARTICIPATING IN NFIP

1. Chocolay Township
2. Ely Township
3. Ewing Township
4. City of Marquette
5. Marquette Township
6. Powell Township
7. Republic Township
8. Skandia Township
9. West Branch Township

Flood Insurance Program (NFIP). Privately issued flood insurance, subsidized by the federal government, became available within communities that agreed to manage flood prone areas within their boundaries. In addition to coverage of the structure(s), coverage of contents is also available. To become eligible, the community enters an "emergency phase" by adopting preliminary actions to reduce flood threat. The coverage in the "emergency phase" is limited.

After the Federal Emergency Management Authority conducts detailed flood studies, and the community enacts stringent measures to protect life and property from future flooding, the community qualifies for the regular program phase. At that time, much higher levels of insurance become available. In the late 1990's, Increased Cost of Compliance coverage became mandatory for most new policies.

Policy holders in special flood hazard areas can get up to $15,000 to help pay the costs to bring their home or business into compliance with their community's floodplain ordinance. Flood insurance policy holders have four compliance options with the community's floodplain management ordinance.

Some preventive measures to reduce flood damage to an insured building are reimbursable. Policyholders may also be eligible for cost of removal and storage of insured contents when a building has been declared in imminent danger of flooding by officials. However, it is important to know that trying to obtain coverage after a declaration of imminent danger may leave property exposed to loss.

Flood insurance is available only in communities that participate in the NFIP. Participating communities must adopt and enforce a floodplain management ordinance that meets NFIP requirements. The floodplain must be mapped. Provisions have recently been approved that allows but does not require consideration of future land development upon the boundaries of the floodplain. By displaying future conditions on the map, the community and the Federal Emergency Management Agency are alerting the public that flood hazards may increase in the future. If a community does not participate in the NFIP, flood insurance is not available within its boundaries. Federal officers and agencies may not provide any form of financial assistance for acquisition or construction purposes. It would prohibit loans guaranteed by the rural Housing Services, Federal Housing Administration, or the Department of Veterans Affairs. No federal financial assistance could be provided for the permanent repair or reconstruction within the flood hazard area. Eligible applicants would still be able to receive other forms of disaster assistance that are not related to reconstruction or repair.

Dam Failure

Michigan has over 2,500 dams. The first dams were constructed to provide water and power for mills. In the early 1900s, there was a shift to hydroelectric power development. There are approximately 114 dams used for hydroelectric power generation in Michigan. Most of these hydropower dams are regulated by the Federal Energy Regulatory Commission (FERC). Five dams in Marquette County are regulated by FERC. These dams are exempt from State Regulations. FERC requires emergency action plans that include maps of approximate inundation areas in the event of a worst-case dam failure. Dam inundation data is currently unobtainable due to Covid-19 restrictions and sensitivity of sharing the inundation maps widely. FERC may also require a dam owner to conduct functional exercises based upon their emergency action plans.

Other dams are regulated by the Michigan Department of Natural Resources. Under both State and Federal regulations, dam owners may be required to study areas of impact below the dam. PA 300 of 1989 regulates all dams that are over 6 feet in height create an impoundment area of at least 5 acres. Owners must keep emergency action plans current and consult with Local Emergency Management Officials to assure coordination with local emergency operation plans. Stare regulated dam inundation data is also not included in this plan do to data deficiency from Covid-19 restrictions at State of Michigan offices, but will be included in future updates to this plan. Since the 1930s, dam construction has been primarily for lake development and fish and wildlife habitats. Many of the dams play an important role in flood control by storing and gradually releasing large stream flows.

There are approximately 60 dams in Marquette County. Some of the major dams in Marquette County include the dams along the Dead River, Cliff Natural Resources Dams, private dams, and natural dams.

Dead River Dams

Silver Lake Dam: The dam at Silver Lake does not generate electricity, but is used to control flow to the Hoist Dam. Principal project features include the reservoir, dam, spillway, outlet, and four saddle dikes. The reservoir is approximately 20 miles northwest of the City of Marquette, in Champion Township. It has an area of about 1570 acres and a gross capacity of 27,400 acre-feet.

Hoist Dam: The Hoist Dam in Negaunee Township creates the largest impoundment on the Dead River. The reservoir is approximately five and a half miles west of the City of Marquette. It consists of a concrete spillway and earth embankment section .The principal features are the reservoir, dam, spillway, power intake, tunnel, penstock, and powerhouse. The Hoist Storage Basin covers approximately 3,750 acres. It contains approximately 55,300 acre-feet of water.

McClure Dam: This dam is located between the Hoist and the Forestville Dam, in Negaunee Township. The reservoir covers 150 acres and has a capacity of 2500 acre-feet of water. The dam consists of a concrete gravity section with an un-grated overflow spillway at its center. There is a concrete intake section and an earth embankment on the left. The non-overflow sections have a crest elevation of 1200.5 feet and the spillway has a crest elevation of 1196.4 feet. The left non-overflow section is about 66 feet long with a maximum height of 37 feet.

Forestville Dam: The Forestville Dam is Marquette Township. The surface area of the impoundment is 106 acres. It drains an area of 153 square miles. The area below the dam is extremely rugged, dropping 80 feet in elevation over a mile. Normal headwater elevation is 770'. The normal tailrace elevation is 638'.

Tourist Park Dam: The Tourist Park Dam, in the City of Marquette, was destroyed during the Dead River Flood in 2003. A 4.8 million dollar project began in 2011 to replace the previous dam. The new dam was designed to handle high water levels and now has two spillways.

According to the National Inventory of Dams by the US Army Corps of Engineers, there are 10 dams in Marquette County denoted as "High Risk". High Risk means loss of human life is likely if the dam fails. These dams include: 2 Tilden Recirculation Basin Dams, Ogden Dam, Ogden Lake Dam, Carp River (Deer Lake) Dam, Carp Intake Dam, Hoist Dam, Forestville (Dam 2), McClure Dam, and the Tourist Park (Marquette Dam 3).

Further, there are 9 denoted as Significant Risk in Marquette County, meaning no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant Risk dams in Marquette County include: Brebner Dam, Gribben Tailings Basin Dam, Schweitzer Dam, Greenwood Reservoir Dam, Greenwood Afterbay Dam, Empire Mine Tailings Basin Dam, Empire Mine Expanded Tertiary Dam, ETB Tertiary Expansion Dam, and the Republic Dam.

The dams located along the Dead River were all greatly impacted and tested by the Dead River Flood in 2003. The Collinsville Dam, which was constructed in 1897, was removed in recent years. The last impoundment on the river is the "Hot Pond" at the Presque Isle Generating Plant. The small impoundment size and low dam keep this structure off the DNR's list of dams. The Dead River then empties into Lake Superior at its mouth near the Presque Isle Power Plant in the City of Marquette.

Cliffs Natural Resources (CCI), a large mining company with two active mines in Marquette County, also has numerous dams located within the County. Two of the CCI dams are located on the Greenwood Reservoir. The Greenwood Reservoir is over 1,400 acres large and was created to provide water for operations at the Tilden Mine. CCI has many other dams including those on Lake Sally, Lake Ogden and along the Carp River. Another dam to be noted is the Lake Independence Dam in Powell Township, which is owned by Marquette County. The Lake Independence Dam is located along the Iron River, the outlet for Lake Independence to Lake Superior. The dam raises the lake level in Lake Independence approximately six to eight feet.

Privately owned dams and natural dams also exist in Marquette County. Natural dams can be created by fallen logs and by activity of beaver. Beaver have frequently blocked culverts, causing localized flooding.

Dam Failure
Risk: Low
Vulnerability: High

Mitigation

Frequent inspection and monitoring of conditions and structure integrity

Flood insurance program awareness

GIS Mapping of dam inundation zones

Public awareness campaign of dam inundation zones

RISK ANALYSIS

Dam owners are responsible for the safe operation and maintenance of dams. With the end of the National Dam Inspection program in the early 1980's the state became unable to carry out regular dam inspections. Many small dams were built by logging companies to facilitate spring log drives. Because companies that no longer exist constructed many of the older dams, maintenance of those dams has become an ongoing concern.

The Dead River Flood of 2003 had a major impact in Marquette County. On May 14, 2003, the earthen fuse plug spillway of the dam failed and released approximately 8-9 billion gallons of water from Silver Lake Basin in Champion Township into the Dead River. The forced the evacuation of 2,300 people. While there were no fatalities, damage was estimated to be in excess of $100 million. The Presque Isle Power Plant in the City of Marquette was flooded, which caused it to be shut down for several weeks. Power from this facility is used to supply electricity to two local mines, which had to be shut down, forcing the temporary layoff of approximately 1,100 workers. The repairs and replacement of dams on the Dead River have been completed in a manner for them to be able to handle higher volumes of water and reduce the chance for future dam failure events.

Unstable Ground

Marquette County has had multiple incidents of unstable land. Of primary concern are undercut areas of shoreline. These areas tend to attract tourists and others who are unaware of the danger. Man also creates unstable land because of mining and excavating. The sudden rise or lowering of water levels, whether controlled by man, nature, or a dam break, can also create unstable conditions.

The extensive mining history in Marquette provides for numerous abandoned underground mines, pits, and shafts. State law makes the owner of mineral rights responsible for capping and maintaining fencing around abandoned mines. The surface owner is responsible for shallow test pits and open holes, many of which have steep sides and could fill with water. The county mine inspector is responsible for monitoring compliance. Smaller gravel pits and closed or abandoned mines are also the responsibility of the county mine inspector.

Unstable Ground/Subsidence
Risk: Medium
Vulnerability: Low

Mitigation

Continue mine inspector school programs to promote education and awareness

Require fencing and reclamation plans through zoning

GIS mapping to identify old mine sites

RISK ANALYSIS

Marquette County has experienced unstable ground and caving events. In 1996, significant landslide occurred during a major spring snowmelt along the Yellow Dog River in Powell Township. There is also evidence of a landslide on the banks of the McClure Basin looking eastward from the CR 510 Bridge in Negaunee Township.

The Rope's Gold Mine Access Road Cave-in occurring on Dec. 31, 1987 in Ishpeming, represented a serious incident that could have resulted in loss of 10 to 20 lives had it occurred at a different time or portion of the mine. Fortunately only one minor injury occurred. The affected area was approximately 6000 square feet with a depth of about 40 feet. In that situation, old workings collapsed. The mine continued to be worked for approximately 1½ more years. In 1997, there was subsidence in Ishpeming, where a garage had been built over an old well. A hole resulted that was roughly 25' deep by 10 to 15 feet in diameter. The old garage was removed and the hole filled.

During the 1960's after the tragic loss of a young girl in an uncapped shaft in the western Upper Peninsula, a renewed effort was made to locate and fence abandoned shafts. Owners of mineral rights (who frequently are not the surface owners) are responsible for keeping the shafts fenced. Some have also capped them to reduce their liability from individuals seeking to explore them. Unfortunately, many of the old mining companies have gone bankrupt, cease to exist, or ignore their responsibilities. Equally unfortunate was the absence of standards for capping. Many old caps consisted of used timbers or tree stumps (which could deteriorate over time) covered with rock and soil while others used concrete. However, unless the concrete rests upon bedrock, it too could shift and become ineffective.

As old fences fall and are not replaced, it becomes harder to locate the old shafts. The County's Mine Inspector is responsible for monitoring the condition of fencing and ordering corrections. Mines that were shut down or abandoned before 1968 do not need to be capped, but must be fenced. Those shut down after 1968 must be capped. Since 1970, the capping must be done with concrete after digging down to bedrock. They must also be fenced with non-climbable fencing to a height of 4 feet, and be topped with three strands of barbed wire, for a total of 6 feet of fencing.

It is believed that all of the caving ground areas resulting from underground mining have been identified and fenced. A concern that still remains of some area fire chiefs is the potential for brush fires in caving ground areas.

Earthquakes

An earthquake takes place when two blocks of the earth suddenly slip past one another. The surface where they slip is called the fault. The largest, main earthquake is called the mainshock. Mainshocks are sometimes preceded by foreshocks. Foreshocks are smaller earthquakes that take place in the same location as the large earthquake prior to it happening. Aftershocks always follow the mainshock. Aftershocks can occur for an extended period of time after an earthquake.

The first reports of earthquake tremors in areas of Michigan were in the early 1800s. These tremors were from the New Madrid earthquake which was centered in Missouri. Most earthquake activity felt in Michigan is from earthquakes centered elsewhere.

Earthquakes are commonly measured on the Richter Scale. The Richter Magnitude Scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. Earthquakes with a magnitude of 2.0 of less are usually called micro earthquakes and are not normally felt by people. An earthquake measuring 8.0 would be catastrophic. On average, only one earthquake of this size occurs per year in the world.

Earthquakes
Risk: Low
Vulnerability: Low

Mitigation

Not necessary

RISK ANALYSIS

The United States Geologic Survey tracks and records seismic activity. In the Upper Peninsula, most seismic activity is related to mining. Seismic activity can be measured during a mine collapse or explosion. This was especially common in the

Keweenaw Peninsula during the busy mining period of the early 1900s. There was active seismic activity in 2017-2018 with four events including three mining explosions and one quarry blast that were at least a 2.2 magnitude in the County. Mining and old mine related collapses seem to pose the most seismic activity hazard in Marquette County.

In recent years there have only been three earthquakes that centered in Michigan. The first took place in 1998 and centered near Bergland in the Western Upper Peninsula. The USGS reports that this earthquake was due to a mine collapse and was also felt in White Pine approximately 12 miles from the earthquakes center. This event measured a 3.6 on the Richter Scale. In 1994, an earthquake occurred that centered to the northwest of Lansing. This 3.5 magnitude earthquake was felt in East Lansing, Grand Rapids, Grand Haven, and areas in between. In May 2015, a 4.2 magnitude earthquake occurred in Michigan. This earthquake, centered in the area between Battle Creek and Kalamazoo, was also the second strongest earthquake ever recorded in Michigan. However, no injuries or damage were report. The strongest earthquake in Michigan, a 4.6 magnitude quake, occurred in the same area in 1947.

The USGS fault map shows no documented faults in Marquette County which significantly reduces the chances of an earthquake occurring. The 2018 Seismic Hazard Map also classifies Marquette County as lowest hazard.

CHAPTER 4 WEATHER HAZARDS

Various weather related hazards take place in Marquette County each year. Weather hazards can take several forms, can occur at any time of year, and can create risks for life and property. The severity of these events varies greatly. Many of these hazards are related to the county's proximity to Lake Superior and also it's humid continental climate classification. This classification is known for its large seasonal temperature differences.

The National Oceanic and Atmospheric Administration (NOAA) maintains a thorough record of weather related data. NOAA's National Climatic Data Center (NCDC) Storm Events Database was reviewed for data used within this chapter. During a ten year period, from 07/01/2010-07/01/2020, there were 309 days with recorded storm events in Marquette County. These events caused over 6.8 million dollars in damage and resulted in the loss of six lives.

Severe Winds

The National Oceanic and Atmospheric Administration classifies damaging winds as those over 50-60 miles per hour. Areas of Marquette County abutting Lake Superior often experience high winds. Gale force winds, 39-54mph, can frequently occur on Lake Superior. The National Weather Service issues watches and warning for Gale Winds. Small Craft Advisories can also be issued as these winds are especially dangerous to those on the water.

High winds accompanying thunderstorms also occur in Marquette County. Winds over 58 miles per hour are one of the criteria for severe thunderstorms. Straight line winds produced from thunderstorms can be dangerous, damaging, and occur rapidly.

Tornadoes, although rare, can happen in Marquette County. Tornadoes are defined as a violently rotating column of air extending from a thunderstorm to the ground. Wind speeds can reach 250 mph or more. Damage paths can be in excess of one mile in width and up to 50 miles long. The most common form of tornado in the Upper Peninsula generates from thunderstorms. Before thunderstorms develop, there is a change in wind direction and an increase in wind speed with increasing height creates an invisible, horizontal spinning effect in the lower atmosphere. The rising air within the thunderstorm's updraft tilts the rotating air from horizontal to vertical. An area of rotation, two to six miles wide, extends through much of the storm. This rotating wall cloud is often nearly rain-free. Most strong winds and violent tornadoes form within this area of rotation. Large hail can also be generated. The tornadoes may appear nearly transparent until sufficient dust and debris has been picked up to give the familiar dark appearance. The Fujita Scale is most commonly used to classify tornados. The scale ranges from F0-F5 with F0 having the lowest wind speeds and being the least damaging. From 07/01/2010-01/01/2020, there were four tornados recorded in Marquette County.

RISK ANALYSIS

The NCDC storm events database has multiple categories of wind events. The events include: strong winds, high winds, thunderstorm winds, and tornadoes. Marquette County experienced 52 days with recorded wind events from 01/01/2010-01/01/2020. A majority of the events were thunderstorm winds.

Severe Winds
Risk: Medium
Vulnerability: High
Probability: An average of 5.2 events per year.

Mitigation

NWS radar and alerts systems

Encourage the evaluation of vegetation to identify and remove limbs vulnerable to wind

Monitor vegetation in utility and road right of ways

Public awareness campaign about severe weather

Damage from wind events has consisted of mostly downed trees and wires. Downed wires can then contribute to fire hazards and power outages. Extended outages can leave residents without essential services and pose the need for shelter elsewhere. Structure and vehicle damage has also occurred in Marquette County as a result of wind events. On 09/29/2011, bricks were blown off the Pioneer Square Building in Ishpeming causing structure damage and also extensive damage to a nearby vehicle. This incident resulted is approximately $70,000 in damage. On 10/24/2017 a fall storm produced winds in excess of 60 mph causing widespread power outages and extensive wind damage and flooding. Coastal damage and erosion were the result of 25-30 foot waves in Lake Superior. The storm caused over 1 Million dollars in damage and resulted in 2 fatalities.

Wind events take place most frequently and severely near Lake Superior. Other wind events are isolated and tend to be linked with thunderstorms.

Rip Currents

Rip currents are defined as powerful, narrow channels of fast moving water flowing away from the shore. Swimmers often get pulled away from shore and drown while struggling against the current trying to return to shore. Swimmers can escape a rip current by swimming perpendicular to the flow and out of the current.

FIGURE 9 RIP CURRENT WARNING SIGNS

Beach flag advisory systems and warnings have been implemented on some of the beaches in Marquette County, see Figure 9. These systems and warnings alert swimmers to hazardous conditions. Northern Michigan University has also assisted in warning students of swimming hazards. The City of Marquette has established a 'No Swimming' rule in the water near picnic rocks, an area known for very dangerous rip currents. In spring 2015, the Marquette City Commission reestablished the Waterfront Safety Task Force. The group is in charge of finding ways to improve awareness and education relating to waterfront safety.

RISK ANALYSIS

Rip currents are very common in the Great Lakes and responsible for multiple deaths each year. The NCDC storm events database has record of three deadly rip current events in Marquette County from 7/01/2010-07/01/2020

On 07/21/2010, a 62 year old male drowned as the result of a wave which pushed him off of a sandbar and into a rip current near picnic rocks. On 08/05/2010, two teenage boys drowned in the water near Presque Isle due to high waves, winds, and strong rip currents. On 08/27/2010, an 18 year old male drowned and two other went into distress as the result of a strong rip current near picnic rocks. Rip currents often go unnoticed so predicting recurrence is difficult. Some monitoring of rip currents has been done along the shores of Lake Superior in Marquette County and the National Weather Service also issues surf zone forecasts which can include warnings on high risk of rip currents.

Rip Currents
Risk: High
Vulnerability: Medium
Probability: 30% chance of deadly occurrence a year.

Mitigation

Increase the number of emergency responders, such as lifeguards

Additional education and awareness of the existing flag and signage system

Additional lifesaving equipment—floatation rings, buoys, boats

Public awareness campaign about severe weather

Thunderstorms, Lightning, Hail

Size of Hail Diameter

Pea Size: ¼ inch
Marble Size: ½ inch
Nickel Size: ¾ inch
Quarter Size: 1 inch
Golf Ball Size: 1 ¾ inches
Tennis Ball Size: 2 ½ inches
Grapefruit Size: 4 inches

Thunderstorms are produced when warm, unstable air, moisture, and lifting occur. The moisture forms clouds and rain. The unstable air can rise rapidly. Lifting can be accomplished by fronts, sea breezes, or topography. In the first (developing) stage of a thunderstorm towering cumulus clouds indicate rising air. There is little rain and only occasional lightning in the developing stage. In the mature stage, there is heavy rain, strong winds, frequent lightning, possible hail, and tornadoes. In the dissipating stage, rainfall decreases, lightning remains a danger and the storm may still produce bursts of strong winds. A thunderstorm is classified as a severe thunderstorm if it contains any of the following: hail one inch or greater, winds gusting in excess of 57.5 mph, or a tornado. Thunderstorms are mostly likely during the spring and summer months.

Since lightning causes thunder, all thunderstorms have lightning. Lightning is defined by NOAA as a giant spark of electricity in the atmosphere between the clouds, the air, or the ground. Air acts as an insulator for positive and negative charges but when then opposite charges build up, the air breaks down and lightning strikes. The National Lightning Detection Network (NLDN) monitors and records data on lightning strikes**.** Data from the NLDN shows that an average of twenty million cloud to ground lightning strikes occur in the continental United States each year.

Hail is another common component of thunderstorms. Hail is a form of precipitation that occurs when raindrops that are carried into cold areas of the atmosphere freeze and turn into ice. Hail is usually under a ½ inch in diameter. However, severe thunderstorms can produce larger and more damaging hail.

RISK ANALYSIS

Marquette County experienced 27 days with recorded thunderstorm wind events from 07/01/2010-07/01/2020. Of those, 26 days also had recordable damage from wind related to a thunderstorm. Marquette County is not located in an area particularly associated with frequent or strong thunderstorms. Thunderstorms are more common and severe in the Great Plains and Gulf Coast regions. Branches of the National Oceanic and Atmospheric Administration issue severe thunderstorm watches and warnings to alert people of potentially dangerous conditions.

Data from the National Weather Service shows Michigan has ranked second in the nation for lightning related deaths and injuries since 1959. This is an especially startling statistics since

Thunderstorms, Lightning, Hail
Risk: Medium
Vulnerability: Low-Medium
Probability: An average of 2.7 events per year.

Mitigation

NWS radar and alerts

Installation of lightning protection on susceptible structures

Weather spotter program and training

Building codes to increase structure soundness

Public awareness campaign about severe weather

Michigan is not located in a region known for strong storms and also because Michigan ranks much lower in number of lightning strikes per year than many other states. There has been seven recorded damage causing lightning events in Marquette County from 07/01/2010-07/01/2020. These events caused over $58,000 in damage. On 07/12/2018, lightning struck a shed in Trowbridge Park, in Marquette Township, engulfing the structure in flames. Other fires and electronics damage has resulted from lightning strikes in Marquette County.

From 07/01/2010-07/01/2020 hail was the cause of some of the weather related damage in Marquette County. Of the approximately 6.8 million dollars in damages recorded in the NCDC storm event database in the ten year period used, over 600 thousand of this has been attributed to hail. In that same period of time, there has been 26 days with hail events in Marquette County.

On 06/08/2012 Marquette County was hit by a warm unstable air mass. This produced some severe thunderstorms with golf ball sized hail causing damage to homes and vehicles in the Marquette area. Hail up to one and three quarter inches in diameter fell in parts of the county.

Ice, Sleet, Snow

Ice and snow events occur more than any other weather hazard in Marquette County. A winter storm is defined as a combination of heavy snow, blowing snow and/or dangerous wind chills. The NCDC storm events database has multiple categories of winter weather events. The events include: winter weather, winter storms, blizzards, ice storms, heavy snow, sleet, and lake effect snow. In order to be considered a blizzard a storm must have winds over 35 miles per hour with snow and blowing snow, reducing visibility to a ¼ mile or less for at least three hours.

Marquette County lies in the Lake Superior Snow Belt region, an area associated with frequent and heavy lake effect snow. Lake effect snow occurs when cold, dry air moves over a lake and picks up moisture from the lake which then drops as snow. It is not uncommon for areas of Marquette County to receive over a foot of lake effect snow in one event. Blowing snow is also a common hazard in Marquette County. Blowing snow reduces visibility and can make driving hazardous.

FIGURE 10 WINTER WEATHER

A short and intense snow shower accompanied by strong winds is a phenomenon known as a snow squall. Snow can accumulate quickly during a snow squall and the events are common in the Great Lakes Region. Winter weather events that would be thought of as major in other regions are not generally considered such in Marquette County. The frequency and intensity of winter weather events in Marquette County makes both residents and response crews accustomed and prepared.

RISK ANALYSIS

Marquette County experienced 129 days with recorded significant winter events from 07/01/2010-07/01/2020. The NCDC storm events database accounts over a Million dollars in damage to these events. Of these events, 2 were classified as blizzards.

Winter Weather
Risk: High
Vulnerability: High
Probability: An average of 12.9 events per year.

Mitigation

NWS radar and alerts

Effective and timely snow clearing

Establish warming centers/emergency shelters

Education on winter weather driving

Snow fences to limit blowing and drifting snow

Public awareness campaign about severe weather

On 02/24/2019, a major winter storm hit Marquette County. Blizzard and white out conditions developed with heavy blowing snow and major drifting caused by winds in excess of 60 mph. This storm shut down some area schools including Northern Michigan University for multiple days. Some areas in the higher terrain reported nearly two feet of snowfall causing many roofs to collapse including the Negaunee Bus Depot in Negaunee Township. The frequency and severity of winter weather events in Marquette County makes them a large point of focus. Preparing for and removing snow can be expensive in terms of labor and equipment. Winter storms can place serious burdens on public works crews and community finances. Winter events can also keep citizens from attending imperative appointments, school, work, and shopping. School closings can lead to longer school years and business closings can mean loss of pay for many employees. Winter weather events can make travel especially hazardous. A section of M-28 from Chocolay Township in Marquette County to Munising in Alger County has been known to shut down due to blowing and drifting snow. Alternate routes must be used during these closures. Lakeshore Boulevard in the City of Marquette has also frequently been closed due to winter weather events, ultimately causing a section of the road to be moved 300 feet inland after repeated severe damage from Lake Superior.

Narrow streets can interfere with fuel deliveries and hamper emergency response services during winter weather. Local units must also attempt to keep fire hydrants accessible and ensure there is visibility at intersections. Traffic accident counts are generally higher than usual during a winter storm, putting a strain on police and emergency response personnel.

Drought

Drought is a prolonged period without precipitation. It can have a number of adverse effects. Agriculture can suffer, particularly during the planting and growing seasons. Forests can be stressed, leading to higher fire risks. Lake levels can drop significantly, stressing aquatic life and waterfowl and affecting navigation and recreational usage. If the drought is prolonged, groundwater levels and well production can be affected. In extreme cases, subsidence of soil can be triggered. In addition, watering of yards and gardens can strain public and private water systems.

Drought
Risk: Medium
Vulnerability: High

Mitigation

Encourage water conservation techniques

Water use restrictions on non-essential watering

Public awareness campaign about severe weather

RISK ANALYSIS

The state of Michigan has multiple drought events every year, about 3 events per year. Each climate division varies a bit but still averages some level of drought about every 2 years. According to the National Storm Events Database, Marquette County has not experienced any recorded drought events since 2004. Despite lack of official designation, that has not precluded areas from suffering from lack of precipitation. Drought affected the entire Upper Peninsula in recent years, reaching severe levels during the summer of 2007. Long-term drier than normal conditions coincided with near record low levels in the Great Lakes. Precipitation helped to ease drought conditions in fall 2007. The 2019 Michigan Hazard Analysis divides the state into regions. Division 1 includes: Baraga, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Marquette, Menominee, and Ontonagon Counties. The most extreme drought was in January 1977, when the Palmer Drought Severity Index (PDSI) hit a record low of -7.33 (the all-time record for Michigan). Lengthy drought incidents (at least 8 months long) took place more recently in 2006-2008 (22 months), 2008-2009 (12 months), 2011-2012 (12 months).

Extreme Temperatures

Michigan is subject to both extreme heat and extreme cold. Periods of extreme temperature occur every year. The most vulnerable populations are the elderly, very young, and those with medical problems. The threats are often accompanied by other weather conditions, such as drought, high humidity, blizzards, or high winds. These conditions make extreme temperature events even more intense.

Major threats caused by extreme heat are heat stroke and heat exhaustion. Heat stroke is a life-threatening medical emergency. Extreme heat is generally more serious in urbanized areas because development patterns create a heat island, which is unable to cool during the nighttime. Portions of Marquette County benefit from the cooling effect of Lake Superior. Limited paved surfaces reduce heat absorption. The abundance of trees also has a cooling effect.

Extreme cold is a more serious problem than extreme heat in Marquette County. Hypothermia and frostbite are the most common threats of extreme cold. Hypothermia is a life-threatening medical emergency. Unreliable transportation creates a great risk for exposure to this hazard. Longer distances between shelters also increase the risk. In addition, the aging housing stock in Marquette County has many homes with substandard insulation and older, inefficient, costly heating systems. Elderly and low-income households may be forced to endure less than optimum temperatures, exacerbating health risks. Extreme cold can also affect the functioning of infrastructure. Cold makes metal brittle and susceptible to breakage. In addition, it can cause freezing of water and breakage of service lines and mains.

RISK ANALYSIS

Marquette County experienced 2 days with recorded extreme temperature events from 07/01/2010-07/01/2020. Neither of these were associated with extreme heat. Between 1/5/2014 and 1/8 2014 a cold air mass produced temperatures consistently between 30 and 45 degrees below zero coupled with moderate lake effect snow.

Cold events are much more common. The NCDC storm events data has 11 recorded cold events in Marquette County between 07/01/2010-07/01/2020. Many of these events have temperatures below zero with wind chill values as low as 40 degrees below zero. With temperatures this low, frostbite can occur is as little as ten minutes. Though not recorded in the storm events database, freezing temperatures occur nearly daily throughout Marquette County in the winter.

Severe extreme cold conditions existed for much of winter 2013/2014. Recording breaking cold temperatures were recorded throughout the winter in Marquette County. 75 consecutive days below freezing was recorded at the National Weather Service Marquette. There was also 65 days below zero. The mean temperature at the National Weather Service Marquette from December 2013 until February 2013 was 7.5 degrees, which is a record for that period. Many schools and business were forced to close often due to the extreme cold. The weather caused many local municipalities to issue let runs orders for water customers due to freezing pipes.

Extreme Temperatures
Risk: High
Vulnerability: High
Probability: An average of 1.1 record cold events per year.

Mitigation

Assistance for vulnerable populations—warming/cooling centers

NWS Alerts

Proper equipment for municipal pipe thawing

Encourage weatherization programs to improve insulation factors for all structures

Create a public notification system for weather events requiring let run deployment

Public awareness campaign about severe weather

CHAPTER 5 TECHNOLOGICAL HAZARDS

Technological Hazards are the result of the man-made environment. Sometimes the hazards are created by technology and other times by its failure.

In Marquette County, the LEPC is responsible for keeping information about each site that has threshold quantities of substances that are classified as extremely hazardous. The LEPC is also responsible for developing response plans for accidental spills or releases of an extremely hazardous substance.

Hazardous Materials

Hazardous materials come in solid, liquid, and gaseous forms. The storage and handling of these chemical products are critical. Separation of incompatible products is essential to hazard mitigation. For example, if strong acids and bases combine, a violently exothermic reaction will occur, which could lead to a fire or explosion. Storing acids near some compounds could result in the creation of toxic gases. Even common household products, such as bleach and ammonia, can release toxic chlorine gas when mixed. Combining petroleum products with strong oxidizers could also result in a fire.

Not only is location of storage a factor, but also the physical and chemical attributes of the container are important in preventing deterioration, spillage, or the creation of gases that could build to explosive pressures or ignite. The importance of containers and storage is so critical that OSHA, DOT, and EPA all make it a violation to store or transport incompatible chemical products together or to store the products in improper containers. They also regulate the labeling of container contents.

In addition to primary containers, regulations also exist regarding secondary containment. Without adequate secondary containment, contamination could result from improper handling, spills, overflows, or accidental leaks. Even if secondary containment is not mandatory, businesses and industries should be encouraged to have it as a safety precaution. Benefits include reducing or preventing contamination of soil, surface water, and/or groundwater. Providing secondary containment may

Emergency Planning and Community Right-to-Know Act of 1986

- AKA the Superfund Amendments and Reauthorization Act (SARA).
- Establishes:
  - Local Emergency Planning Committees (LEPC) and
  - State Emergency Response Commission (SERC- AKA the Michigan Emergency Planning and Community Right-to-Know Commission).
  - Requires facilities with stocks of extremely hazardous substances to report what they have to the SERC, local fire department, and Local Emergency Planning Committee.
  - Facilities with reportable quantities must provide Material Safety Data Sheets (MSDS).

Four characteristics of chemical products:

1. Ignitability: those having a flash point of <100 ºF
2. Corrosion: generally have a pH of <6 (acids) or >8 (bases), or cause damage to the skin
3. Reactivity: liquid or solid which is reactive to water, shock, heat, pressure and/or undergoes a rapid or violent chemical reaction
4. Toxicity: any substance containing one or more of 8 heavy metals or more than 31 organic compounds which can induce an adverse response to animals, humans, or plants.

reduce insurance premiums. To remain effective secondary containment needs to be inspected and maintained periodically.

In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA). This was done to support and promote emergency planning and provide the public with information about releases of toxic chemicals. Section 313 of EPCRA established the Toxic Release Inventory (TRI). The TRI is a mandatory program and compliance is enforced by the EPA. There are 2 TRI facilities located within Marquette County. Table 6 shows 2018 TRI data for facilities in Marquette County. Another EPA website, Enforcement and Compliance History Online (ECHO), can also provide valuable information and data on environmental compliance and toxic releases.

	ZIP Code 49855
Number of TRI Facilities:	2
Total Production-Related Waste Managed:	360.1 thousand lbs
Total On-site and Off-site Disposal or Other Releases:	211.8 thousand lbs
Total On-site:	120.2 thousand lbs
• Air:	78.0 thousand lbs
• Water:	48 lbs
• Land:	42.2 thousand lbs
Total Off-Site:	91.5 thousand lbs

TABLE 6 TRI 2018 DATA, MARQUETE COUNTY

Hazardous Waste Generators

There are three classes of hazardous waste generators:

1. Conditionally Exempt Small Quantity Generators (CESQG) that generate less than 100 Kg (220 pounds-generally less than 25 gallons) of non-acute waste per month and never have more than 1,000 kg (2,200 pounds) accumulated at any time. There is no time limit on how long the waste can be accumulated. This group of generators is not subject to RCRA manifesting, training, emergency preparedness and response planning, inspections, storage, or disposal requirements. In Michigan, most of the materials they accumulate may be disposed of in the local landfill if it is not in liquid form (i.e. if liquids are absorbed by newspaper, the newspaper can legally be placed in the landfill). Other generators store their wastes until sufficient quantities make it economical to contract for pick up by a licensed disposal company. The vast majority of hazardous waste generators in Marquette County are in this category. They include apartment complexes, small retail stores and Mom & Pop services or manufacturing with small quantities of wastes such as cleaning supplies.
2. Small quantity generators (SQG) generate between 220 and 2200 lbs. per month -- or accumulate, at any one time, at least 2200 pounds (a 55 gallon drum holds approximately 440 pounds). Although subject to all RCRA requirements, the documentation for demonstrating compliance is not as extensive as for large quantity generators. SQGs that have contractual agreements with a qualified transporter/reclaimer do not have to use a hazardous waste manifest. SQGs may store up to 13,000 lbs (approximately 30 barrels) for a period of up to 90 days without becoming a large quantity generator.
3. Large Quantity Generators (LQG) generates more than 2200 lbs per month. These generators are subject to all RCRA requirements and have extensive documentation. Manifests are required for all shipped hazardous wastes.

Small quantity generators must post emergency information by telephones and keep this information current. Failure to post information is common, but a more common violation is failure to keep the posted information current. Business managers must also arrange with outside agencies such as fire, police and hospitals, etc. that would be contacted in an emergency. Many of the smallest generators do not do this.

Large Quantity Generators must have a current, written contingency plan. The plan must have: The emergency coordinator contact information, and other contacts, including home addresses and home telephone numbers, lists of emergency equipment and its capabilities, a facility map showing the location of emergency equipment, and an evacuation plan that includes a signal to evacuate, a principal evacuation route and alternative evacuation routes. Large quantity generators must also mail copies of the contingency plan to local emergency responders and document that response agencies were contacted.

Manifests track the waste from its origin to its ultimate place of disposal. Information and signatures are required at various stages. There can be up to six copies. Each site that contains a large quantity generator receives an identification number from the EPA. That number remains with the site through all subsequent owners or businesses, although there have been many instances in Marquette County where new owners or tenants have applied for and received numbers in their own name, creating a paper-tangle. It has been suggested by one official that, since the ID number runs with the land, it be included on any lease or deed document.

In counting the hazardous waste, all portions of the waste stream are considered. Oil is not considered a hazardous waste unless other hazardous materials are mixed with it, such as additives from gasoline. There are numerous hazardous waste generating sites within Marquette County, which have EPA Identification numbers as hazardous waste generators. However, there are no active large quantity generators within the county.

Because of the costs in dealing with hazardous materials and in properly disposing of hazardous wastes, there has been a concerted effort across the United States to modify industrial processes to reduce dependency on hazardous materials and to reduce generation of waste at its source. Preventing hazardous waste is preferable to controlling it. This was mandated by Congress through the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA) in 1984. It is not a regulatory program. The hierarchy for waste management is:

- Source Reduction
- Recycling (use, reuse or reclaim)
- Energy Recovery (usually under carefully controlled conditions)
- Treatment (to reduce toxicity or volume)
- Land Disposal

The Marquette County Landfill conducts monthly household hazardous wastes collections at four sites from late spring through fall. This program is only available to households. It is not legal for any business to use this service, regardless of the business's size. The collections reduce the hazardous materials that enter the landfill, prolonging its life and reducing the risk of contamination.

To keep hazardous wastes generated by Conditionally Exempt Small Quantity Generators out of local landfills, at least two counties in Michigan also facilitate hazardous waste collection programs for those businesses. These generators are not eligible for the household hazardous waste program and often cannot afford frequent pick-ups by licensed transporter/ reclaimer. As a result, CESQGs tend to stockpile hazardous waste on-site, often creating dangerous situations. The CESQG collection sites are operated to make it convenient and economical for small businesses to properly dispose of hazardous materials. They function similarly to household hazardous waste collection sites with a few exceptions. First, unlike most household collection programs, there is a fee based on the material and the quantity. Second, the program contracts directly with the licensed transporter/recycler for the best the price. Third, the program staff acts as agent for the licensed transporter/recycler. The program never takes legal possession of the waste. Fourth, materials are accepted only by prior appointment. The generator must submit a written description and quantity before the scheduled collection. Staff then calculates the disposal fee, accepts payment, and schedules the drop-off. Lastly, wastes cannot be co-mingled with the household wastes.

Most hazardous wastes including medical waste is transported out of the county for treatment and disposal by a contracted service. Medical facilities contract the company to supply the means to safely dispose of the waste and it is then collected by that company. Residential, low level medical waste such as sharps, and home medical supplies can be deposited in the county landfill. Medical wastes are no longer imported into the County for treatments, and disposal.

"302" Sites and "Tier II" Sites

Businesses, which exceed threshold quantities of an extremely hazardous material(s), must report and prepare contingency plans. These sites are known as Section 302 Sites (after the section of SARA that requires them). Other businesses, with lesser quantities or less hazardous materials are known as Tier II sites. It is probable that many businesses are unaware of the total quantities of hazardous materials they have on-site and do not report as required by law. Unfortunately, fire departments and the county do not have sufficient staff to follow-up with all local businesses. The storage and retrieval of MSDS sheets is sometimes a problem for local fire departments, particularly where more than one fire hall is maintained.

A subcommittee of the LEPC works with Section 302 Site Operators to prepare off-site response plans. Through the Hazardous Materials Emergency Preparedness (HMEP) grant, administered by the Michigan State Police-Emergency Planning and Community Right-To-Know Commission, the LEPC is reimbursed a modest amount for each newly completed plan and for each update.

Transportation of Hazardous Materials

Michigan has adopted the Federal Hazardous Materials Regulations (FHMR) into state law. Thus, compliance is mandatory for both intrastate and interstate transportation of hazardous material. It is the responsibility of the employer to train, test, and certify all employees that are involved in shipping or transporting a hazardous material.

RISK ANALYSIS

Marquette County has had a number of hazardous material incidents. Incidents could have had major health or property impacts. Under Section 304 of SARA Title III, accidental releases of chemicals must

be reported to the State Emergency Response Commission (SERC), the Local Emergency Planning Committee (LEPC), and the National Response Center (NRC).

Hazardous materials transportation accidents are more common than hazardous materials fixed site accidents. Typically, the area of impact is local although some materials could have a wider impact. The risk to on-site personnel is moderate to high and generally low to moderate for individuals in the surrounding area. Property damage is generally low for most incidents, but could be moderate to high, particularly in cases of large industrial explosions. Depending on the material, clean-up costs can be significant.

Hazardous Materials
Risk: Low
Vulnerability: Low-Medium

Mitigation

Proper training of employees

Encourage the development of response plans

Practice scenario training of a hazardous materials situation

CHAPTER 6 INFRASTRUCTURE FAILURE

The County of Marquette has endured several examples of infrastructure failure. This identification of critical systems and contingency planning can have long-term benefits.

Water Systems

Potential hazards exist for both public and private water systems. The most probable threat is a hazardous substance spill within a vulnerable wellhead area, which could be a radius of many miles. The spill could be a sudden or slow leak at a fixed site, or it could result from a transportation accident.

The Michigan Department of Environmental Quality is responsible for inspections of water systems. They contract with the Marquette County Health Department for inspection of Type II and Type III systems, which include wells that supply rural restaurants and gas stations.

A comprehensive understanding of each public water supply system is essential to respond to a water supply emergency. Essential information includes the location and capacity of all water sources, treatment facilities and storage tanks, and the location and size of all distribution lines, and isolation valves. In addition, each water supply system should have contingency plans for supplying water. These can include special treatment, use of alternative wells, and isolation of portions of the system, using a supply source from outside the system, and limiting use.

The City of Marquette is the only community in Marquette County that uses surface water for its public water system. Because a surface body of water is the source, the city's plant must meet stringent filtration requirements. The source of all other community water systems is groundwater. The source for most mining operations is surface water.

Facility	Operator	Water Body	Use
Empire/Tilden Mines	CCI/mining partnership	Schweitzer Reservoir	Industrial
Marquette Water Department	City of Marquette	Lake Superior	Public water supply
Emergency Intake	City of Ishpeming	Lake Sally	Public water supply
Emergency Intake	City of Ishpeming	Lake Angeline	Public water supply
Emergency Intake	City of Negaunee	Teal Lake	Public water supply

TABLE 7 SURFACE WATER INTAKE IN MARQUETTE COUNTY

Ground Water

There are three major locations of groundwater -- surface deposits, glacial drift, and bedrock. Surface deposits contain precipitation that saturates the pore spaces in the soil. Referred to as the water table, the level fluctuates seasonally when water on the surface as snow and ice, melts and is absorbed by the earth. In locations where surface deposits are thick, the deposits are usually reliable water sources. As described in the drought section however, shallow wells in western Marquette County have gone

dry. This water is highly susceptible to contamination. Glacial drift aquifers occur in areas with layered sands, gravels and clays. Water is stored at several levels. Volume and quality can vary from level to level. Major aquifers within Marquette County are the Sands Plains, Carp Creek and Humboldt Area, Morgan Creek Area, and West Branch Creek Area.

Where surface deposits are thin, and there is no glacial drift, wells must be drilled into bedrock. The type of rock affects its water storage capacity. Sandstone and dolomitic limestone have pores between sand grains, allowing a significant amount of storage. These stones also contain natural fractures, which contain water and enhance its movement. Igneous and metamorphic rocks are denser. Within these rocks, storage occurs primarily in fractures. Yields are generally low because fractures are only a small portion of the rock's total composition. Occasionally wells are placed along major faults or fractures in bedrock and thus have high yields. Because ores were deposited along such fractures, mines frequently required pumping of water to allow extraction of mineral.

Permeability is the ability of a material to transmit water. Sand and gravel have high permeability. Clay has such a low permeability that it is often considered impenetrable. Infiltration rates determine the recharge of groundwater that is removed through use or migration below the surface. The recharge area can be a significant distance from the aquifer. Rapid rates help to assure sufficient supply, but can also result in rapid transmission of contaminants. In general, rates are very rapid in portions of Chocolay, Richmond, and Sands Townships and in the southern parts of Forsyth, Tilden, and Ely Townships, in small areas of Michigamme and Champion Townships and in pockets along the Lake Superior shoreline. Areas that have moderate to slow rates include much of the west-central and west portions of the County. That means that there is a slower recovery from heavy pumping. While it may take longer for contamination to move, it will also take longer for cleanup. Slow and very slow rates exist in portions of Republic, Chocolay, Skandia, Turin, Forsyth, Wells, and Ewing Townships. Slow and very slow infiltration can often make an area too wet for farming and can make septic systems malfunction, creating health risks.

Wellhead Protection

Except for the City of Marquette's water system, all of the community systems utilize wells. Wellhead protection is recommended but not required. The Michigan Department of Environmental Quality operates the Michigan Wellhead Protection Program. The program assists local communities with the protection of groundwater used for drinking water supply systems. Guidance documents and grants are also available.

Numerous land use activities threaten the quality of our groundwater resources. Contaminated water can affect public health of our residents and the economic health of our communities. Only well-conceived and coordinated land management efforts can protect the County's aquifers. Remediation of polluted groundwater is technically and financially challenging.

Each wellhead protection plan is custom designed with appropriate control measures for individual aquifers and wells. Due to the fact geology does not follow political boundaries, several units of government may need to participate. Other participants include citizens, local, and state agencies. Plans establish a protection area based upon hydrogeological studies and ground water flow models. Recharge areas are also identified. Plans also inventory potential contaminant sources, including

abandoned wells. Plans address issues of public education, operational policies, facility inspections, and land use. Generally best management practices, such as sealing of abandoned wells, monitoring of underground storage tanks, storm water management, secondary containment for hazardous material storage and proper floor drain connections are also included. Plans should include procedures for responding to contaminant releases, providing alternative water supplies, address changing conditions, and identify potential expansion/replacement well sites. Success of a wellhead protection plan requires involvement of the public in its development and on-going public participation and education in its implementation.

The Negaunee-Ishpeming Water Authority and the townships of Tilden, Ely, and Ishpeming along with the Cities of Ishpeming and Negaunee have adopted a wellhead protection plan. Other municipalities within the County that have Wellhead Protection Areas include: Forsyth Township, Richmond Township, Powell Township, KI Sawyer, Republic Township, Negaunee Township, Skandia-West Branch Township, and Marquette Township. Several other water system operators have inquired about developing a protection plan for their wellheads. GIS Data and other maps on Wellhead Protection are available through the Michigan Department of Environmental Quality.

Public Water Supply Systems

There are three types of public water supply systems in Marquette County has. Type I public water supply systems service municipalities and include wells for mobile home parks, which serve more than 15 units. Type I systems are regulated by Michigan Dept. of Environmental Quality. Type II and Type III water systems are generally small municipal systems or serve rural gas stations and restaurants. The same types of problems, including possible contamination, exist with all systems.

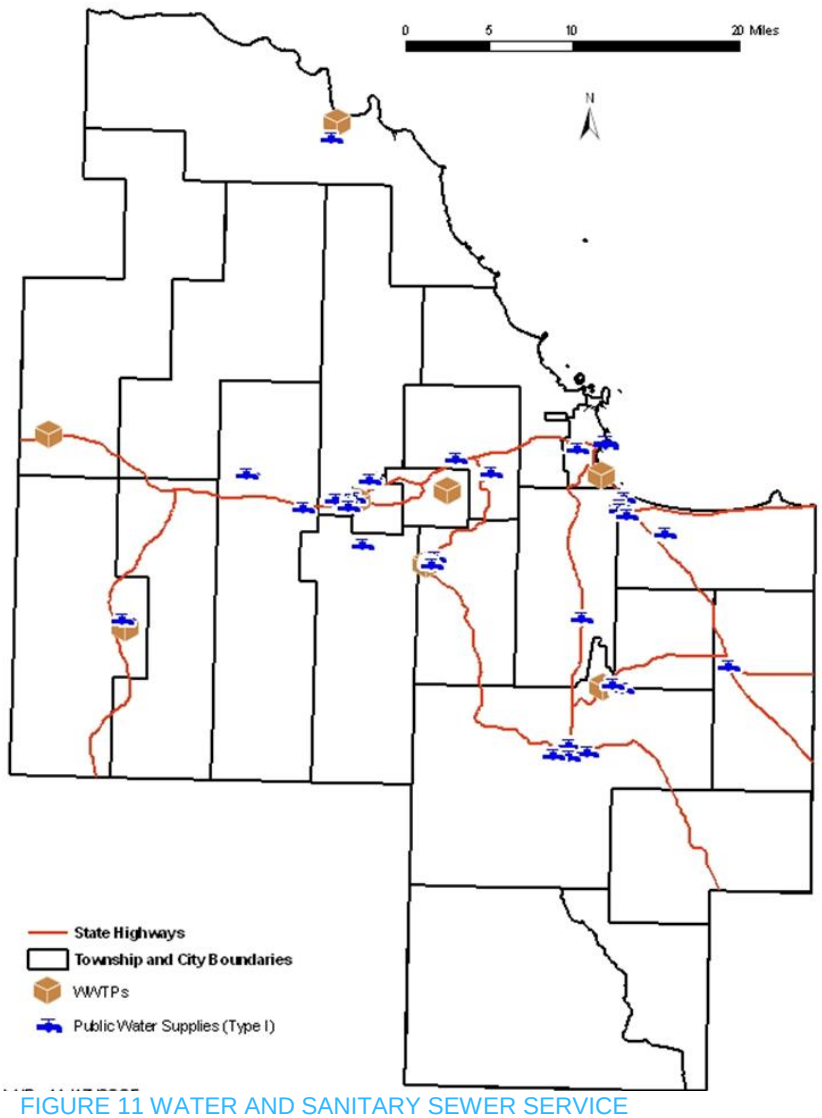


FIGURE 11 WATER AND SANITARY SEWER SERVICE

Wastewater Treatment

A large portion of the County relies upon on-site septic systems to treat sewage and gray water. However, where populations are concentrated, and where soils have proven unsuitable to handle the demand of increased development, wastewater treatment is provided by public entities. The treatment of wastewater is essential to public health and

well-being. During many disasters, primarily flooding and prolonged power outages, these systems can fail, resulting in the release of raw sewage into water bodies or causing it to back up into homes and businesses. Failure of the treatment system can also occur because of introduction of materials toxic to the organisms, which act upon the sewage, again resulting in the release of raw sewage. Raw sewage could result in an outbreak of disease, creating a secondary disaster.

Public Wastewater Treatment Systems

Systems used in Marquette County include lagoons, communal septic systems, and wastewater treatment plants. Treatment facilities are required to have commercial users submit an industrial pre-treatment plan, identifying materials in their waste. Pretreatment is required if hazardous materials or excessive quantities are present in the effluent. Household users also have the potential to introduce substances that affect the system's operation and the quality of effluent.

Communications

TELEVISION

Many residents of Marquette County rely upon services for television for news and entertainment purposes. Marquette County has three companies providing cable service including Negaunee Cable Company, Sprectrum Communications, and Cable America. Other television service is available through satellite providers.

BROADBAND

Marquette County is the first certified Connected Community in the Upper Peninsula and the 11th in the state. The Marquette County Broadband Initiative (MCBI) team worked with Connect Michigan to identify gaps in the local broadband landscape and establish goals for increasing high-speed Internet access, adoption, and use. Representatives from Northern Michigan University, the Lake Superior Community Partnership, and Marquette County led the collaboration with Connect Michigan. Table 8 lists broadband providers in Marquette County.

Cable America Michigan, LLC: Cable	Pasty.Net: Fixed Wireless
Charter Communication: Cable	SonicNet: Fixed Wireless
Chatham Telephone Company: DSL	UP Telephone Company: DSL
Chatham Telephone Company: Fiber	Northern Michigan University: Fixed Wireless
Iron Bay Computer and Design: Fixed Wireless	Negaunee Cable Company: Fiber
Michigan Bell Telephone: DSL	Michigan Bell Telephone: Fixed Wireless

TABLE 8 MARQUETTE COUNTY BROADBAND PROVIDERS

TELEPHONE

Various providers and services of telephone exist in Marquette County. Main landline providers include: Charter Communications, TDS Telecom, and Upper Peninsula Telephone Company. IP phone service from AT&T is also available in portions of Marquette County. Wireless services is mainly provided by Verizon Wireless and AT&T. There are still several areas of the county where landline and wireless service are not available. This is due to scattered development patterns and geographic characteristics of the County.

Electric Systems

Electricity is vital to our hospitals, schools, homes and makes the distribution of products and the delivery of services possible. There are four electric utility service providers in Marquette County.

MARQUETTE BOARD OF LIGHT AND POWER (BLP)

More than 120 years ago, the City of Marquette established an electric utility. Originally consisting of hydroelectric dams on the Dead River, the system has since expanded greatly. The Shiras Steam plant, a 3 unit 78 MW production facility that operated since 1967 was decommissioned in 2018. It was replaced with a 51 MW reciprocating gas fired engine plant at the existing facility on Wright Street. At the same facility, a community solar garden finished construction in 2017 and houses 480 panels with 155 KW total output potential. The BLP services approximately 17,000 customers in all or portions of nine townships in Marquette County along with the City of Marquette.

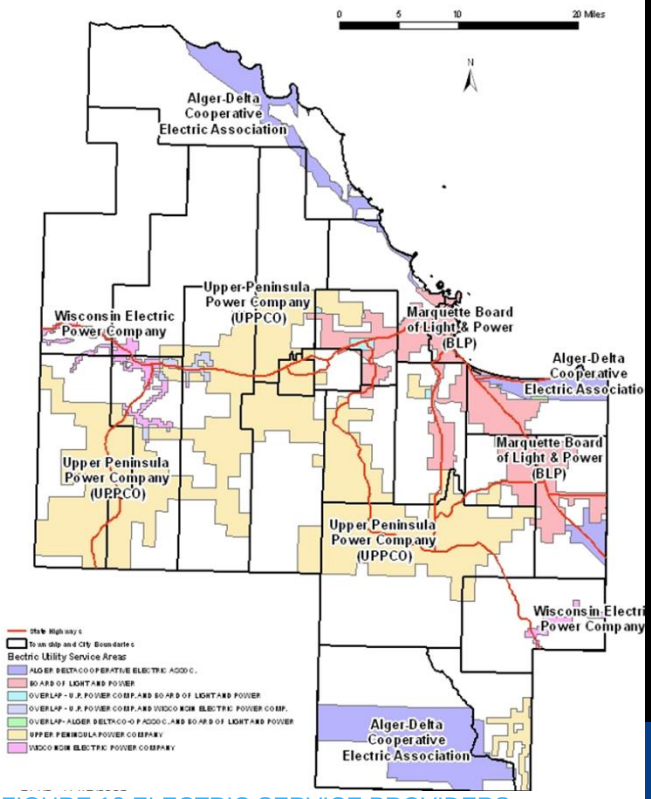


FIGURE 12 ELECTRIC SERVICE PROVIDERS, MARQUETTE COUNTY

UPPER PENINSULA POWER COMPANY (UPPCO)

The American Transmission Company owns the major transmission lines that serve Northern Michigan and Wisconsin. UPPCO is responsible for maintaining them. UPPCO still owns their distribution lines and substations. UPPCO services fourteen communities in Marquette County including the Cities of Ishpeming and Negaunee. UPPCO also services all or portions of fifteen townships located within the County.

ALGER DELTA COOPERATIVE ELECTRIC ASSOCIATION

Alger-Delta provides service in the area north of Marquette to Big Bay, along M-28 in Chocolay Township, in southern Skandia Township, and in Wells Township. Electricity is purchased from the Marquette Board of Light and Power and We Energies. The utility has around 3,500 customers within the County.

WE ENERGIES

The Presque Isle Power Plant operated by We Energies and located within the City of Marquette was a major provider of electric energy to CCI's Tilden and Empire Mines, to residential and commercial customers throughout the Upper Peninsula, and to areas outside of the Upper Peninsula. There are transmission lines interconnections with Wisconsin and the Lower Peninsula of Michigan. The plant was decommissioned in March of 2019 and replaced by two new gas fired power plants: A.J. Mihm Generating Station and F.D. Kuester Generating Station. On March 31, 2019 the F.D Kuester generating station, located in Negaunee Township, started providing power to the grid. It is a 128.1 MW station that helps supply the power that was once produced at the Shiras plant, and is operated remotely by We Energies out of Green bay and Milwaukee, Wisconsin.

Infrastructure Hazards

Risk: High

Vulnerability: Medium

Mitigation

- Mutual aid agreements between utility companies
- Encourage back up heating and power systems
- Fencing around public water supply system
- Encourage wellhead protection plan and regulation adoption
- Staff or contract foresters for utility companies

Transportation

Transportation is crucial for the economy of the Upper Peninsula and Marquette County. The primary mode is surface transportation by motor vehicle, although other forms include water, air, rail, and pipeline. All of these forms of transportations have risks. These risks are further outlined in the risk analysis section.

RISK ANALYSIS

There have been several instances of water system problems in the Upper Peninsula. Historically there have been cases of wells running dry due to drought conditions. When the City of Negaunee used Teal Lake as its water source, advisories were frequently given to boil the water prior to use due to bacterial counts. Groundwater contamination by

Transportation Hazards

Risk: High

Vulnerability: Low

Mitigation

- Continued administration of the airport zoning ordinance
- Continued coordination of the US-41 Corridor Group
- Encourage adoption of access management regulations on highways and primary roads
- Emergency response exercises and scenario practice
- Coast Guard Auxiliary training and vessel inspection
- Boater's safety courses

petroleum products of multiple private wells required the installation of a municipal system in Skandia. The system became operational in 1987. In the severe winter of 1993, the City of Marquette had numerous lines freeze and break, leaving some households and citizens without water for several months. In 2014, the Governor issued a State of Emergency for Marquette County after an extremely harsh winter. Damage estimates grew to over 1.6 million dollars due to broken water and sewer lines. Water line freeze issues are common throughout the County and let run orders are frequently issued in winter months.

General water quality is always a concern, particularly with surface waters. The City of Marquette intake is located about 3,100 feet from shore in about 55 feet of water. It is relatively difficult to access. Urban areas face increased challenges from storm water run-off, discharges from sewage treatment plants, and industrial facilities. Vandalism at the Marquette Branch State Prison in April 2002 resulted in raw sewage entering the Carp River and Lake Superior.

A main concern with electric service in Marquette County is disruption of service by storms. It is not uncommon for both winter and thunderstorms to cause power outages and downed lines in the County. Disruption in service is generally able to be restored quickly as crews are on call and mobilized as outages are reported. Service can sometimes be more difficult to restore in the event of a substation failure. Substation failure resulted in the outage of approximately 4,800 customers in 2010, however, service was restored within hours. Aging lines and infrastructure are also of concern for electric service in Marquette County.

Motor vehicle transportation is the most common form of transportation in Marquette County. It also has, by far, the most risks and accidents. In 2019 there was 1,803 traffic crashes within Marquette County. Of these, eight resulted in death and 268 in injury. Data on traffic crashes, injuries, and fatalities can be found through the Michigan State Police and also through Michigan Traffic Crash Facts.

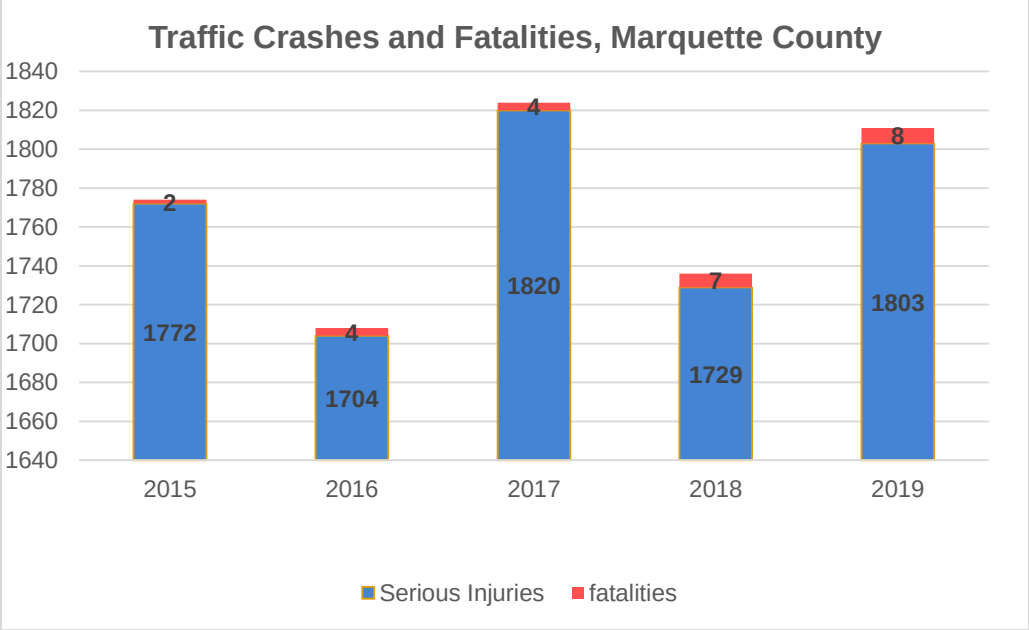


FIGURE 13 TRAFFIC CRASHES

Reduced budgets for road authorities have led to the deteriorated condition of the road network. The reduced budget also impacts routine maintenance of roads. This impact is realized especially during winter weather events as roads are plowed less frequently than in the past.

Air, rail, and marine transportation also can pose a hazard in Marquette County, however, incidents are rare. Sawyer International Airport has experienced very few aircraft related crashes. Most recently, a small single engine aircraft crashed during takeoff. This incident took place in January 2015 and while the plane experienced significant damage, there were no injuries. Rail incidents have also been rare within the County. Primary rail cargo in the area is iron ore pellets, however, hazardous materials are also transported at times. These products include sodium hydroxide, calcium chloride, ammonium nitrate, polymers, liquid propane, and ethanol. Rail operators generally have hazardous response plans in case of an emergency. Rail/Vehicle accidents within the County are rare. Similarly, marine incidents are infrequent.

CHAPTER 7 HUMAN RELATED HAZARDS

These hazards are the result of human activity and the functioning or failure to function of the social structure. It includes deliberate efforts to disrupt society as well as natural events that affect large numbers of individuals.

Public Assembly Events

Marquette County's many communities enjoy celebrating their local heritage and have created a number of events for their residents and which draw tourists and participants from around the nation. Attendance at these events ranges from several hundred at local township festivals to an estimated 10,000 at the Seafood Fest in Marquette. Guests from outside the area may not be familiar with facilities, road systems, or where to find assistance in an emergency. Gatherings with many individuals often create opportunities for accidents. As the size of the event increases, the risk for a large-scale incident increases. An incident could easily lead to multiple injuries or panic among attendees. In addition, any large gathering or activity that attracts media attention is a potential target for terrorism, although that risk is considered small in Marquette County.

Civil Disturbances

Civil disturbances occur when a group of individuals disrupt essential functions, damage property, or threaten the wellbeing of other individuals. Large-scale civil disturbances rarely occur. Areas particularly vulnerable to civil disturbances include government buildings, military installations, universities, controversial businesses, service providers, and critical service facilities such as police and fire stations. Sports arenas and facilities for large gatherings can also be vulnerable. Prison uprisings and political decisions are also a form of civil disturbance. Marquette County has a number of locations and events at risk for civil disturbance.

SITUATIONS THAT MAY CAUSE CIVIL DISTURBANCES

Labor disputes with a high degree of animosity between the dissenting parties

High profile or controversial judicial proceedings

Implementation of controversial laws or other governmental actions

Resource shortages because of catastrophic events

Disagreements between special interest groups

Perceived unjust death or injury of a person held in high regard by a particular segment of society

School Violence

The Revised School Code was amended with Public Act 102 of 1999, which identifies reportable incidents and specifies incidents that mandate expulsion. P. A. 102 of 1999 does not mirror criminal code. In addition, local school districts can identify other situations that will result in expulsion. The Revised School Code act was further amended in 2011 to address bullying and require schools to develop and enforce policies related to bullying. In 2013, further legislation was introduced to include cyberbullying within the code. Having a policy that reflects expected conduct, discipline for various infractions, mandatory expulsion terms and reinstatement conditions in place may reduce incidents.

School districts in Marquette County have site emergency plans, which indicate when children should be sheltered in place or evacuated from a building. During some types of incidents, keeping students within a classroom and preventing entry is the preferred method. This is because most classrooms are equipped with phones and can be locked with students out of sight. School offices often have emergency kits that contain items such as emergency response contact names and numbers, enrollment rosters, guardian contact information, flashlights, keys and floor and structural plans. School resource officers have been implemented in many districts, often with the assistance of local police departments. Pre-identified safe areas have been identified for a number of schools. Some schools have protocols for calling out back-up drivers if regular school bus drivers cannot be located. Local fire departments generally do not conduct fire inspections, but police and firefighters frequently visit school buildings so that they are familiar with hallway and classroom locations. Many area schools are also equipped by cameras both on the interior and exterior of the building.

Terrorism

There have been no reported acts of terrorism in Marquette County. The worst account of terrorism in the State of Michigan took place in 1927 in Bath, MI. In this event, 45 people were killed in a school bombing that was intended to protest the raising of property tax. Nationally and internationally there has been an increase in events in recent years. The randomness of targets and variety of actions make it difficult to establish a risk rating. Potentially the risk to life and property could be very high. With regard to national security, Sawyer International Airport located in Marquette County is home to the largest runway in Michigan. The runway, at over 12,000 feet in length, has the capability to accommodate some of the world's largest aircraft. Sawyer International Airport also has the only air traffic control tower in the Upper Peninsula.

Economic Disaster

A disaster incident can have catastrophic effect on local businesses. Unfortunately, statistics have not been kept locally regarding the impact of disasters on businesses. It is known that at least one business qualified for a Small Business Administration Disaster Assistance Loan following the Sept. 11 Terrorist Attacks. The loan was based upon disruption of delivery of critical supplies because of closure of airports. Statistics show that 45% of businesses that are struck by a disaster never reopen. Of those that reopen, 28% fail within three years of the catastrophe. Only 23% fully recover and remain in operation. 93% of all businesses that experience a major data processing disaster are out of business within 5 years. Natural disasters such as storms and earthquakes are not the only cause of loss. Technological disasters such as infrastructure failure and fires, man-made disasters such as riots, human error, or sabotage by disgruntled employees can wreak havoc on a business.

Economic disaster can also have an effect in the form of a recession. Characteristics of a recession include: A general slowdown in economic activity, a downturn in business cycle, and a reduction in the amount of goods and services produced and sold. According to the National Bureau of Economic Research, there were 10 recessions between 1948 and 2011. The most recent being in 2007-2009. A significant spike in the unemployment rate occurred during this time. Marquette County's unemployment rate reached close to 12%. This was higher than the national average but lower than the rest of Michigan. In April of 2020 Michigan saw one of its highest unemployment rates on record at over 24%. This was due to the widespread shutdown of businesses in the midst of the COVID-19 Pandemic.

The Housing Bubble and its burst was one of the most significant occurrences in housing nationwide. The Housing Bubble began after the end of the high tech and dot.com era, about 2001 and burst around 2008. The Housing Bubble is defined as an era where conditions were created that drove up the prices of homes such as low mortgage interest rates, loose lending practices and even local land use regulations. As prices for homes increased, homeowners spent against false equity in their homes and speculators and developers rapidly bought, built and sold houses for large profits.

Housing prices started stabilizing around 2006. Soon home foreclosure rates began to escalate because many homeowners owed more for their houses than they were worth on the market. In addition, many homeowners were carrying sub-prime mortgages that adjusted and doubled their payments after 12 months. The Housing Bubble burst was denoted by a significant deflation period that is still being felt by homeowners today. In 2007 the United States sub-prime mortgage industry collapsed because of the large number of home foreclosure rates. More than twenty five sub-prime lenders declared bankruptcy, reported huge losses, or put themselves up for sale. Lending was halted and the national economy was in peril. This led to business closings, high unemployment rates and Federal Government intervention. Marquette County did not experience the severe housing price increase and ensuing decrease that was realized in other locations across the country but the County did experience many of the same symptoms and results. Like many locations throughout the country, the local housing market is slow and many people are holding on to their houses until the market improves.

RISK ANALYSIS

Hazards can be reduced and security improved through proper planning and cooperation between event organizers and local units of government. Civil disturbances and terrorism are relatively uncommon in Michigan. The impact area is typically local. The most recent events took place in Marquette County in 2020 concerning political and racial injustice topics.

Human Related Hazards
Risk: Low
Vulnerability: Low-Medium

Mitigation

Mutual aid agreements between law enforcement and fire agencies

Police presence at large events

Emergency response exercises and scenario practice

Foster sustainable economic development opportunities

Encourage participation on the Chamber and Economic Development Organizations

CHAPTER 8 ENVIRONMENTAL HAZARDS

There are a number of environmental threats that could potentially damage the economy and lifestyle of Marquette County. Segments of the tourism industry could be destroyed because of outbreaks. Recovery from physical damage and public perception could take years. Citizens and visitors to the County need to be educated regarding the seriousness of the threats and the steps that should be taken to control their spread.

Invasive Species

Invasive species are plans, animals, or pathogens that are non-native to the ecosystems under consideration and whose introduction causes or is likely to cause harm. Ecosystems all over Michigan are threatened by invasive plants. Every year more and more acres of land are invaded by non-native species. As these plants move into an area native vegetation often cannot compete and are eventually displaced. In turn, the animals that depend on the native plants for food and shelter can no longer be sustained and the ecosystem is entirely disrupted. Invasive species often arrive as “hitchhikers” from other states or even foreign countries. They may be accidentally introduced by inadvertent transporting of seeds or parts of plants. In other cases, plants may be brought in for a different purpose, such as ornamental use, and “escape” into the wild.

The United States Department of Agriculture (USDA) maintains the National Invasive Species Information Center. This database can be used to gain information on certain types of invasive species and also invasive species by geographic area. Locally, the Marquette County Conservation District, Superior Watershed Partnership, National Forest Service, Northern Michigan University, and the Upper Peninsula Resource & Development Council among others are heavily involved with sustaining native plants and invasive species control.

ZEBRA MUSSELS: Present in the waters of Lake Superior and have formed a colony at the City of Marquette Water Intake. They are also found in inland lakes. This species is known to accumulate PCB’s and may contribute to bioaccumulation in other species. Care needs to be taken when transporting boats or docks from one body of water to another.

EURASIAN MILFOIL: An invasive weed that has potential to choke lakes within the county and adversely affect boating and fishing. Boats should be washed with hot water before transportation from one body of water to another, to prevent transmission of spores.

GOBY: Two species are currently in the Great Lakes. Within 5 years of its initial discovery in Duluth, the round goby spread to all five great lakes. It is an aggressive fish, which can spawn repeatedly during the summer months. It is a voracious feeder. The tubenose goby is less aggressive. It appeared in the St. Clair River in 1990. It has remained uncommon. Diet in the Great Lakes currently includes insect larvae and zebra mussels, although they are capable of eating larger fish. They have the capability of occupying and affecting fish populations in deep water.

PURPLE LOOSESTRIFE: This plant is invading wetlands throughout the Upper Peninsula. As it chokes out native plants, many birds, insects, and other wildlife are adversely affected. Each root crown can produce over 2 million seeds per year. It produces dozens of pinkish purple mid-summer flowers at the top of each stem.

Infestations

Infestations of timber stands can cause serious problems, especially as approximately 85% of Marquette County is classified as agriculture/forest. The Marquette County Forestry Commission manages forest resources on County owned lands, this includes the County Forest. The County Forest is approximately 9,300 acres located in Sands and Forsyth Townships. There are several insects that can damage forest resources. Most prevalent of these in the County Forest is the jack pine budworm though white pine weevil, forest tent caterpillars, spruce budworm, and bark beetles can all cause damage.

JACK PINE BUDWORM: This is a needle feeding caterpillar that can have devastating impact on stands of trees that are 45 years or older, particularly those on sandy sites and suffering from drought or other stresses. Tree mortality and top kill can make the forest more vulnerable to wildfire. Outbreaks occur on a regular cycle. The best control measure is maintaining healthy stands and harvesting mature trees.

EMERALD ASH BORER: The emerald ash borer is an insect that was introduced to North America in the 1990s. It was first reported in areas of Lower Michigan and Canada near Detroit and Windsor. The Michigan Department of Agriculture and Rural Department (MDARD) is the agency responsible for issues relating to the insect. The movement of firewood, which could carry the insect, has been banned from the Lower Peninsula to the Upper Peninsula.

WHITE PINE WEEVIL: The larvae of this weevil girdle the uppermost portions of both white pine and jack pine. The damage caused to the tree results in reduced growth rates and tops with multiple rather than a single stem. The last noted infestation in the County Forest was discovered in 1994. The most affected stands were those that were understocked. The best solution is converting to red pine however, not all soils are suitable for this conversion.

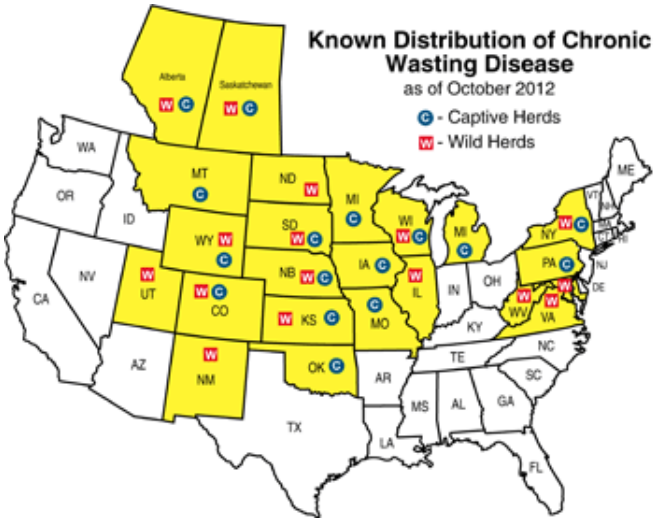
SPRUCE BUDWORM: Spruce budworm target balsam fir and white spruce. The insect defoliates tree causing top kill and mortality. The most susceptible stands are those which are over-mature.

FOREST TENT CATERPILLAR: These insects target primarily aspen. These caterpillars are defoliators but their long-term impact is minimal and tree mortality is uncommon.

BARK BEETLE: Bark beetles are not generally attracted to healthy stands. However, when a stand is damage by other insects, bark beetles then seek out the freshly killed or stressed trees.

Public Health

Public health emergencies can result from widespread or serious disease. This can be contamination of food or water supplies, infestations, or exposure to harmful substances. With modern travel, a highly contagious disease could spawn a national health emergency. The H1N1 (Swine Flu) outbreak in 2009 and the COVID-19 pandemic of 2020 are two of the most recent examples to have a local impact. COVID-19 was first discovered and reported in December of 2019 in Wuhan, China and spread worldwide in early 2020. As of November 2020 there were over 48 Million cases and over 1.2 Million deaths worldwide.



DISEASES

[1]***Chronic wasting disease*** has been discovered in deer herds in southern Wisconsin. In 2008, one case was identified in an animal facility in Lower Michigan. Some health advisories recommend against eating potentially tainted meat. Others recommend against handling various body parts and using special precautions in butchering and processing the meat. Although no documented cases of human illness have been attributed to chronic wasting disease in deer, three cases of human death are undergoing further investigation.

Ticks have been moving northward and have the potential of transmitting Lyme disease, Ehrlichiosis, and Babesiosis. All three diseases can affect canines and humans. Lyme disease is a bacterial infection that sometimes shows up as a "bull's eye" ring around the bite location. If untreated, Lyme disease could affect the heart, joints, and nerves. Ehrlichiosis is a bacterium that attacks white blood cells. Most cases are mild or without symptoms, but the disease can be life threatening. The HGE form, associated with deer ticks, is present in the Upper Midwest. Babesiosis is a parasitic infection that has been likened to malaria, however, the infections are very

[1] http://www.ct.gov/deep/cwp/view.asp?A=2700&Q=323412

different biologically. The parasite attacks the red blood cells. Babesiosis does not occur in cycles as malaria does. Chronic babesia infection might manifest itself as anemia. It can be fatal to individuals with suppressed immunology.

Control of tick exposure mitigates the risk of infection by these diseases. Brush should be cleared from the vicinity of dwelling units. Protective clothing should be worn when in tick-infested areas. Careful inspection for ticks should occur after entering tick habitat. Chances of disease are reduced when ticks are removed within 24 hours. Ticks should be removed by a method which does not force tick fluids into the wound.

Climate Change

The United States Environmental Protection Agency (EPA) defines climate change as any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer. Climate change is often interchanged with the term global warming which the EPA defines as the recent and ongoing rise in global average temperature near Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere. Global warming is causing climate patterns to change. Climate change can increase the effect, frequency and/or severity of many other weather hazards and natural disasters, and may change the duration of season length affecting growing seasons.

Predicted Climate Change Effects

- Shorter winters
- Hot, dry summers
- Frequent, intense precipitation events
- Loss of native plant species

Methane, carbon dioxide, and nitrous oxide are all common greenhouse gases. Greenhouse gases trap heat within the atmosphere. The greenhouse effect occurs when solar radiation emitted from the sun is reflected off the earth and absorbed by greenhouse gas molecules. The molecules trap the heat and warm the atmosphere. Agriculture, industry, and transportation are all contributors to greenhouse gas production. The combustion of fossil fuels creates and adds to various air pollutants including greenhouse gases. The EPA has multiple websites and tools on climate change and greenhouse gases. The Greenhouse Gas Inventory Data Explorer is an interactive tool that provides access to data from EPA's Annual Inventory of U.S. Greenhouse Gas Emissions and Sinks.

The average temperature on Earth has risen over a degree in the past hundred years. This number is expected to rise over the next century. Even small global temperature changes can result in a dramatic shift in weather and climate. Adaption and strategic plans relating to climate change are being developed and implemented all across the country by various agencies. The federal government has also addressed climate change thorough numerous agencies. The United States Department of Agriculture and Forest Service maintain the Climate Change Resource Center. This website provides information, tools, and models relating to climate change.

Radon

It is estimated that in the United States we spend approximately 80-90% of our time indoors. Frequent cold weather in Marquette County often pushes this number even higher. This increases risk of being exposed to indoor air pollution, such as radon.

Radon is a natural occurring radioactive gas. It is produced through the decay of radium, a product of uranium. It is a noble gas that is colorless and odorless. It typically enters buildings through cracks and openings in floors and walls that touch soil. It can also be found in drinking water. According the EPA estimates, radon is the number one cause of lung cancer among non-smokers.

High levels of radon can be reduced through proper radon mitigation. This is typically done by preventing radon from entering the home and also through added ventilation. Preventing radon from entering the home can be done through different types of suction systems, ventilation systems, and also through sealing cracks where radon could enter. Water systems with high levels of radon can also be treated with aeration or filter systems.

RISK ANALYSIS

The introduction of exotic species, transmission of disease, and insect pests can have serious consequences. Most initially involve environmental protection groups and agencies, and may not require the typical responses provided by emergency services teams. They do, however, have the potential of creating disasters of local and regional significance.

With Marquette County's proximately to water resources and also its climate, climate change could cause dramatic and potentially hazardous conditions here. Many local groups and institutions are working to address climate change. The Climate Change Adaption Taskforce was formed to help prepare local leaders and the general public to think proactively about the effects of climate change and to develop strategies that will make the Upper Peninsula more resilient and effective when dealing with the consequences of climate change. The Superior Watershed Partnership, Marquette County, Northern Michigan University, and the City of Marquette along with other local stakeholders make up with group.

Elevated levels of radon have been document in Marquette County. The EPA maintains a map of radon zones. Marquette County is classified in Zone 2. This zone indicates a moderate potential for radon. Counties within this zone have a predicted average indoor radon screen level between 2 and 4 pCi/L. It is recommended a homeowner take action to mitigate radon when levels exceed 4 pCi/L. Radon test kits are frequently available for little to no cost at community organizations. Test kits can also be purchases at home improvement stores and at the Marquette County Health Department.

Environmental Hazards
Risk: High
Vulnerability: High

Mitigation

Invasive species control measures

Education on forestry, moving firewood

Education and outreach on climate change

Public health awareness and education

Participation in Climate Change Adaptation Taskforce

Public awareness campaigns about radon and public health in general

SECTION III COMMUNITY ANALYSIS

CHAPTER 9 LOCAL UNITS ANALYSIS

This chapter discusses each township and city in Marquette County. The mitigation projects listed in the Local Units Analysis chapter were identified and prioritized by the local units of government (LUG) during meetings and conversations with elected officials and staff as part of the update process. The Action Plan, that follows, identifies countywide mitigation strategies and actions.

It is noteworthy that a webpage dedicated to hazard mitigation for Marquette County was established as part of the 2015 Plan update. The website contains the County's most current resources and educational materials related to the mitigation of hazards. The site is a porthole to educational materials including the adopted Hazard Mitigation Plan. The site also houses maps displaying information pertinent to hazard mitigation planning, such as structures and flood plain data. Local units of government and the public are encouraged to use information from the website to assist in local hazard mitigation efforts.

hmp.mqtco.org

Where applicable, hazards that are more likely to occur are identified for each township or city and are represented by icons. Figure 14 defines what each icon means.

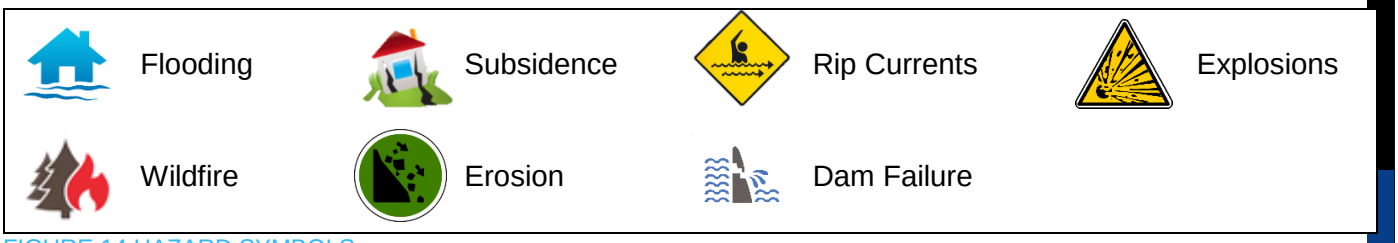


FIGURE 14 HAZARD SYMBOLS

Champion Township

Champion Township lies near the center of Marquette County. Most of the township's population is in the historic mining town of Champion. Few people live in the rest of the township, especially in the north, where access is difficult.

FIGURE 15 POOR ACCESS

Although flooding hazards were not identified during the update process, the history of this hazard type is prevalent in the Township. The Dead River Flood (May 2003) began in northern Champion Township when the plug for the newly-redesigned Silver Lake Dam gave way, releasing nine billion gallons of water into the Dead River. The dam has since been rebuilt.

The long, thin shape of the township causes it to cross several watersheds, including the Dead, Escanaba and Yellow Dog Rivers. The upper reaches of the Dead River are within the dam inundation zone for Silver Lake. The effects of the 2003 dam breach there were dramatic within Champion Township. A new mile-long channel, sandbars, and eroded cut banks were created, and debris was spread over a wide area of the Dead River floodplain. While most of Champion Township is covered by forest, and much of the township's land is owned by paper companies, there are relatively few jack pines.

Champion Township Mitigation Projects:

1. **Truck capable of accessing off road areas, substandard seasonal roads**
2. **Need for dry hydrant on Wolf Lake Road, Section 21 stream crossing**
3. **Need for brush truck for brush fires beyond structure fires**

Chocolay Township

Chocolay Township lies southeast of the city of Marquette, extending southward from the Lake Superior shore. Most of the township's population lies in the northwest corner, centered on the historic center of Harvey. Many people also live along the Lake Superior shore in the western half of the township.

Hazards more likely to occur in Chocolay Township:

Both floods and fires are real threats to Chocolay Township. The mouth of the Chocolay River in Harvey often is blocked by ice during spring break-up. In the past, dynamite has been used to free the flow of the river. Historically, coastal flooding and erosion has occurred along the Lake Superior shore.

The sand ridges paralleling Lake Superior are ideal large jack pine habitat. The pines, Lake Superior, and easy access to Marquette via M-28 make this area a favored place to live, enhancing the fire danger. Many expensive homes along Lake Superior are in the jack pine zone. Surprisingly, no large fires have occurred in this area recently, perhaps because with a relatively large population, no fires go unnoticed.

FIGURE 16 RESIDENTIAL AREA IN JACK PINE FOREST

Chocolay Township Mitigation Projects:

1. **Additional water sources are needed. Water access is restricted especially in northeast and southern portions of the Township**
2. **Dredge the mouth of the Chocolay River and protect the nearby lift station**
3. **Educate the public about why construction should not be taking place in hazard zones**

City of Ishpeming

The City of Ishpeming is Marquette County's second-largest community, and is near the geographic center of the county. Founded in 1870 as an iron-mining town, the city's residential and commercial building stock reveals evidence of the boom and bust cycle of mining, including unique buildings used in historic mining operations. The City includes a portion of the workings of the current Tilden Mine.

Portions of Ishpeming were built up from cedar marshes and special storm water drainage has been recently constructed (Partridge Creek Project) to help resolve ground water problems. Mining, lumbering, and other commercial activities have increased sedimentation in rivers and lakes. Much of the City's water delivery infrastructure is old and deteriorated.

Hazards more likely to occur in Ishpeming City

FIGURE 17 FROZEN PIPE REPAIR

City of Ishpeming Mitigation Projects:

Watershed Management:

Dredging of Lakes / Stream / Waterways

1. Carp River (Unknown $)

2. Lake Bancroft (Estimated $2M Project)

3. Lake Bacon (Unknown $)

4. Others within the City Limits (Unknown $)

Stormwater / Sewer Infrastructure:

1. Inflow/Infiltration of Sewer System – Repair/Replace Brittle/Cracked/ Broken Pipes (City At Large – Estimated $10M Project)

2. Repair / Replace Lift Stations ($500K Project)

3. Replace Waste Water Treatment Plant (Estimated $30M)

City of Ishpeming Mitigation Projects Continued:

Drinking Water Infrastructure:

1. Replace Old / Failing Water Delivery Infrastructure (City At Large – Estimated $5M)

2. Replace Water Treatment Plant (Estimated $30M)

Emergency Operations and Communication:

1. Develop Community-wide Communication System
2. Development of City Owned Limited Emergency Operations Center with Back-up Power (Estimated $100K)

Wildfire Management:

1. Development of Forestry Management Plan including City Canopy (Project Cost - $30K)

2. Develop Forest Management Projects (Estimated $100K/yr for 5 yrs)

Roadway / Service Delivery Infrastructure

1. Repair / Remediate Low lying Areas (Culverts) and Wildlife Damage (e.g. Beaver) causing roadway flooding and failures of drainage

2. Repair Roadway between Ishpeming and Negaunee (M28 Business)

3. Remediate life threatening intersection (US-41 and Lakeshore) with MDOT / City Traffic Circle Construction and roadway realignment

4. Repair / Reconstruct Roadways for Transit System (MARQTRAN)

5. Repair / Replace Roadways (City At Large – Estimated $10M)

6. Realign Roadways to increase accessibility and improve maintenance (City At Large – Estimated $5M)

7. Assess Railroad Bridging Infrastructure – (estimated $100K)

8. Maintain Auto / Roadway Bridges (Four) (Unknown $)

City of Marquette

The City of Marquette is the largest community and county seat of Marquette County. Many of the facilities here are of regional importance, including Northern Michigan University, the Presque Isle ore docks, and the Marquette Branch Prison.

Hazards more likely to occur in Marquette City:

The primary natural hazards within the City of Marquette is the threat of flooding, mainly on the Dead River, coastal Lake Superior erosion, rip currents and unstable ground along the shoreline, most notable at Presque Isle Park. The City of Marquette participates in the National Flood Insurance Program. The City was seriously affected by the 2003 dam breach on the Dead River, which resulted in another dam collapse at Tourist Park, washout of the bridge approaches on Lakeshore Boulevard, and flooding of the Presque Isle power plant. Closure of the power plant, in turn, forced the Empire and Tilden mines to shut down for lack of sufficient power.

FIGURE 18 LAKESHORE BLVD CLOSURE

In addition to the natural hazards, the City is also subject to infrastructure, technical, and human-health hazards due to the existence of a natural gas-fired power plant, a chemical laboratory at Northern Michigan University, and an extensive transportation network that is integrated through a high-density population area.

City of Marquette Mitigation Projects:

1. Shoreline restoration to protect the Hawley Street lift station and a 3,680 foot-long section of 16" sanitary sewer main located along the Lake Superior shoreline.

2. Shoreline restoration to protect Lakeshore Boulevard, the Lakeview Arena storm drain outfall and Shiras Park parking area.

City of Negaunee

The City of Negaunee is the fifth largest community in Marquette County and home to Michigan's first iron mine, the Jackson Mine. Remnants of inactive mines and the workings of the Tilden and Empire mines occupy much of the city. Localized areas within the city, adjacent to the historic downtown, have been declared subsidence "caving grounds," areas where the ground above underground mines has collapsed or is in danger of collapsing.

Hazards more likely to occur in Negaunee City

City of Negaunee Mitigation Projects:

1. **Identify and locate mining shafts and develop an evaluation system to rate their level of security, seek opportunity to improve security**
2. **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**
3. **Identify water bodies that have beaver dam obstructions that are causing unnatural flooding of adjacent properties or have shown historical failure, causing damage to adjacent properties.**

Ely Township

Hazards more likely to occur in Ely Township

Ely Township lies west and southwest of the city of Ishpeming. Historically, population was centered around several mine locations (e.g., Diorite, Greenwood), but more recent growth has focused on the County Road 581 corridor. This area of population growth intersects one of the county's major concentrations of jack pine, increasing fire risk. This hazard was realized during the Black River Falls Fire. The fire occurred on May 20, 2009. It was started when high winds knocked a dead Jack Pine down onto a power line, ultimately consuming 806 acres. The Township Supervisor reported that nearly 75% of the houses are now rebuilt.

Wildfire is a serious problem for much of the township. The Michigan DNR has designated the outwash plains of southern Ely Township as one of two fire zones in Marquette County receiving special attention.

Ely Township participates in the National Flood Insurance Program. The long, thin shape of the township causes it to cross several watersheds, including the Escanaba and Carp Rivers. On the upper reaches of the Escanaba, Greenwood Reservoir, a 1088-acre impoundment created by Cleveland Cliffs, represents the greatest flood threat to township residents. There have been concerns over gasoline contamination in one of the water supplies used by Ely Township. The contamination is being monitored.

FIGURE 20 DEAD JACK PINE NEAR POWER LINE

FIGURE 19 BLACK RIVER FALLS FIRE

Ely Township Mitigation Projects:

1. **Vegetation maintenance should be done on an ongoing basis by the utility companies and the Marquette County Road Commission.**

Ewing Township

Ewing Township is Marquette County's most remote township; to reach it from other parts of the county, drivers must leave the county and go through the unincorporated community of Rock in Delta County. None of the roads are paved, a source of irritation for the township's 126 residents.

The dominant drainage feature of Ewing Township is the Escanaba River, which serves as the township's western boundary. Swimming Hole Creek flows into the Escanaba River within the township, draining the Cyr Swamp to the north.

Despite the proximity of Marquette County's largest river, Ewing Township has few flooding problems, according to the township supervisor. While between 25 and 30 camps lie within the floodplain, the majority of township's permanent residents live away from the river. No current critical infrastructure lies within the floodplain, but the township's former dump adjoins it.

FIGURE 21 AIRPORT ROAD

Ewing Township Mitigation Projects:

1. **Drainage solutions needed on N end of Airport Road and County Road DH**
2. **Shower system needed in basement of Township Hall**
3. **Drainage Solutions: Including proper ditching along roadways**
4. **Bridges: Assessment of 70 plus year old bridges. Roads are impassable in the spring and cannot support service by ambulance, fire, and police.**
5. **Better solution needed for power and phone service outages**

Forsyth Township

Forsyth Township is in southern Marquette County. It is 183 square miles in size with 53 inland lakes, industrial areas, an international airport, rail lines and yards, gas lines and storage facilities. Several communities lie within its boundaries: Gwinn, Princeton, Austin, Little Lake, and most of K.I. Sawyer. Much of the southern part of the township is occupied by the Cyr Swamp. The Middle and East branches of the Escanaba River drain most of the area and represent the greatest flood risk.

Hazards more likely to occur in Forsyth Township

Of the various communities, Gwinn is most at risk from flooding. The town lies at the confluence of the Middle and East branches of the Escanaba River, and is accessible only by bridges over the branches. Flood-prone areas of Forsyth Township include 382 structures worth an estimated $19.5 million.

Wildfire is a serious problem for much of the township. The Sands Plains extend south into Forsyth Township and are covered with jack pine forests. The Michigan DNR has designated the Sands Plains as one of two fire zones in Marquette County receiving special attention. In the mid 1980's a large fire burned from Marshall Drive to east of Little Lake and north to K.I. Sawyer. Again, in the early 1990s, the residential area of K.I. Sawyer was evacuated because of a wildfire approaching the area. New residential development continues to encroach upon jack pine forests. Forsyth Township has 836 structures worth an estimated $36.7 million in jack pine forests. Roughly half (410) were associated with permanent residences.

FIGURE 22 EAST BRANCH OF ESCANABA RIVER, FORSYTH TOWNSHIP

Forsyth Township Mitigation Projects:

1. **Iron Street Bridge: raise the bridge over the East Branch of the Escanaba River**
2. **Generators: to back up the commercial power to the city's water wells, emergency operations center, emergency shelters, and evacuation centers**
3. **Lift Station Protection: additional flood protection is needed for the sewer lift stations**
4. **Emergency Vehicles: for Disaster Response by the Forsyth Township Police and Emergency Management Departments**

    a. **The city of Gwinn is separated by rivers on the east and center of the city thus making it an island. Should flooding of these rivers compromise the area; Emergency Services must preposition vehicles and personnel:**
        1. **west of the Middle Branch of the Escanaba River**
        2. **downtown Gwinn and residential area between the two branches**
        3. **east of the East Branch of the Escanaba River**

    b. **The township does not have enough police vehicles to man such a response Emergency Management has no vehicles at all. An Emergency Management Mobile Command vehicle is necessary.**

5. **Firefighting Equipment: additional and upgrade firefighting equipment to help alleviate response capability to the industrial area and local wildland fires.**

Humboldt Township

Humboldt Township lies in the southwestern part of the county. The mainstay of its economy was iron mining, but the Humboldt Mine shut down in the early 1980s. A recent mining project in the region has reopened the Humboldt mill for use as a resource processing facility.

The Escanaba and Michigamme rivers flow through Humboldt Township, and each river has had a history of flooding in the area. In addition, the Black River and other tributaries of the Escanaba and Michigamme systems flow through the township. The topography is dominated by rocky knobs and wetlands, but some of the land was high and fertile enough for marginal farming in the early 20th century.

FIGURE 23 WOLF LAKE ROAD BRIDGE

Humboldt Township Mitigation Projects:

1. **Propane powered generators are a need**

Ishpeming Township

Ishpeming Township lies to the west and north of the City of Ishpeming. It has two main clusters of residential development, one in West Ishpeming, a suburban community near US-41, and the other a series of largely seasonal residences to the north along the Dead River Storage Basin. Both areas face some flooding threat. In 2003, approximately ten township residents were flooded along the Dead River Storage Basin flood event when the dam broke.

Hazards more likely to occur in Ishpeming Township

FIGURE 24 FLOODING ALONG THE DEAD RIVER STORAGE BASIN

Ishpeming Township Mitigation Projects:

1. **Improve culverts on Cooper Lake Road**

Marquette Township

Marquette Township lies to the west and north of the City of Marquette. Most of the population lives in Trowbridge Park and adjacent areas just west of the city limits. The majority of the township is unpopulated, and includes rocky shorelines along Lake Superior.

Flood-prone areas of the township are along low-lying portions of the Lake Superior shore. The northern part of the township is largely forested, with some jack pine forests as part of the mix.

Marquette Township Mitigation Projects:

1. **Establish a permanent water source for firefighting in the northern part of the township, somewhere along County Road 550. Fire officials believe that the Lindberg gravel pit south of Sugarloaf is a possibility.**
2. **Additional tanker turnouts needed.**

Michigamme Township

At the far west end of Marquette County lies Michigamme Township. The dominant feature of the township is Lake Michigamme, a popular vacation spot. The town of Michigamme lies at the west end of the lake.

Flooding occurs along the shores of Lake Michigamme, the Peshekee River which flows south into the lake, and the Michigamme River, which flows south out of the lake toward Republic.

FIGURE 25 BREAKWALL ALONG NORTH SHORE OF LAKE MICHIGAMME

FIGURE 26 LIFT STATIONS ON THE SHORE OF LAKE MICHIGAMME

Michigamme Township Mitigation Projects:

1. **Additional pump stations are needed on the levees and break walls at the wastewater plant. Estimated cost is $15,000 per unit**
2. **More break walls are needed along the Lake Michigamme shore to protect adjacent properties**
3. **Wastewater system improvements are needed**

Negaunee Township

Negaunee Township is located between the cities of Negaunee and Marquette. With easy access from US-41, the township has been growing. One area of growth is along the Dead River Storage Basin, a reservoir on the Dead River formed by the Hoist Dam. The Carp River meanders across the southern part of the township.

Hazards more likely to occur in Negaunee Township

Flood-prone areas are mostly near the Carp River and the Dead River Storage Basin. In the wake of the 2003 flood, Negaunee Township passed an ordinance requiring elevation surveys and construction only above legally-designated elevations along the Dead River. Figure 12 below shows the positive application of such thinking earlier saved the property of one property owner during the 2003 flood.

FIGURE 27 A HOME SAVED BY PROPER CONSIDERATION OF FLOODPLAINS, DEAD RIVER STORAGE BASIN

FIGURE 28 NEED FOR CULVERT, M-35/CARP RIVER CROSSING

Negaunee Township Mitigation Projects:

1. **Raise the Carp River Bridge on Heritage Drive**
2. **Flood proofing or movement of structures in the flood zone along Dead River Storage Basin**

Powell Township

Powell Township is in northernmost Marquette County. The core community of the township is Big Bay. The township participates in the National Flood Insurance Program, and has Zone "A" maps of floodplains.

FIGURE 29 DAM ON THE IRON RIVER OUTLET OF LAKE INDEPENDENCE

Powell Township Mitigation Projects:

1. **Ensure stability of Lake Independence dam on the Iron River**
2. **Some access issues–private road ordinance needed**

Republic Township

Republic Township is in the southwest corner of Marquette County. The core communities of the township are Republic, South Republic, and Witch Lake.

Republic Township participates in the National Flood Insurance Program, yet it should be noted that the FEMA Community Status Book claims Republic Township has no special flood hazard area in its map.

Hazards more likely to occur in Republic Township

FIGURE 30 RIVER ROAD SHOWING FLOODING VULNERABILITY

Republic Township Mitigation Projects:

1. **Dry hydrants needed**
2. **Hawk Road – raise road from hollow, passed dam, back to the intersection of 601**
3. **Raise the level of River Road, so that it is less likely to be flooded by the Michigamme River**

Richmond Township

Richmond Township lies near the center of Marquette County. The township's landscape is dominated by the Empire iron mine, whose pits and slag piles have significantly modified the terrain since topographic maps of the area were compiled in the 1950s. Much of the mine area was estimated to be in a floodplain.

FIGURE 31 MINE TRUCK, RICHMOND TOWNSHIP

Richmond Township Mitigation Projects:

1. **Road improvements– heavy mine truck impact**

Sands Township

Hazards more likely to occur in Sands Township

Sands Township lies south of the City of Marquette. The dominant landscape feature is the Sands Plains, a large outwash plain, forested with jack pines. Wildfires are the top natural hazard in Sands Township.

Despite the dry conditions favored by jack pines, Sands Township may have a flood threat, as designated in the updated FEMA flood map from April 19, 2016, noting an area of minimal flood threat. Property owners in moderate- to low-risk areas are eligible for lower-cost flood insurance, known as Preferred Risk Policies (PRPs), pending municipality adoption. This map has not been adopted by Sands Township. Between 2014 and 2018, more than 40 percent of flood insurance claims came from outside high-risk flood areas. Most of the township can be characterized as upland, the source of tributaries to the Escanaba, Carp, and Chocolay river systems.

Sands Township Mitigation Projects:

1. **Additional/alternate water sources needed**
2. **Tree trimming along power lines needed**

Skandia Township

In eastern Marquette County, Skandia Township straddles the watershed divide between rivers flowing to Lake Superior and those flowing to Lake Michigan. Despite the relatively high elevation of the township, much of it is swampy.

Skandia and West Branch Townships have established a joint evacuation center for their residents to be located at the Skandia Township Hall. The evacuation center needs a generator.

Skandia Township Mitigation Projects:

1. **Purchase generator for pump house located near the intersection of US 41 and M 94 E**

Tilden Township

Tilden Township lies just to the south of the City of Ishpeming. The dominant feature of the township is the Tilden Mine, an open pit iron mine. Nearby is the old mining community of National Mine, where much of the township's population lives. Ely Creek runs alongside the major thoroughfare in this historic community. While flood-prone properties are mainly in the northern part of the township, the southern half of Tilden Township is heavily forested with jack pines.

Hazards more likely to occur in Tilden Township

FIGURE 33 ELY CREEK FLOWING PAST HOUSES IN NATIONAL MINE

FIGURE 32 COUNTY RD PCC BRIDGE OVER ELY CREEK

Tilden Township Mitigation Projects:

1. **Improve the bridge over Ely Creek on County Road PCC**
2. **Dry hydrants needed in Charlie Lakes area**
3. **Dredge Ely Creek alongside County Road 476, National Mine**

Turin Township

Turin Township lies in the southeast corner of Marquette County, bordering Alger and Delta counties. Only 152 people live in the township, which encompasses much of the Cyr Swamp. The Michigan Department of Natural Resources is the largest landowner in the township.

Much of Turin Township is low-lying. Its flood prone areas are along County Roads 444 and RM, which is also where most of Turin Township's population lives. Although the township is heavily forested, relatively few jack pines are found there.

Turin Township Mitigation Projects:

1. **Enhance 911 Mapping capabilities to reduce hazard response time.**
2. **Enhance broadband capacity in the Township.**

Wells Township

Wells Township is in southernmost Marquette County. The core communities of the township are Northland, Arnold, and Watson.

Drainage in Wells Township is to the Escanaba and Ford rivers. The Escanaba is fairly large and forms the eastern boundary of the township. Relatively little settlement is found along its banks, but a few camps are sprinkled along its length. Jack pines are relatively rare among the many trees of Wells Township.

FIGURE 34 WELLS TOWNSHIP

FIGURE 35 INADEQUATE DRAINAGE

Wells Township Mitigation Projects:

1. **Improve drainage along County Road 557 in Section 19.**
2. **Improve the crossing of County Road 426 over Erie Creek, near Arnold**
3. **Install three dry hydrants on local streams to support local firefighting personnel/equipment**

These two roads are the critical links between Wells Township and the rest of the region

West Branch Township

West Branch Township lies southeast of the City of Marquette. It is largely rural, but takes in a small portion of the former K.I. Sawyer Air Force Base, which has a more urban character. Roughly half of the township's population lives in the one square mile of K.I. Sawyer within the township's boundaries. Most hazard zones are in the eastern half of the township, where most residents outside of K.I. Sawyer live.

The township lies at the headwaters of the Chocolay River system, with many tributaries crossing the area. Unlike neighboring Sands and Forsyth townships, West Branch Township has relatively few jack pine forests.

West Branch Township Mitigation Projects:

1. **Improve ditching and build up the roadbed of Engman Lake Road. Wiseman Creek flows alongside the road and has a shallow riverbed**

SECTION IV HAZARD MITIGATION

CHAPTER 10 MITIGATION GOALS AND ACTIONS

This plan was developed to mitigate the hazards Marquette County faces and reduce the negative effects that they have on the residents and physical components of the county. Local units of government and individuals can often have great impact on reducing risks. In many instances, the County's role must be limited to encouragement and technical assistance. Most importantly, the County, through its many Boards and Commissions, can serve as a role model by incorporating hazard mitigation into all of its ongoing activities. The following goals, mitigation actions, and action plan are intended to guide decision-making and promote implementation of mitigation strategies by boards, commissions, and agencies throughout Marquette County and beyond. Other units of government, businesses, and individuals are encouraged to implement accordingly.

Goals

The following comprehensive goals were established to guide strategies, actions, and mitigation efforts.

1. ***Protect the lives, health, and safety of citizens and visitors of Marquette County from potential hazards.***
2. ***Protect critical facilities, key resources, and public infrastructure.***
3. ***Reduce or eliminate the effects of hazards to the greatest extent possible.***
4. ***Have the County be a leader in the Upper Peninsula and State with respect to emergency management.***
5. ***Have a public educated on effective mitigation measures.***

Mitigation Actions

Mitigation actions are specific projects and activities that help achieve goals. Specific actions and projects are listed in the Local Unit Analysis and Action Plan. Mitigation actions are completed through the following mitigation types:

PREVENTION: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

PROPERTY PROTECTION: Actions that involve modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.

PUBLIC EDUCATION AND AWARENESS: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

NATURAL RESOURCE PROTECTION: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

EMERGENCY SERVICES: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

STRUCTURAL PROJECTS: Actions that involve construction of structures to reduce the hazard impact. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

LOCAL PLAN AND REGULATIONS: Actions that include government authorities, policies, or codes that influence the way land and buildings are developed and built.

CHAPTER 11 ACTION PLAN

Current Action Plan

In addition to local operating budgets and private-public partnerships, FEMA Hazard Mitigation Grant Program funding should be utilized for implementation of these actions.

Priority Levels consider cost-effectiveness and/or a favorable cost/benefit ratio. The levels include:

- **Low:** A poor cost/benefit ratio for implementation within a 5 year timeframe.
- **Medium:** A moderate cost/ benefit ratio for implementation within a 5 year timeframe.
- **High:** A favorable cost/benefit ratio for implementation within a 5 year timeframe.

TABLE 9 BROAD ACTION ITEMS

Action Item	*Responsible Agency*	*Time Frame*	*Priority*
Incorporate hazard mitigation planning into guiding documents including, but not limited to community master plans, storm water management, solid waste management, climate change adaptation, capital programming, brownfields, and community food systems.	LUGs, Superior Watershed Partnership, other groups/agencies	On-going	High
Continue to conduct scenario based training, such as public assembly events.	Marquette County Emergency Management, LUGs, Law Enforcement, Fire Departments, Emergency Responders	On-going	High
Create and run public health awareness programs and campaigns addressing health hazards identified in this Plan.	Marquette County Health Department, UP Health Systems, Law Enforcement	Mid-term	High
Maintain and update website with hazard mitigation related information and maps.	Marquette County Planning	On-going	High
Encourage awareness of proper household hazardous waste disposal and recycling techniques, including a program for children.	Marquette County Solid Waste Authority, LUGs, Public Schools, Superior Watershed Partnership	Mid-term	High
Development and disseminate information on hazards and methods of hazard mitigation, including a program for children and the CERT training program.	Marquette County Emergency Management, Marquette County Planning, Marquette County Health Department, LUGs, MSUE, Public Schools	Mid-term	High

Encourage residents to develop a family plan to address emergency preparation including emergency supplies.	Community, MSUE, Civic Groups, Emergency Management	On-going	High
Identify and expand community awareness of evacuation plans and emergency snow routes.	Road Agencies, LUGs, Emergency Management	On-going	High
Work with CUPPAD, Marquette County Broadband Initiative, and stakeholders to improve broadband access.	CUPPAD, MCBI, Broadband providers	On-going	Medium
Work with legislators, communities, and key stakeholders to ensure that electrical generation capacity in Marquette County is not only maintained but also improved.	Marquette County Board of Commissioners, LUGS, State Government	Short-term	Medium
Develop a drainage improvement and maintenance program.	Drain Commissioner, Road Agencies, LUGs	Long-term	Medium
Develop new and enhance existing interagency and mutual aid agreements to promote collaboration and preparedness.	Law Enforcement, Fire Departments, Emergency Responders, Utility Companies, Businesses, Nonprofits, Government Agencies	On-going	High
Pursue Storm Ready Designation for Marquette County and encourage participation by other governments, agencies, and businesses in the Storm Ready Program.	Marquette County Emergency Management, LUGs, Interested Parties	Short-term	Medium
Update existing and create additional GIS data to enhance hazard mitigation planning and activities, including vulnerable population areas.	Marquette County GIS Coordinator, Marquette County Planning, other GIS users	Short-term	High
Implement Marquette County Community Wildfire Protection Plan Action Items.	As identified in MCCWPP	On-going	Medium
Encourage the development and practice of site emergency and response plans.	Emergency Management, Public School Administration, Local Businesses, UP Health System, Correctional Facilities Administration, etc. to cover all potential hazards.	Mid-term	High
Research and implement where feasible, innovative construction design to reduce	Marquette County Building Codes, MCHD Environmental	Mid-term	Medium

damage potential from wind, fire, and flooding hazards.	Health, Builders Associations, MSUE		
Pursue funding for emergency response equipment.	LUGs, Marquette County Emergency Management, Law Enforcement, Road Agencies, Fire Departments, Health Department, Emergency Responders	On-going	High
Participate, or continued participation in the National Flood Insurance Program.	LUGs	On-going	High
Encourage asset management programs for critical equipment and facilities.	Marquette County Emergency Manager, Public Works and Facilities Departments, LUGs	On-going	High
Encourage creation of safety programs, including employee protection, to ensure safe working conditions.	Marquette County Safety Committee, other safety committees, Local Businesses, LUGs	Short-term	High
Encourage the establishment of heating and cooling shelters for vulnerable populations.	Civic Groups and Churches, American Red Cross, Salvation Army	Long-term	Medium
Identify locations for additional water supply for firefighting and pursue acquisition and installation of dry hydrants.	Fire Departments, DNR, Emergency Management	Short-term	High
Continue Brownfield cleanup actives; identify and remediate hazardous materials sites.	LUGs, DEQ, Marquette County Brownfield Authority, Marquette County Land Bank, Local Brownfield Authorities	On-going	Medium
Limit development in identified hazard areas through the use of regulations that address private roads, access management, rental inspection, reclamation, zoning (riparian areas, erosion, Firewise techniques), land division, and others	LUGs	On-going	High
Continue to assist emergency management teams during hazardous events.	Marquette County Planning	On-going	High

Local Unit Action Plan

Actions listed by each local unit of government in Table 10 should consider coordination with other entities in the county. In addition to local operating budgets and private-public partnerships, FEMA Hazard Mitigation Grant Program funding should be utilized for implementation of these actions.

Priority Levels consider cost-effectiveness and/or a favorable cost/benefit ratio and consideration of potential for loss of human life. The levels include:

- **Low:** A poor cost/benefit ratio for implementation within a 5 year timeframe. No human loss of life will occur if the hazard is unmitigated within a 5 year timeframe.
- **Medium:** A moderate cost/ benefit ratio for implementation within a 5 year timeframe. Loss of human life is unlikely within a 5 year timeframe.
- **High:** A favorable cost/benefit ratio for implementation within a 5 year timeframe. Loss of human life may occur if the hazard is not mitigated within a 5 year timeframe.

TABLE 10 SPECIFIC ACTION ITEMS

Action item	*Local Unit*	*Priority*
Improve ditching and build up the roadbed of Engman Lake Rd	West Branch Township	Low
Improve drainage along County Road 557 in Section 19.	Wells Township	Low
Improve the crossing of County Road 426 over Erie Creek, near Arnold.	Wells Township	Low
Install three dry hydrants on local streams to support local firefighting personnel/equipment.	Wells Township	Medium
Enhance 911 Mapping capabilities to reduce hazard response time.	Turin Township	High
Enhance broadband capacity in the Township.	Turin Township	Low
Improve the bridge over Ely Creek on County Road PCC.	Tilden Township	Low
Install dry hydrants in Charlie Lake area.	Tilden Township	Medium
Dredge Ely Creek alongside County Road 476, National Mine.	Tilden Township	Low
Purchase generator for pump house located near the intersection of US 41 and M 94 E.	Skandia Township	Medium
Secure additional/alternate water sources.	Sands Township	Low
Tree trimming along power lines.	Sands Township	Medium
Road improvements to repair heavy mine truck impacts.	Richmond Township	Low
Install dry hydrants.	Republic Township	Medium
Raise Hawk Road from hollow, passed dam, back to the intersection of 601.	Republic Township	Low
Raise the level of River Road, so that it is less likely to be flooded by the Michigamme River.	Republic Township	Medium
Ensure stability of Lake Independence dam on the Iron River.	Powell Township	Low
A private road ordinance is needed to mitigate access issues.	Powell Township	High
Raise the Carp River Bridge on Heritage Drive.	Negaunee Township	Low

Flood proofing or movement of structures in the flood zone along Dead River Storage Basin.	Negaunee Township	Medium
Install additional pump stations on the levees and break walls at the wastewater plant. Estimated cost is $15,000/unit.	Michigamme Township	Medium
Install additional break walls along the Lake Michigamme shore to protect adjacent properties.	Michigamme Township	Low
Wastewater system improvements.	Michigamme Township	Medium
Establish a permanent water source for firefighting in the northern part of the township, somewhere along County Road 550.	Marquette Township	High
Install additional tanker turnouts.	Marquette Township	Medium
Improve culverts on Cooper Lake Road.	Ishpeming Township	Low
Purchase propane powered generators.	Humboldt Township	High
Iron Street Bridge: raise the bridge over the East Branch of the Escanaba River	Forsyth Township	Low
Purchase Generators: to back up the commercial power to the city's water wells, emergency operations center, emergency shelters, and evacuation centers.	Forsyth Township	High
Lift Station Protection: additional flood protection is needed for the sewer lift stations.	Forsyth Township	Medium
Purchase Emergency Vehicles: for Disaster Response by the Forsyth Township Police and Emergency Management Departments.	Forsyth Township	High
Purchase Firefighting Equipment: additional and upgrade firefighting equipment to help alleviate response capability to the industrial area and local wildland fires.	Forsyth Township	High
Install drainage solutions on N end of Airport Road and County Road DH.	Ewing Township	Low
Install shower system in basement of Township Hall.	Ewing Township	Low
Install drainage Solutions: Including proper ditching along roadways.	Ewing Township	Low
Assess 70 plus year old bridges.	Ewing Township	Medium
Solution for power and phone service outages.	Ewing Township	Medium
Ongoing vegetation maintenance by the utility companies and the Marquette County Road Commission.	Ely Township	Medium
Identify and locate mining shafts and develop an evaluation system to rate their level of security, seek opportunity to improve security.	City of Negaunee	High
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	City of Negaunee	Medium

Identify water bodies that have beaver dam obstructions that are causing unnatural flooding of adjacent properties or have shown historical failure, causing damage to adjacent properties.	City of Negaunee	Low
Shoreline restoration to protect the Hawley Street lift station and a 3,680 foot-long section of 16" sanitary sewer main located along the Lake Superior shoreline. (Forthcoming BRIC application)	City of Marquette	High
Shoreline restoration to protect Lakeshore Boulevard, the Lakeview Arena storm drain outfall and Shiras Park parking area. (Forthcoming BRIC application)	City of Marquette	High
Dredge the Carp River (Unknown $)	City of Ishpeming	Low
Dredge Lake Bancroft (Estimated $2M Project)	City of Ishpeming	Low
Dredge Lake Bacon (Unknown $)	City of Ishpeming	Low
Repair/Replace Brittle/Cracked/ Broken Pipes in the city Inflow/Infiltration of Sewer System – (Estimated $10M)	City of Ishpeming	Medium
Repair / Replace Lift Stations ($500K Project)	City of Ishpeming	Medium
Replace Waste Water Treatment Plant (Estimated $30M)	City of Ishpeming	Low
Replace Old / Failing Water Delivery Infrastructure (City At Large – Estimated $5M)	City of Ishpeming	Medium
Replace Water Treatment Plant (Estimated $30M)	City of Ishpeming	Low
Develop Community-wide Communication System.	City of Ishpeming	Medium
Development of City Owned Limited Emergency Operations Center with Back-up Power (Estimated $100K)	City of Ishpeming	Low
Development of Forestry Management Plan including City Canopy (Project Cost - $30K)	City of Ishpeming	Low
Develop Forest Management Projects (Estimated $100K/yr for 5 yrs)	City of Ishpeming	Low
Repair / Remediate Low lying Areas (Culverts) and Wildlife Damage (e.g. Beaver) causing roadway flooding and failures of drainage.	City of Ishpeming	Low
Repair Roadway between Ishpeming and Negaunee (M28 Business)	City of Ishpeming	Low
Remediate life threatening intersection (US-41 and Lakeshore) with MDOT / City Traffic Circle Construction and roadway realignment	City of Ishpeming	High
Repair /Replace Roadways (City At Large – Estimated $10M)	City of Ishpeming	Low
Realign Roadways to increase accessibility and improve maintenance (City At Large – Estimated $5M)	City of Ishpeming	Low
Assess Railroad Bridging Infrastructure – (estimated $100K)	City of Ishpeming	Medium
Maintain Auto / Roadway Bridges (Four) (Unknown $)	City of Ishpeming	Low

Additional water sources are needed. Water access is restricted especially in northeast and southern portions of the Township.	Chocolay Township	High
Dredge the mouth of the Chocolay River and protect the nearby lift station.	Chocolay Township	High
Educate the public about why construction should not be taking place in hazard zones.	Chocolay Township	High
Purchase of a truck capable of accessing off road areas and substandard seasonal roads.	Champion Township	Medium
Install dry hydrant on Wolf Lake Road, Section 21 stream crossing.	Champion Township	High
Purchase a brush truck for brush fires beyond structure fires.	Champion Township	Medium

Progress on Previous Mitigation Action Items

The following items were included as Action Items in the Marquette County Hazard Mitigation Plan 2015.

VEGETATION REMOVAL (ELY TOWNSHIP)

Description of problem: Vegetation growth around power lines and roadways create a fire hazard.

Description of Action: Remove or trim vegetation along power lines and roadways to prevent wild fires.

Action Taken: Utility companies along with MCRC are helping maintain these areas. This is an ongoing process.

BRIDGE MITIGATION (ELY TOWNSHIP)

Description of problem: Bridge going over Escanaba River on Co rd. CP was small and in need of repair.

Description of Action: reconstruct bridge.

Action Taken: Replaced with a much larger bridge.

BRIDGE REPLACMENT (HUMBOLDT TOWNSHIP)

Description of problem: Bridge on County RD FX (Wolf Lake Rd) in need of repair or replacement

Description of Action: reconstruct bridge.

Action Taken: Bridge was replaced in summer of 2020.

EMERGENCY POWER FOR EVACUATION CENTER (SKANDIA TOWNSHIP)

Description of problem: In need of emergency power for the Skandia-West Branch Township Evacuation Center.

Description of Action: Purchase a generator.

Action Taken: Generator was purchased and is operational.

PREVENT ROAD AND PROPPERTY FLOODING (TURIN TOWNSHIP)

Description of problem: poor placement or nonexistent culverts on County Rd RM cause flooding and property damage.

Description of Action: Ditch, or add culverts to remediate flooding.

Action Taken: Some culverts were replaced or repaired in the early 2000's.

STORM WATER MAINTENANCE (ISHPEMING TOWNSHIP)

Description of problem: Clear cutting and sand erosion from mismanaged development has caused poor drainage systems that have affected some residents with runoff from other properties.

Description of Action: Ishpeming Township should be encouraged to develop a storm water management plan. They should also be encouraged to adopt "Site Plan review" procedures for all future development that includes a review by the Marquette County Drain Commissioner.

Action Taken: Ishpeming Township has updated their zoning ordinance in 2011 to include standards for site plan review. Section 30.1.3 states special attention shall be given to proper site surface drainage so that removal of storm waters will not adversely affect neighboring properties. It does not required review by the Marquette County Drain Commissioner. Further action may be necessary.

CREATION OF TRUE DRAIN SYSTEM (FORSYTH TOWNSHIP)

Description of problem: There are no storm drains on the western part of the community. There are a number of old catch basins that detain water but are not connected to a true drain system.

Description of Action: Create a true drain system for Forsyth Township.

Action Taken: No action taken. Drainage systems improvements are mentioned in Forsyth Township's Master Plan. Action still needed.

MITIGATE FLOODING OF THE CHOCOLAY RIVER (CHOCOLAY TOWNSHIP)

Description of problem: Ice blows in and blocks discharge, causing flooding events upriver.

Description of Action: Reconfigure mouth of Chocolay River to allow enhanced flow of water into Lake Superior.

Action Taken: No action taken. Strategies to reduce ice blockage and sedimentation build up are discussed in Chocolay Township's Master Plan.

ELEVATE HOMES ALONG COMPEAU CREEK WITHIN THE MIDDLE ISLAND POINT CAMPERS ASSOCIATION (MARQUETTE TOWNSHIP)

Description of problem: Homes adjacent to the creek in the Middle Island Point Association receive flooding. One home has been elevated so far.

Action Taken: Action ongoing.

REMOVE THE CARP INTAKE DAM (#158) NORTH OF LINDBERG'S GRAVEL PIT ON CR 480 (SANDS TOWNSHIP)

Description of problem: There is a concrete abutment with a 30-foot drop that collects trees and debris causing a backup of water and flooding.

Description of Action: Project includes the removal of Carp Intake Dam #158

Action Taken: The dam is still in place. It is privately owned and action is ongoing.

PRESQUE ISLE PARK SHORELINE REMEDIATION (CITY OF MARQUETTE)

Description of problem: Approximately 3000 feet of shoreline on the western side of the Presque Isle is experiencing sever erosion.

Description of Action: Basic remediation plan is to construct an underwater break wall.

Action Taken: Basic mitigation methods, including erosion signage and the installation of riprap, have been completed. Additional long-term mitigation is needed. In 2018 the Superior Watershed Partnership completed erosion control measures and installed signage to deter foot traffic near the popular Blackrocks recreation area on Presque Isle Park.

LAKE INDEPENDENCE DAM (POWELL TOWNSHIP)

Description of problem: The dam on Lake Independence is no longer used to generate power and is now used to protect the land value along the edge of the impoundment. The soil that surrounds the lake is saturated. Many homes have been flooded. Also, the CR 550 bridge acts as a second dam but the soil around the bridge is saturated and because of pressure from the water (i.e. flash flooding) could make the bridge unstable.

Description of Action: Work with the Drain Commission to determine the usefulness of the dam and mitigate pressure on the bridge.

Action Taken: The dam is still in place. Action ongoing.

WHETSTONE BROOK (CITY OF MARQUETTE)

Description of problem: A large detention area has been created between the US-41/M-28 Bypass and the City of Marquette Service Center. Development has been occurring in the basin. High storm water could be a problem in the future. Concern was expressed that any blockage of runoff at an inlet to the creek would result in flooding of the Front Street (City of Marquette) and US41&M-28 Bypass intersection and adjoining highways.

Description of Action: The drainage basin has had flooding problems in the past. Whetstone Creek/Brook drainage district was created in March 1982. Consideration is being given to opening the mouth of the brook. Returning the lower portion of the brook to its natural state is part of the City's Lower Harbor Development Plan.

Action Taken: Whetstone Brook, along with Orianna Creek, in the City of Marquette have been 'daylighted' and restored to their original flow in 2004.

URBAN FLOODING IN MARQUETTE CITY AND TOWNSHIP:

Description of Problem: Most citizens are not aware of what can cause a drainage problem, which leads to property flooding. The most common form of urban flooding is water topping curbs. Improperly designed curb cuts can also channel water along driveways, funneling it into garages and basements. In some instances, the backup of water could be the result of the height of catch basins or the grade of the adjacent street. In others, it could be due to volume exceeding the capacity due to addition of impervious surfaces after construction of the system or elimination of a natural detention area.

Description of Action: The homeowners need to be educated about placing leaves in the ditches. This action reduces their efficiency. Possibilities for public awareness campaigns include intervention by the county and city authorities to implement mandatory ditch cleansing. Try to implement better building codes for driveway construction. There also needs to be a Storm Water Management Ordinance.

Action Taken: Marquette Township adopted a storm water management plan in 2015. The City of Marquette has General Guidelines and Standards for Street and Utility Design–storm water and sewer sections are currently under production. Additional action may be needed.

CLIFF'S SEVENTH ADDITION SUBDIVISION (CITY OF ISHPEMING)

Description of Problem: In 1985 and in 2002 there were many basements flooded in Cliff's Seventh Addition subdivision.

Description of Action: Creek dredging and better maintenance of railroad ditches and culverts and separation of storm and sanitary sewers are recommended to alleviate this problem.

Action Taken: Action ongoing.

Other Action Taken

COMMUNITY WILDFIRE PROTECTION PLAN ADOPTION
CITY OF ISHPEMING INFRASTRUCTURE PROJECTS
VARIOUS CULVERT REPLACEMENTS THROUGHOUT COUNTY
SUPERIOR WATERSHED PARTNERSHIP STORM WATER PROJECTS

Implementation and Monitoring of Projects

Many of the recommended mitigation strategies are outside of the County's specific jurisdiction, and are strategies for each local unit of government to facilitate or implement. However, the County should, through its Planning Commission and Local Emergency Planning Committee, promote responsible decisions and assist with coordination of projects by the local units of government. Under amendments to the Michigan Planning Enabling Act, the County Planning Commission must review local plans. The review should consider:

- Consistency with county plans
- Validity of comments received at local public hearings on the plan and the unit of government's response to those comments.
- Degree of consistency with the plans of adjoining units of government. If inconsistencies exist, are they due to outdated plans of the adjoining unit? Is there some way to resolve the conflict? Which has the highest consistency with the County Plan?
- Consistency with other governmental agency plans

The County Planning Commission should also substantiate its comments with facts. While its comments are only advisory, the County Planning Commission has an important role in coordinating planning among its local units, adjoining units, and other government agencies. The County Planning Commission should be proactive and initiate coordination opportunities such as initiating meetings between groups and units of government. The County Planning Commission also reviews local zoning amendments. This is an ideal time to consider the compatibility of land uses and current and future populations that may be placed at risk by existing or future activity. Promoting mitigation projects and identifying areas where hazard mitigation features should be incorporated into structural design could also be done when the County Planning Commission review capital budget requests by County Departments.

The County's Emergency Preparedness Coordinator and the Local Emergency Planning Committee should work with local agencies and units of government to encourage them to undertake mitigation projects as well as those that prepare for response and recovery. On an ongoing basis, the Emergency Preparedness Coordinator should monitor available grants and inform appropriate parties of potential matches with mitigation strategies and projects identified in the plan. Progress will be documented in the annual reports filed by the Marquette County Planning Commission and the Local Emergency

Planning Committee. The LEPC also files quarterly reports with the Michigan State Police-Emergency Management Division.

Public participation will continue as part of a plan maintenance with primary focus on: 1. Keeping the County's Hazard Mitigation website current and directing municipalities, organizations, and the general public to the site through press releases and social media posts, with opportunities for feedback to the County Planning Division. *And* 2. Strengthening partnerships and coordination between the county and public-private partnerships to promote implementation of action items.

Administrative Action

The Marquette County Planning Commission must review this Hazard Mitigation Plan at least every five years after adoption and determine whether to commence the procedure to amend the plan or adopt a new plan. Before the 5th anniversary of its adoption, the Marquette County Local Emergency Planning Committee should review the plan and make recommendations to the Planning Commission regarding outdated information and recommendations for hazards' risk and vulnerability assessments. The County Planning Division Staff help to ensure the timeline is met with the LEPC and Planning Commission communication as well as the Local Unit project updates to prevent the plan from expiring.

As part of the planning procedure, the plan is presented by the Marquette County Planning Division Staff to The County Planning Commission before sending to the County Board of Commissioners for review and adoption. This provides multiple opportunities for formal public input, as both the Planning Commission and County Board Meetings are open to the public, with the agendas and packets posted on the County's website at least a week prior to the meetings.

After this plan is approved by FEMA, each of the 22 Local Units of Government have the opportunity to adopt the FEMA approved plan. Once adopted by the Local Unit, they become eligible for FEMA grant funding to implement the mitigation projects listed within the plan. The County Planning Division assists with this coordination to ensure the Local Units of Government qualify for these important Hazard Mitigation grants.

Review and evaluation of the Marquette County Hazard Mitigation Plan is crucial since changes in the type, extent, and numbers of hazards are likely to occur over time. For instance, the Plan's identified risks and hazards may increase or decrease, new hazards may be brought forward due to new development patterns, or strategies may be implemented and new ones proposed. The Marquette County Planning Commission may of its own accord, or upon recommendation of another public body or citizens group, elect to amend this plan at any time.