Gogebic County

Photo Credit: Ironwood Daily Globe

2013-2018

Hazard Mitigation Plan

Prepared for: **Gogebic County**
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Background

Setting the Context

Hazard mitigation is any action taken before, during, or after a disaster to eliminate or reduce the risk to human life and property due to natural, technological, or human-related hazards. This is accomplished through the coordination of resources, programs, and authorities.

When successful, mitigation will lessen the impacts to such a degree that future events will remain only incidents and not become disasters. Disasters occur only as a result of human structures and habitation. The events we call disasters, after all, would not have a detrimental external impact if not for the presence of entities and resources to which we attribute value.

Mitigation is an essential part of the emergency management process. When a disaster strikes and a community responds, often the focus of repairs and reconstruction is to restore damaged property to pre-disaster conditions as quickly as possible. These efforts expedite a return to normalcy, yet replication of pre-disaster conditions leaves the community vulnerable to the same hazards, resulting in a cycle of damage, reconstruction, and damage again. Hazard mitigation allows this cycle to be broken by ensuring that post-disaster repairs and reconstruction take place after damages are analyzed and that sounder, less vulnerable conditions are produced.

Mitigation planning forces a community to identify potential hazards, assess vulnerabilities, and develop mitigation strategies to deal with those hazards long before an event occurs. The hazards and vulnerabilities are determined based on historical events, incidents in nearby communities, and scientific data and trends. Mitigation measures can be implemented systematically, as grant monies become available, or, in the worst case, through repair and reconstruction after a hazard event occurs.

The Gogebic County Hazard Mitigation Plan was created to protect the health, safety, and economic interests of the Gogebic County residents and businesses by reducing the impact of natural, technological and human-related hazards by

identifying mitigation activities that can be undertaken by both the public and private sector. This document is intended to educate local policy makers and emergency service organizations about hazards and vulnerabilities in the county and to provide a comprehensive reference document for planning and mitigation activities.

Every community faces different hazards and has varying resources to deal with problems.

Planning is one way to mitigate the impact of hazards and ensure they are dealt with in an efficient way. Mitigation activities need funding and an approved local mitigation plan is now a requirement for pre-disaster Federal mitigation funds under Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165), and after November 1, 2004 a plan is needed for post-disaster mitigation funds under the Hazard Mitigation Grant Program. The requirements are spelled out in 44 CFR, Part 201 of the Code of Federal Regulations. This plan is intended to meet the requirements for obtaining funds through the Federal Emergency Management Agency.

1.1 Planning Process

Perhaps just as important as the plan is as a reference and guidance document, the process through which it was created generated enthusiasm by engaging key stakeholders and the public in considering hazard preparedness. The multi-faceted process was carefully developed and orchestrated.

Updating of the Gogebic County Hazard Mitigation Plan began with review of the previous (2005) plan followed by gathering statewide and local data in order to develop an overview of the County and hazards risks to municipalities within the County. WUPPDR staff then coordinated with the Emergency Coordinator to form a new group of people and identify resources that could aid the planning process. Geographic data were gathered from numerous resources, and updates to the data came from local officials and stakeholders.

Participants

An ad-hoc committee was formed by the Gogebic County Emergency Management Office to guide development of the plan. The Hazard Mitigation Committee was comprised of:

- Jim Loeper, Emergency Manager, *Gogebic County*
- Mike Uskiewicz, Manager, *City of Bessemer*
- Officer Brandon Snyder, Department of Public Safety, *City of Ironwood*
- George Beck, Planning & Environmental Director, *Lac Vieux Desert Band of Lake Superior Chippewa*
- F/Lt. Donald Horn, Michigan State Police
- Pete Baril, Emergency Preparedness Coordinator, Western Upper Peninsula District Health Department
- Dean Karlovic, United States Forest Service
- Ken Jacobson, Fire Training Council/Gogebic County Fire Services Representative/Ironwood Volunteer Fire Department
- Mary Aspinwall, Aspirus GrandView Medical Control

Others who provided input from various jurisdictions included:

- Scott Erickson, Manager, *City of Ironwood*
- John Siira, Manager, *City of Wakefield*
- Jeff Randal, Supervisor, *Bessemer Township*
- William Sullivan, Supervisor, *Erwin Township*
- Alan Baron, Supervisor, *Ironwood Charter Township*
- Richard Bouvette, Supervisor, *Marenisco Township*
- John Cox, Supervisor, *Wakefield Township*
- Richard Caudill and Mike Rogers, Supervisors, *Watersmeet Township*

Public and Stakeholder Input

The Committee met in August 2012 and January 2013 to discuss hazards and work on the Plan. The first meeting was introductory and provided an overview of the planning purpose and process. The second meeting was a more detailed

discussion of priority hazards and mitigation actions to address them. These meetings provided enough initial input to put together the draft plan.

Two surveys were developed to gather public input in late 2012. One survey was available for public input (about present hazards, past occurrences, and types of mitigation projects) both online and in print and was publicized in the media. The second survey was targeted to government officials and organizations and was sent to each jurisdiction in the County as well as all other members (at that time) of the Hazard Mitigation Committee. These recipients included several organizations with interests and activities related to hazard mitigation, including Aspirus Grand View Hospital and Gogebic Community College. This survey requested input about hazard threats and past occurrences as well as information about actual projects undertaken and past and future mitigation funding and needs. Both surveys requested hazard priority ratings and localized susceptibility.

Information from returned surveys was gathered, evaluated, and incorporated into the 2013 Multi-Hazard Mitigation Plan. Later, additional information about hazard risks and potential mitigation projects was obtained through personal contacts of local officials. The Committee used the information and its own knowledge to examine changing hazard priorities based on recent events, to rank hazard threats in accordance with these priorities, and to identify and rank mitigation strategies. All the information was then incorporated into the draft plan.

The preliminary draft plan was delivered in July 2013 to the Gogebic County Courthouse and to all jurisdictions within Gogebic County. These and neighboring jurisdictions were also informed about availability of the draft for review and comment at www.wuppdr.org. The public was informed of the same (in addition to availability of the printed plan draft at physical locations in the County) via a July 17 *Ironwood Daily Globe* article. An informal opportunity for public comment was provided at a Gogebic County Board meeting on August 14, 2013. All suggestions were noted and incorporated as applicable into the final draft, which was presented to the Gogebic County Board for a public hearing preceding adoption on October 23, 2013.

Revisions

Ultimately, revisions to the previous (2005) plan reflect increasing concerns related to hazards such as pipeline incidents, changing some of the focus of both hazard analysis and mitigation actions. Furthermore, some new mitigation actions were incorporated in response to changes in conditions and funding related to dams as well as technology progress in areas such as mobile 911 reception and remote water level monitoring. Completed actions were eliminated. General goals remained the same. More routine information, such as that pertaining to demographics and land use, was updated.

Jurisdictional Involvement

Through the stakeholder survey and personal contacts, an effort has been made to involve each jurisdiction in Gogebic County in the planning process; see **Table 1.1**. Overall, this plan update increases the specificity of plan content to the individual local jurisdictions.

Table 1.1. Jurisdictional Involvement

Jurisdiction	Participation Method		
	Survey Response	Committee Meeting Attendance	Personal Contact
Bessemer Township	Yes		
Erwin Township	Yes		
Ironwood Township			Yes
Marenisco Township	Yes		Yes
Wakefield Township	Yes		Yes
Watersmeet Township	Yes		Yes
City of Bessemer	Yes	Yes	Yes
City of Ironwood	Yes	Yes (flood annex)	Yes (flood annex)
City of Wakefield	Yes		Yes

All local units of government in Gogebic County have participated in the development of the Gogebic County Hazard Mitigation Plan as required for pre-disaster Federal mitigation funds under Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165). Projects have been ranked on a county-wide basis with support of the local units of government. Letters of intent to participate in the plan from all local units are included as **Appendix A**. These jurisdictions are all continuing participants from the previous (2005) Hazard Mitigation Plan:

- Gogebic County
- Bessemer Township
- Erwin Township
- Ironwood Township
- Marenisco Township
- Wakefield Township
- Watersmeet Township
- Bessemer City
- Ironwood City
- Wakefield City

The Lac Vieux Desert Band of Lake Superior Chippewa is located within the geographic boundaries of Watersmeet Township and has, unless otherwise noted, the same hazard-related characteristics and mitigation actions. However, the Tribe is not a participant in this plan as an independent entity.

Other Related Plans

In order to avoid duplication of efforts, existing information, including Census data, climate and weather events, and other community characteristics and statistics were incorporated into this update.

Several jurisdictions in Gogebic County have master plans and zoning ordinances that were created or updated within the past few years. These plans inventory public resources related to hazard mitigation in more detail. This plan does not conflict with any of those plans, nor is it inconsistent with the regional Comprehensive Economic Development Strategy. For more information about other existing plans and related administrative mechanisms to carry out hazard mitigation, see **Section 4.1**.

The previous Hazard Mitigation Plan has, since its expiration in 2010, not always been relevant to specifically consider and explicitly include in other recent plans. After this updated plan is complete, hazard mitigation issues and priorities will be considered and incorporated as other plans are updated, with officials involved in hazard planning and response participating as appropriate. Mitigation actions will be included in capital improvements programs when applicable and feasible.

1.2 County Overview

Gogebic County is located on the far west end of Michigan's Upper Peninsula, on the southern coast of Lake Superior and bordering Wisconsin (see **Map 1.1**). The name comes from the Chippewa word "agogebic," which means "a body of water hanging on high." Though it had previously been inhabited by Native Americans and early European hunters and trappers, widespread settlement of Gogebic County did not occur until the 1880s after iron was discovered near the Montreal River. Soon the area was filled with a flurry of mining activity.

By 1884, the Milwaukee Lake Shore and Western Railroad (later the Chicago and Northwestern) was under construction from Antigo, WI to Ashland, WI by way of the new mines. The railroad connected what became the communities of Watersmeet, Marenisco, Wakefield, Ramsay, Bessemer, and Ironwood. Cornish, Irish, Scandinavian, French Canadian, Polish, and Finnish immigrants came to these new villages to work as miners and railroad workers. In 1887 Gogebic County was officially created by the Michigan Legislature, after breaking away from Ontonagon County, which originally extended all the way to the Wisconsin border.

The Gogebic Range was the last U.P. iron range to be opened and at the peak of the mining era in 1920 it produced 7 million tons annually. Logging was the second largest industry in the range. Logging camps and sawmills sprang up throughout the vast pine forests. Pine was king and other trees were bypassed. However, after very few years the large pines were gone and the logging industry began a long, steady decline. Mining activity continued in Gogebic County until the last mine, the Peterson Mine, closed in 1966. Since that time population in the County has been steadily declining (see **Table 1.2**).

Table 1.2. Historic Population

	1900	1920	1950	1970	1980	1990	2000	2010
Gogebic County	16,738	33,225	27,053	20,676	19,686	18,052	17,370	16,427

Today tourism dominates the economy in Gogebic County. Lake Superior, over 300 inland lakes, 1,200 miles of rivers and streams, miles of woods and wilderness, and plenty of winter snow attract thousands of outdoor enthusiasts.

The majority of the county is within the boundaries of Ottawa National Forest. The forest, in addition to the Sylvania Wilderness, Lake Gogebic State Park, and Porcupine Mountains Wilderness State Park, offers numerous opportunities for camping, biking, hunting, fishing, swimming, and boating. In winter, "Big Snow Country" offers hundreds of miles of snowmobile trails and four major ski resorts, including Copper Peak Ski Flying Hill, the only ski flying hill in the western hemisphere. Gogebic County is known as the ski capital of the Midwest and is a growing destination for sports and recreation during all seasons. Modern but quaint cities, historic sites, museums, and a casino also draw tourists. Forest products, injection molding, and tool making are other important industries.

1.3 Population and Demographics

Gogebic County is made up of six townships, three incorporated cities, and the Lac Vieux Desert Reservation (see **Map 1.2**). There are also several small towns and villages. The 2010 population of Gogebic County is 16,427 (see **Table 1.3** as earlier referenced). This represents a 5.4 percent decline since 2000. The county population has been steadily declining since 1940 at rates of between 5 and 15 percent for most decades. As in much of the Upper Peninsula, this population loss is mainly due to migration.

The majority of county residents are concentrated along the US-2 corridor encompassing Wakefield, Bessemer, and Ironwood. Over 9,000 residents live in these three incorporated cities, but the cities are losing population at a faster rate than the county as a whole. This is balanced by the statistical outlier of Marenisco Township, a rural area which took a significant jump in population from 2000 to 2010 due to expansion of the Ojibwa Correctional Facility. Most other townships lost population.

Map 1.1. Gogebic County Location in Nation and State

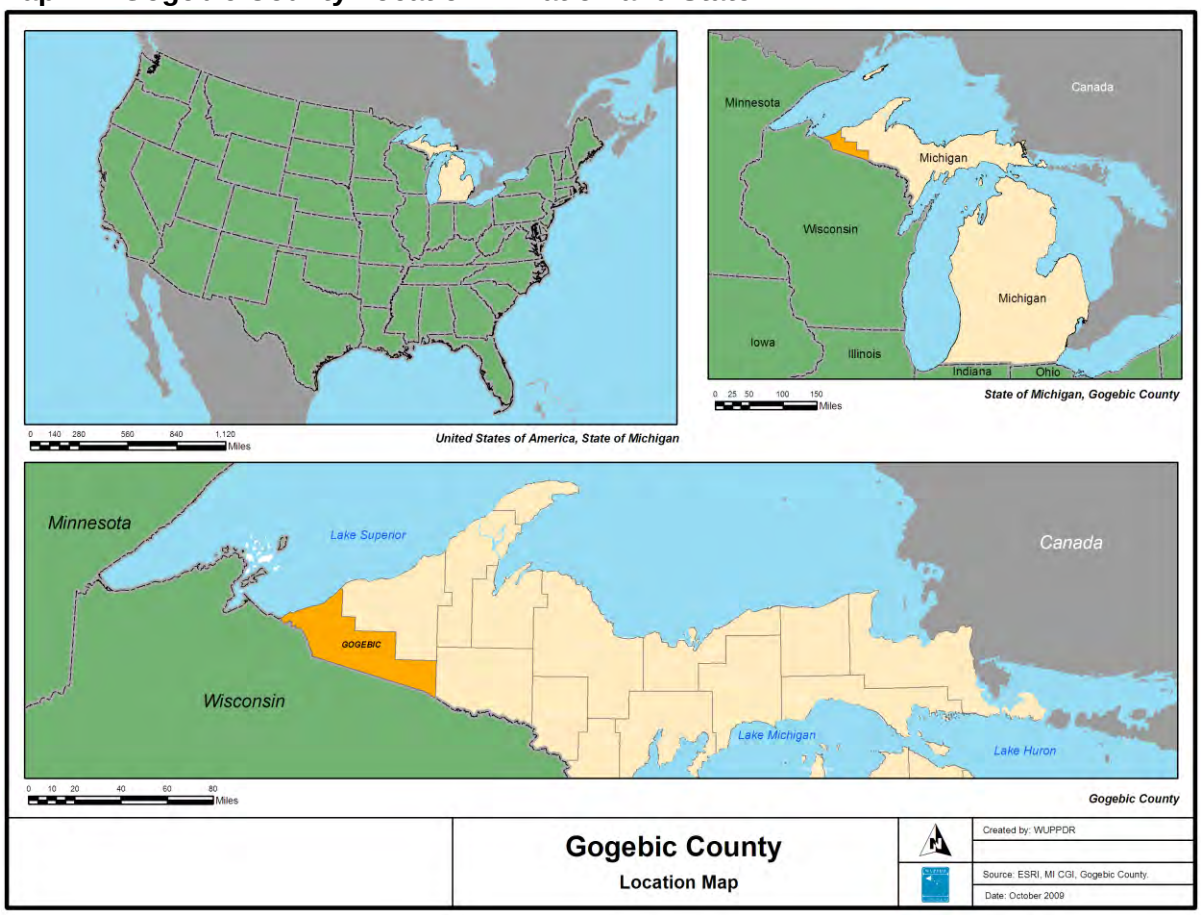


Table 1.3. Population Change

Municipality	2000 Population	2010 Population	% Change, 2000-2010
Bessemer Township	1,270	1,176	-7.4
Erwin Township	357	326	-8.7
Ironwood Township	2,330	2,333	0.1
Marenisco Township	1,051	1,727	64.3
Wakefield Township	364	305	-16.2
Watersmeet Township	1,472	1,417	-3.7
Bessemer City	2,148	1,905	-11.3
Ironwood City	6,293	5,387	-14.4
Wakefield City	2,085	1,851	-11.2
Lac Vieux Desert Reservation[1]	135	137	1.5
Gogebic County	17,370	16,427	-5.4

[1]Included in Watersmeet Township

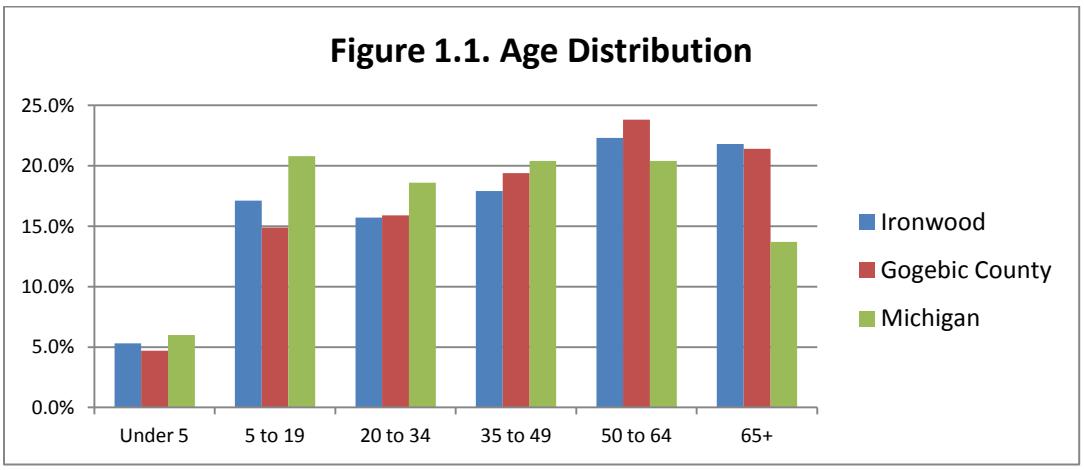
At 91.7 percent, the vast majority of Gogebic County residents are White. African Americans, at 4.1 percent, are the largest minority; most are located in

Marenisco Township within the Ojibwa Correctional Facility, which can accommodate 960 prisoners. American Indians, at 2.4 percent of the population, are the second largest minority. Most residents with Native American heritage are members of the Lac Vieux Desert Band of Lake Superior Chippewa Indians and are located either on their reservation or in Watersmeet Township.

Vulnerable Populations and Housing

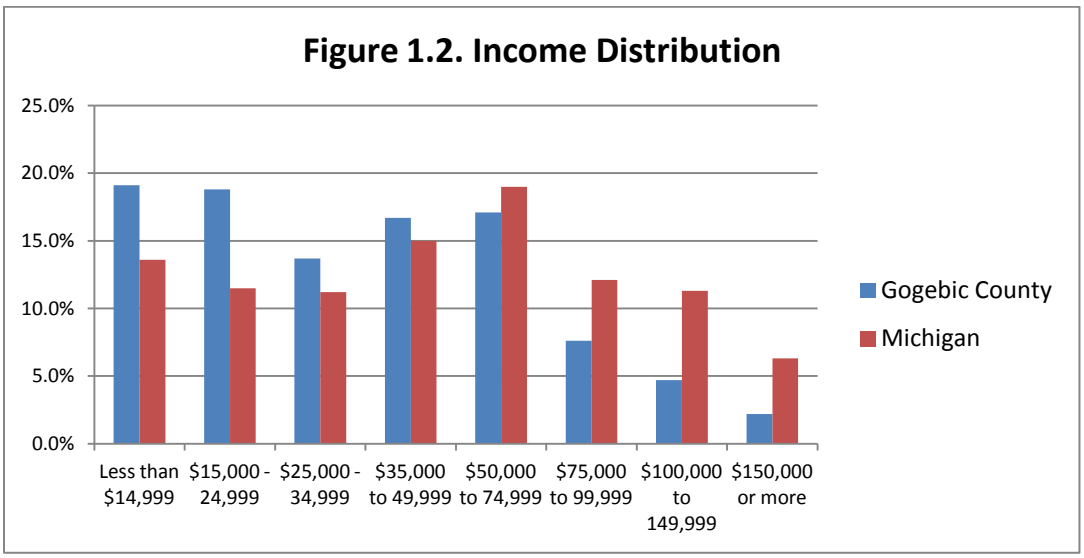
The population of Gogebic County, with a median age of 46.8, is nearly eight years older than the state average of 38.9. This is an ongoing imbalance due to out-migration of young people and families from the county and to an influx of retirees. In fact, while Gogebic County lost about 16 percent of its population between 1970 and 2000 and only 5.4 percent between 2000 and 2010, school enrollment dropped by 21 percent from 2,301 to 1,817 between the 2002-03 and 2011-12 school years.

The population under 5 years old is 765, or 4.7 percent. The county's population age 65 and over is 3,514, or 21.4 percent. (See **Figure 1.1**.) The population 85 years and over is 601. The skew toward upper age ranges is even more extreme for households, with 2,454, or 34.9 percent, of households including individuals 65 or over. The state percentage is 25.4. This group should be carefully considered due to its particular hazard vulnerability and relative stability of location.



Source: U.S. Census, 2010

Median household income in the county, at $33,673, is low relative to the state median of $48,432. The distribution of income ranges is shown in **Figure 1.2.**



Source: U.S. Census American Community Survey 2005-2010 5-Year Estimates

Close to half of all housing in Gogebic County was built before 1940 (see **Table 1.4**). The estimated median housing value in 2010 was $ 69,200. This figure is much lower than the state median of $144,200 and the lowest in the six counties of the Western Upper Peninsula. When planning for disaster response, it is important to consider that 3,547 of the county's 10,849 housing units are vacant. Identifying these structures in advance will reduce unnecessary rescue and evacuation efforts.

Complexes containing concentrated groups of people should be responded to early on. In that vein, the county contains 330 housing units in buildings with 20 or more people. Mobile homes, of which the county contains 431, place their occupants at greater risk from natural disasters than other types of units. Most of these are located in rural areas. The county is also home to 508 households without any vehicles, whose residents may not be able to reach shelters, let alone evacuate the larger area, although approximately half of these are located in Ironwood.

Finally, language in some areas can be a significant barrier in evacuations and warning messages. However, only 118 county residents over 5 years old who

speak a foreign language report being able to speak English less than "very well."

Table 1.4. Housing Statistics

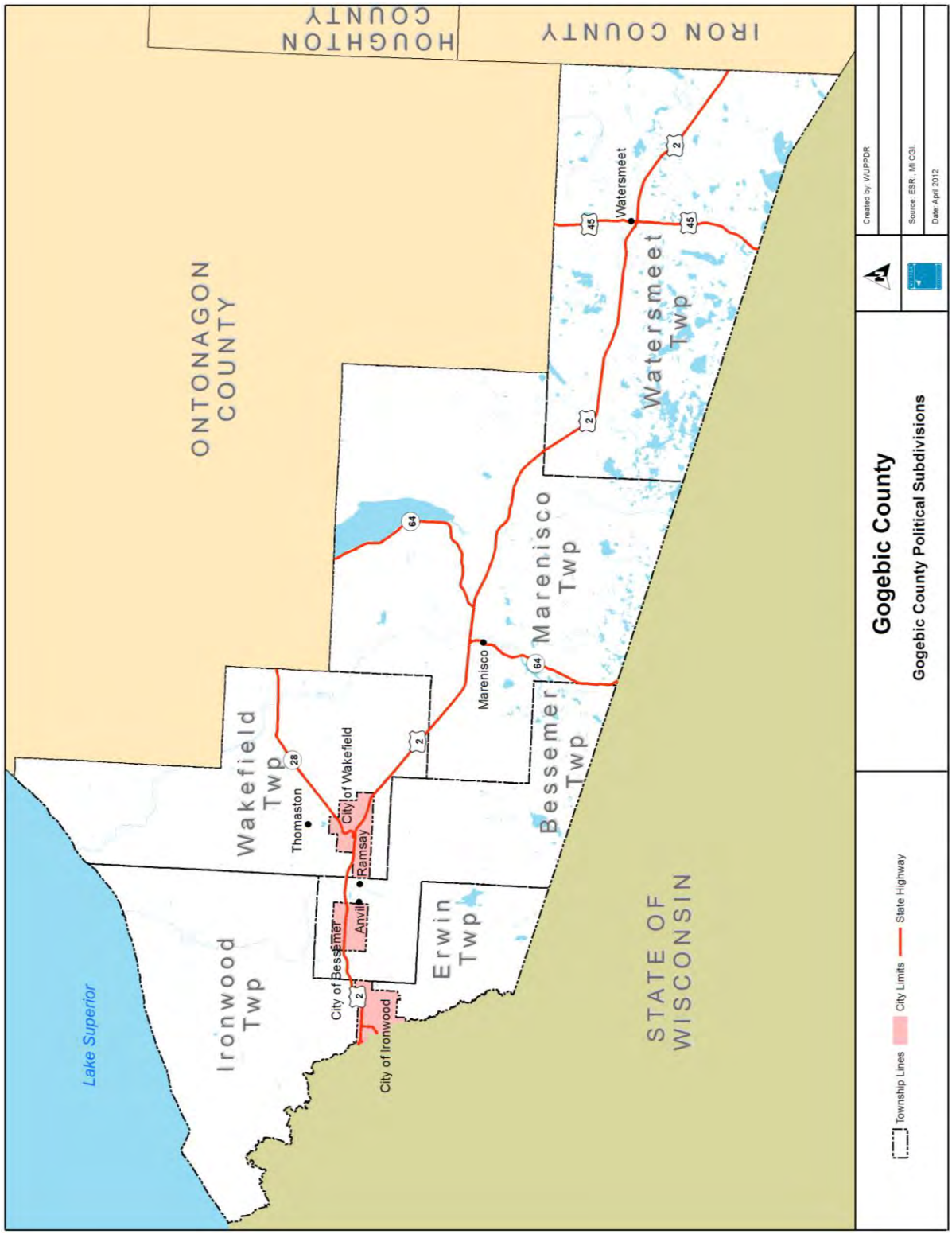
Area	Total Units	Occupied Units		Median Value ($)	Seasonal Units		Built Pre-1940		Built Pre-1970
		#	%		#	%	#	%	
Bessemer Twp	857	547	63.8	66,000	216	25.2	402	46.9	534
Erwin Twp	206	144	69.9	92,100	51	24.8	99	48.1	156
Ironwood Twp	1,708	1,028	60.2	117,500	432	25.3	467	27.3	889
Marenisco Twp	683	275	40.3	123,100	366	53.6	218	31.9	413
Wakefield Twp	369	147	39.8	112,500	121	32.8	56	15.2	123
Watersmeet Twp	1,663	670	40.3	156,900	898	54.0	269	16.2	640
Bessemer City	1,140	888	77.9	48,000	109	9.6	654	57.4	868
Ironwood City	3,175	2,520	79.4	60,600	211	6.6	1,890	59.5	2,814
Wakefield City	994	818	82.3	55,600	86	8.7	481	48.4	804
Lac Vieux Desert Reservation[2]	53	50	94.3	N/A	2	3.8	0	0	0
Gogebic Co	10,795	7,037	65.2	39,700	2,490	23.1	4,536	42.0	7,271

[1] *Source:* 2010 U.S. Census American Community Survey 5-Year Estimates
[2] Included in Watersmeet Township

1.4 Geography and the Environment

Gogebic County covers 732,208 acres or 1,100 square miles. Within this area are 1,200 miles of rivers and streams, over 300 inland lakes, and 30 miles of Lake Superior shoreline. Forests cover over 85 percent of the county, and the majority of trees are upland hardwoods. Several major rivers flow through Gogebic County. The Ontonagon River flows north into Lake Superior, the Wisconsin River flows south into the Mississippi River, and the Paint River flows east into Lake Michigan. The southern half of Lake Gogebic, Michigan's largest inland lake, which covers 13,380 acres, is located in Gogebic County. The Cisco Chain of Lakes near the Wisconsin border is made up of 15 lakes with over 271 miles of scenic shoreline, making it one of the largest chains in the world.

Map 1.2. Gogebic County Political Subdivisions



Climate

Gogebic County lies within the Lake Superior Basin, which has a typical humid continental climate characterized by cold dry winters and warm humid summers. However, the lake exerts a strong microclimate influence on the immediate shoreline, generally resulting in cooler summers and milder winters than those experienced just a few miles inland. This is due to the effect of Lake Superior on the air temperatures and the prevailing westerly winds.

The moderating effect of the lake is experienced in spring and summer months when the cool water tends to level out temperature extremes and reduces the likelihood of frost. Another effect of the lake is the formation of considerable cloudiness when cold air passes over the lake in late fall and early winter. This causes early and heavy snow possibilities, referred to as the lake effect. Both these effects lessen with increasing distance from Lake Superior.

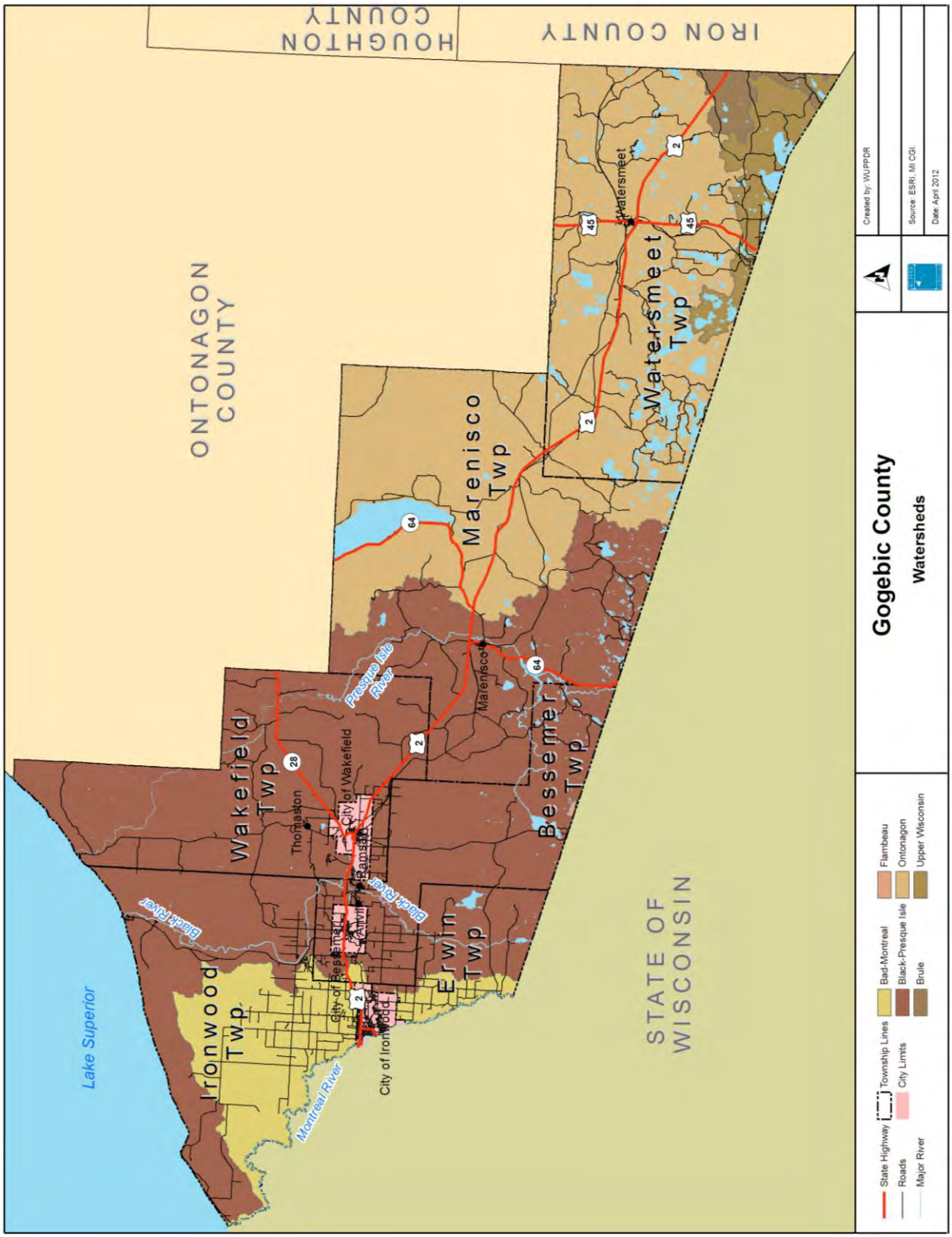
The western part of the Upper Peninsula experiences frequent and sometimes rapid weather changes caused by storms from the west and southwest. It is also characterized by extreme seasonal temperature variations, a fairly uniform annual distribution of precipitation, and large amounts of snow in the winter months.

In Ironwood since 1981, January temperatures have reached an average high of 20.3 degrees Fahrenheit and an average low of 2.9 degrees. In July the average high is 76.1 degrees, while the average low is 55.5 degrees. Average annual precipitation is 34.93 inches. The large amount of winter snowfall, averaging 188.2 inches, often results in heavy spring runoff.

Geology

Gogebic County contains two mountainous (by regional standards) belts. The southern of these is the Gogebic Range, which consists of igneous formations and contains iron ore bodies extending from the Montreal River to Lake Gogebic. The northern chain of mountains, the Gogebic Highlands, consists of steep-sloped clay bluffs extending from Little Girl's Point to the Porcupine Mountains.

Map 1.3. Gogebic County Watersheds



Map 1.4. Notable Gogebic County Lakes

The various soil associations found in Gogebic County have been placed under six categories by the U.S. Soil Conservation Service. They are areas dominated by 1) loamy soils on uplands; 2) loamy soils on uplands, with associated rock outcrops; 3) loamy soils on uplands, with associated sandy soils; 4) organic soils on uplands, with associated wet loams; 5) heavy loamy soils on uplands; and 6) clayey, lacustrine soils on uplands.

1.5 Land and Development

Over 80 percent of the county's acreage is within the boundaries of the Ottawa National Forest, and almost all of this land is open to the public. In total, Ottawa National Forest encompasses over 954,000 acres and spans five counties. The forest contains trails, developed recreation areas, wilderness areas, and lands harvested for timber. The Sylvania Wilderness, located just south of US-2 about five miles west of Watersmeet, is a special part of the Ottawa National Forest. This 18,327-acre wilderness is part of the National Wilderness Preservation System and abounds in lakes and virgin forests. It is known for its majestic scenery, sparkling clear waters, unique fishing, and backcountry camping. Transportation throughout the Wilderness is by foot or canoe, with motorized boats allowed only on Crooked Lake. Adjacent to the Wilderness, the Sylvania Recreation Area provides a 48-unit drive-in campground, a developed beach, a picnic area, and a road system providing access to wilderness entry points.

The Gogebic County Forest was established in 1943 and has grown into a 50,000+ acre forest that provides multiple-use forest opportunities and benefits to the people of Gogebic County as well as the region. It is the only County Forest Program of its kind in Michigan and is completely self-supporting. The County lands are managed by the Gogebic County Forestry and Parks Commission and include three County Parks: Lake Gogebic, Little Girl's Point and McDonald Lake.

Gogebic County is also home to two state parks. Lake Gogebic State Park, on the western shore of Lake Gogebic, covers 360 acres and offers hiking, camping, fishing, swimming, a boat ramp, and a playground. Northwestern Gogebic County is home to a small section of the Porcupine Mountain Wilderness State Park complex,

also known as the "Porkies," which contains 60,000 acres, two campgrounds, and 90 miles of hiking trails.

This section of the Porkies is highlighted by the Presque Isle Campground at the mouth of that river. From the river mouth at Lake Superior, the park extends south along the river for about four miles. Gogebic County also boasts the Black River National Scenic Byway of the Ottawa National Forest. The byway runs from US-2 near Bessemer to the Black River Harbor on the Lake Superior shore. A campground is also part of the complex. Finally, the North Country National Scenic Trail passes through the northwestern part of the county. The hiking route extends 4,600 miles from North Dakota to the New York.

Land use is greatly influenced by the extensive forests within the County. Outside of these areas, developed "urban" land use is focused in the three cities of Ironwood, Bessemer, and Wakefield (see **Map 1.5**). Outlying residential development is found along the numerous lakes, along Lake Superior, and in numerous scattered pockets throughout the county. Land use and development is directed by local zoning regulations in all of the cities and townships (see **Map 1.6**). For land areas of each jurisdiction, see **Table 1.5**.

Table 1.5. Jurisdiction Land Areas

Jurisdiction	Land Area (Square Miles)
Bessemer Township	181.25
Erwin Township	175.26
Ironwood Township	115.10
Marenisco Township	326.61
Wakefield Township	8.44
Watersmeet Township	5.50
Bessemer City	6.59
Ironwood City	48.05
Wakefield City	277.89

Schools

Schools are some of the largest institutions in the county and could potentially see great impacts from the hazards discussed in this plan. Gogebic County has four school districts to serve its population, as in **Table 1.6**:

Table 1.6. School Districts

School District and School Name	Location	Grades	Students	FTE Instructors[1]
Bessemer Area School District				
Washington School	Bessemer	Pre K-6	248	16.6
A.D. Johnston Junior/Senior High School	Bessemer	7-12	211	9.99
Ironwood Area Schools				
Norrie Elementary School	Ironwood	K-6	247	11.1
Sleight Elementary School	Ironwood	K-6	189	14.31
Luther L. Wright High School	Ironwood	7-12	417	24.1
Wakefield-Marensico School District				
Wakefield-Marenisco School	Wakefield	K-12	274	17.49
Watersmeet Township Schools				
Watersmeet Township School	Watersmeet	K-12	166	17.94

[1] *Source:* Michigan Department of Education, 2012

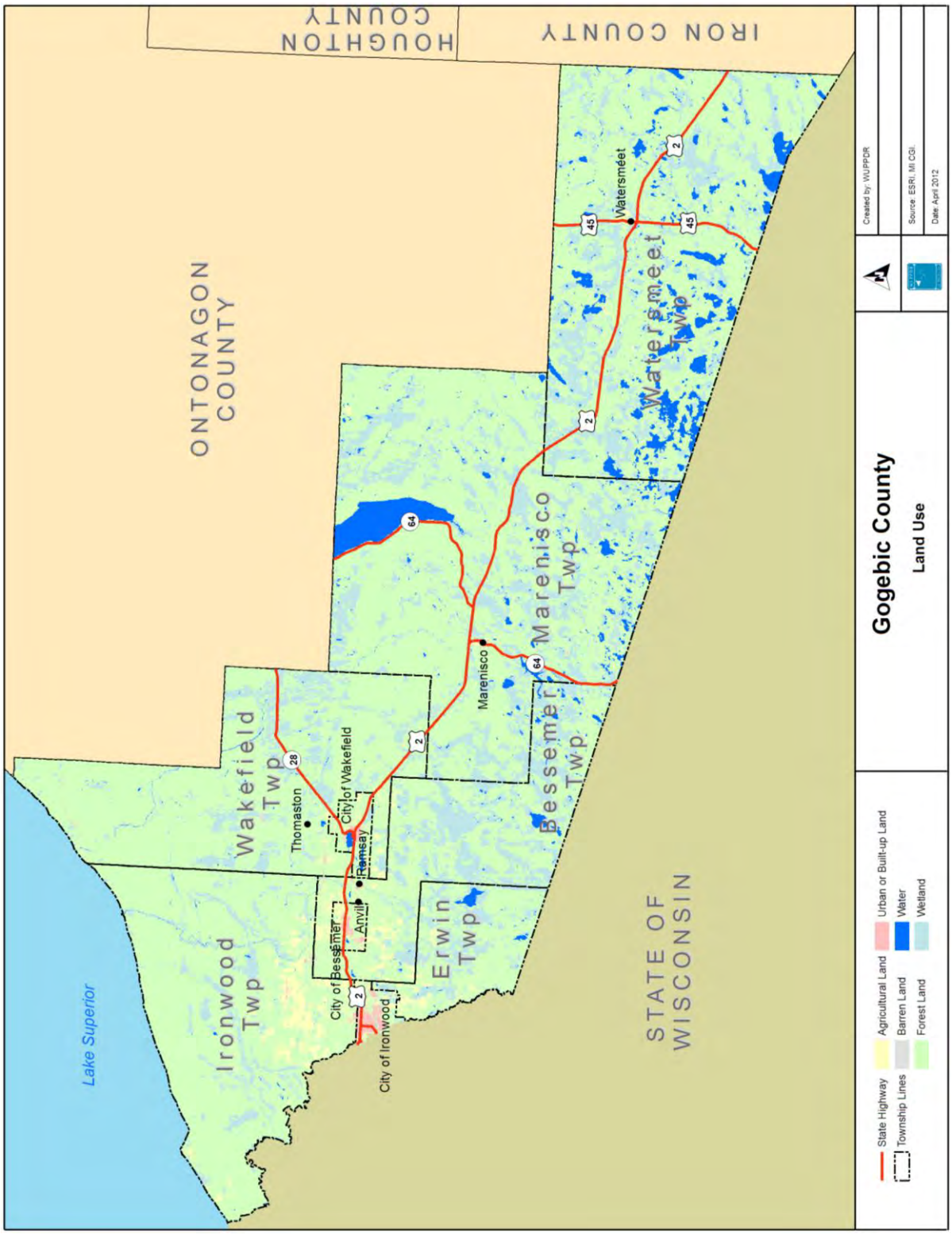
Gogebic Community College in Ironwood offers one- and two-year technical programs in addition to four-year college transfer programs. Much of the curriculum is designed to meet area business and industry needs, including one of a few ski resort management programs in the nation. Enrollment is approximately 1,400 students taught by 100 instructors.

1.6 Employment and Industry

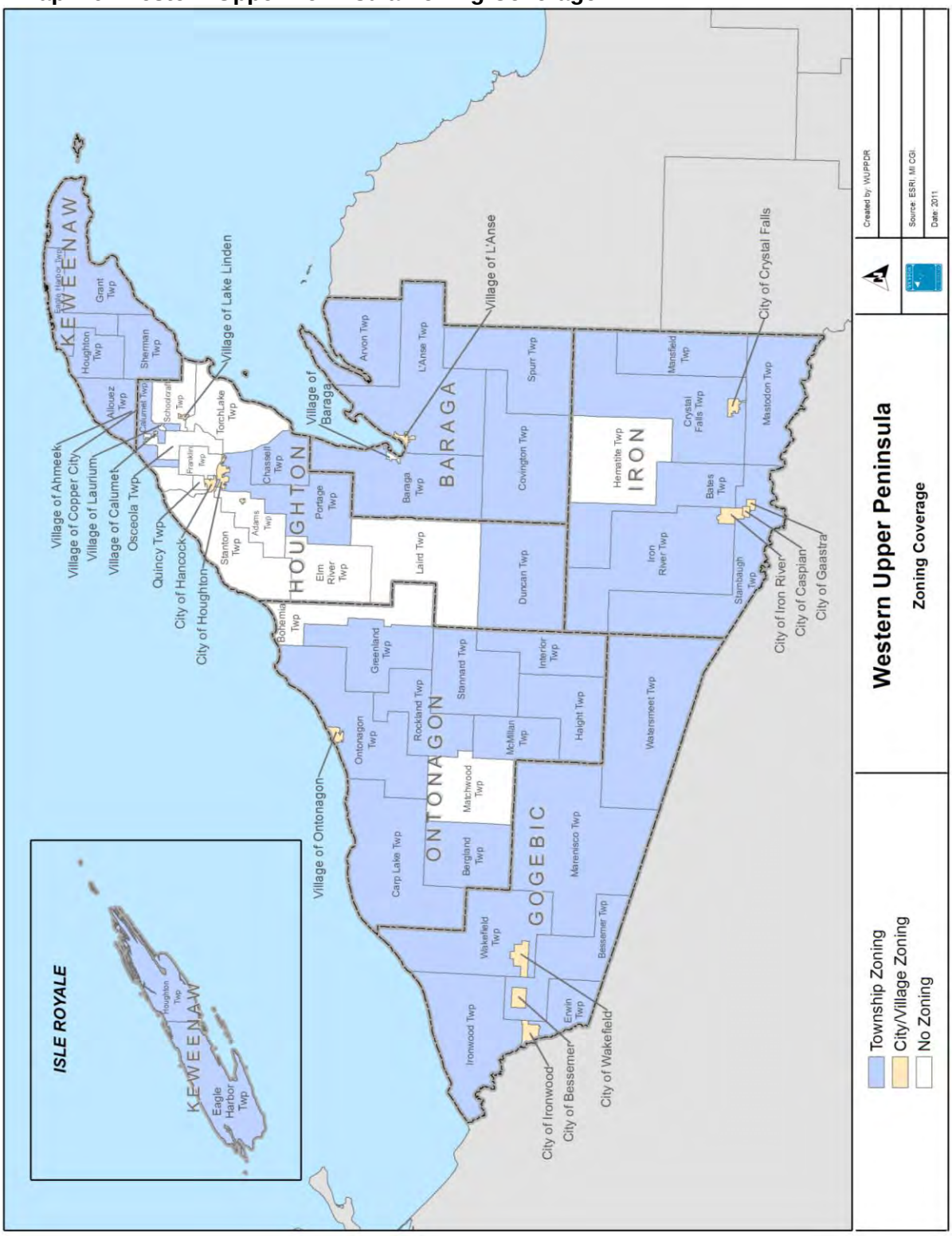
Gogebic County's economy is comprised of three dominant sectors: service industries, forest products, and tourism. The county's largest employer is Lac Vieux Desert Tribal Enterprises (including the Lac Vieux Desert/Dancing Eagles Resort Casino) in Watersmeet, operated by the Lac Vieux Desert Band of the Lake Superior Tribe of Chippewa Indians. The tribe employs 400 in its resort-casino and over 100 more in tribal government systems such as housing and health care.

Grand View Health System in Ironwood has 300 employees. Gogebic Community College, Ironwood School District, and other government entities are also significant employers. Indianhead Mountain Resort and Big Powderhorn Mountain, primary beneficiaries of the strong winter tourism industry, employ 200 and 175, respectively. Manufacturing is dominated by forest related industries, including logging, sawmills, and dimension mills. Bessemer Plywood Corporation is the largest manufacturer. Non-forest industries include precision tool making, plastic injection molding, industrial sewing operations, and electronic assembly.

Map 1.5. Gogebic County Land Cover/Use



Map 1.6. Western Upper Peninsula Zoning Coverage



The tourism industry focuses on the wealth of natural resources located in the county. Lake Superior, trout streams, waterfalls, and inland lakes including Lake Gogebic draw fair weather visitors, while the four alpine ski hills/resorts in the county and miles of ski and snowmobile trails attract the aforementioned winter visitors. Ottawa National Forest offers year-round opportunities, including hiking, camping, hunting, biking, canoeing, snowshoeing, and Nordic skiing. The Lac Vieux Desert Resort Casino provides indoor entertainment. Tourists bring an estimated $90 million to the county every year in the form of direct expenditures.

1.7 Transportation and Public Works

Public Works

Gogebic County has a Road Commission responsible for county roadways as well as public works agencies for maintenance and development of transportation and other infrastructure in the Cities of Bessemer, Ironwood, and Wakefield. Several townships also have staff for maintenance of facilities and utilities. All such agencies are resources for implementation of related mitigation actions.

Roads

A number of primary highways pass through the County, including US-2 from east to west, US-45 north to south, M-28 and M-64 (see **Map 1.7**). The county also contains many miles of seasonal roads with a number being built and maintained by the U.S. Forest Service. Each incorporated city owns and maintains the local street networks within its limits. The Black River National Scenic Byway, County Road 513 (Black River Road), starts in Bessemer and runs north for ten miles to Black River Harbor. County Road 519, which was recently converted to an all-season road to serve the proposed Orvana Copperwood Project mine, traverses the county from the Porcupine Mountains south to Wisconsin.

Rail

The Wisconsin Central Railroad passes through the County, but currently there is no scheduled rail freight service. Special-purpose trains pass through on an "as needed" basis.

Ports

The nearest port suitable for commercial use is the Village of Ontonagon on Lake Superior in Ontonagon County, about 45 miles north of Gogebic County.

Airports

The Gogebic-Iron County Airport (IWD) is located 7 miles north of Ironwood at an elevation of 1,230 feet. The single runway is 6,500 feet long and paved with grooved asphalt. The airport has no tower but is attended year-round. Approach and departure service is provided by Minneapolis Air Traffic Control. Airport services include terminal facilities, fuel, tie-down parking, hangars, mechanics on call, and rental cars. About 90 percent of aircraft operations are general aviation, with 48 percent local and 41 percent transient general aviation. The rest are air taxi service. Fifteen aircraft are based at the field.

The airport provides regular passenger service of two flights a day to and from Minneapolis/St. Paul via Great Lakes Airlines. UPS also offers air freight service from Ironwood.

Transit

Indian Trails provides regularly scheduled long-distance passenger service. Gogebic County Transit Authority provides local fixed-route and on-demand bus transportation and is available for mass transit in the event of evacuation.

1.8 Police, Fire, and Emergency Agencies and Facilities

Police, fire, and other emergency agencies are vital community resources not only for emergency response but for implementation of mitigation actions.

Police

The Gogebic County Sheriff's Department and Jail is located in Bessemer. Staff consists of the Sheriff, Undersheriff, Road Patrol, and Desk/Corrections Officers. The current staff includes 19 full-time officers and a part-time Marine Patrol and Snowmobile Patrol Officer. The Department provides police services to all of the townships, as well as to the cities of Wakefield and Bessemer on a contractual basis. Patrols are done in the Departments' fleet of six standard squad cars, a 4-wheel drive vehicle, a 4-wheel drive Animal Control truck, one rescue snowmobile, and a Marine Patrol boat.

The office dispatches not only its own officers but also Marenisco Township Police, Lac Vieux Desert Tribal Police, and most fire departments in the county. The Sheriff Department also acts as an after-hours paging site for both the State of Michigan Family Independence Agency Child Protective Services and the Community Mental Health Crisis Line. The Gogebic County Jail holds all prisoners arrested within the county and can accommodate a total of 24 inmates. Jail operations are handled by the Sheriff Department's Desk and Corrections Officers, who serve dual roles as dispatchers and jailers.

The Ojibway Correctional Facility is in Marenisco Township on Ojibway Road, near M-64. Ojibway Correctional Facility was known as Camp Ojibway prior to expansion. The facility consists of an administration building; a warehouse and store; buildings for education, meals and training; and five housing units that can accommodate up to 960 prisoners**.**

Fire

There are eight fire departments in Gogebic County (see **Table 1.7**). The Michigan Department of Natural Resources and United States Forest Service also have wildfire-dedicated resources.

Map 1.7. Gogebic County Major Roads and Transportation

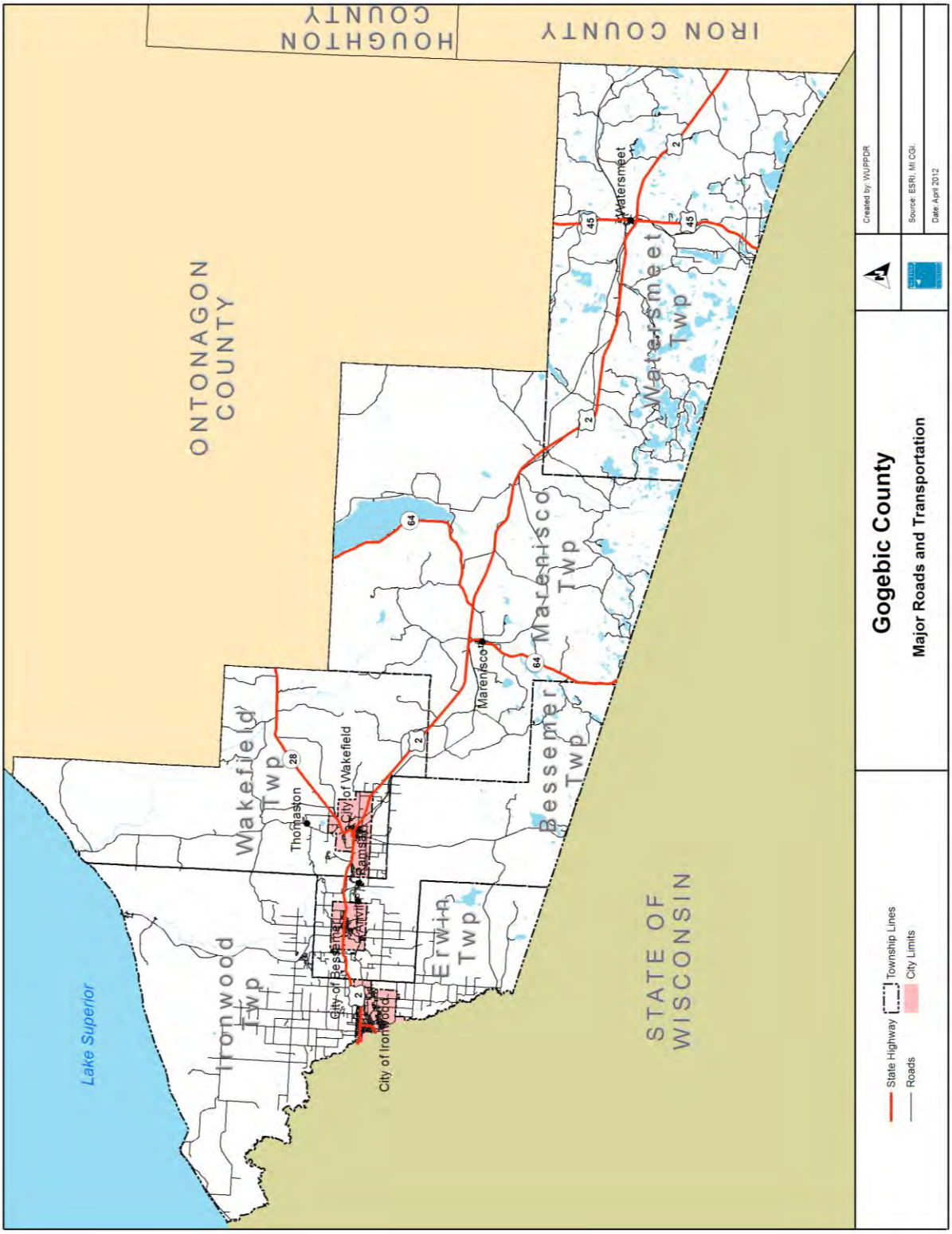


Table 1.7. Fire Departments

Fire Department	Location	Service Area		Staff*
		Sq. mi.	Population	
Bessemer FD	Bessemer	5	2350	19
Bessemer Twp FD	Ramsay	110	1500	15
Ironwood DPS	Ironwood	53	6700	38
Marenisco VFD	Marenisco	360	650	25
Wakefield FD	Wakefield	275	3000	24
Watersmeet Twp VFD	Watersmeet	288	1050	17
Ironwood Twp VFD	Ironwood	176	2300	28
Lake Gogebic VFD	Marenisco	60	200	15

Source: Gogebic County Emergency Management and Department Staff
* Staff includes paid, part-time and volunteers

Medical

Grand View Hospital in Ironwood, a 25-bed facility, offers 24-hour physician-staffed emergency service. An infection isolation room is also available. Diagnostic services include ultrasound, CT scanner, multi-slice spiral CT, diagnostic radioisotope facility, magnetic resonance imaging (MRI), Inpatient services include obstetrics and a coronary intensive care unit. Extensive community health education programs include support groups, women's wellness series, and senior programs.

Gogebic County Community Mental Health in Wakefield provides a complete range of services for all residents of Gogebic County, including services for people with emotional disturbance or mental illness. In addition, services are available for persons with developmental disabilities and substance abuse. Gogebic County is also serviced by the Western Upper Peninsula Health Department and the Gogebic Medical Care Facility.

Domestic Violence Shelter

Domestic Violence Escape (DOVE), Inc., in Ironwood provides services to victims of domestic violence and sexual assault primarily to residents of Gogebic County, Michigan and Iron County, Wisconsin. The center offers a crisis hotline, an emergency shelter, counseling, group meetings, and advocacy.

Siren Coverage

Gogebic County is serviced by three sirens in the County, all remnants of mining days. The sirens are currently used to alert the local fire departments of emergencies and as timers, not as public warning systems. They are set on timers to sound at noon and at 9 pm curfew and are manually activated during emergencies. The current coverage would only cover about 3 miles. Activation switch is located on the buildings at the siren sites. **Table 1.8** shows the siren locations, range and estimated population coverage for Gogebic County.

Table 1.8. Siren Locations

Location	Remote Activation	Range (radius) (miles)	Estimated Population Covered	Location
Bessemer Fire Dept	Yes/On Timer	1.0	2,100	411 S. Sophie St.
Ramsay Mine	Yes/On Timer	1.0	1,200	N10338 Mill St.
Marenisco Mine	Yes/On Timer	1.0	1,000	314 Hall St.

Office of Emergency Management

The Gogebic County Office of Emergency Management (OEM) is located in Bessemer at the County Sheriff's Department. The office promotes emergency and disaster education and awareness. The office serves as dispatcher and ensures interagency coordination before, during, and after disasters or emergencies. The role of OEM is outlined in the 2003 Emergency Action Guidelines which detail interagency response to all types of disasters within the county.

1.9 Critical Facilities

When dealing with hazards, some facilities are more important than others and can be considered "critical facilities." Critical facilities are defined as buildings or infrastructure that, when affected by a hazard, can impact the well being of a large population.

The Gogebic County Courthouse is considered a critical facility because it houses many essential County offices.

Facilities identified as critical generally fall into two categories:

1. Buildings or locations vital to public safety that can impact a disaster response and recovery effort, such as police, fire, and communications stations

2. Buildings or locations that could cause a secondary disaster if damaged, such as hazardous materials sites or nursing homes

For this mitigation plan, critical facilities have been identified in the following categories, with examples:

Emergency response facilities: Police and fire stations, public works sites, and the emergency management office

Utilities: Water and wastewater treatment plants and electrical substations

Other Vital infrastructure: Bridges and primary roads

Health facilities: Hospitals and nursing homes

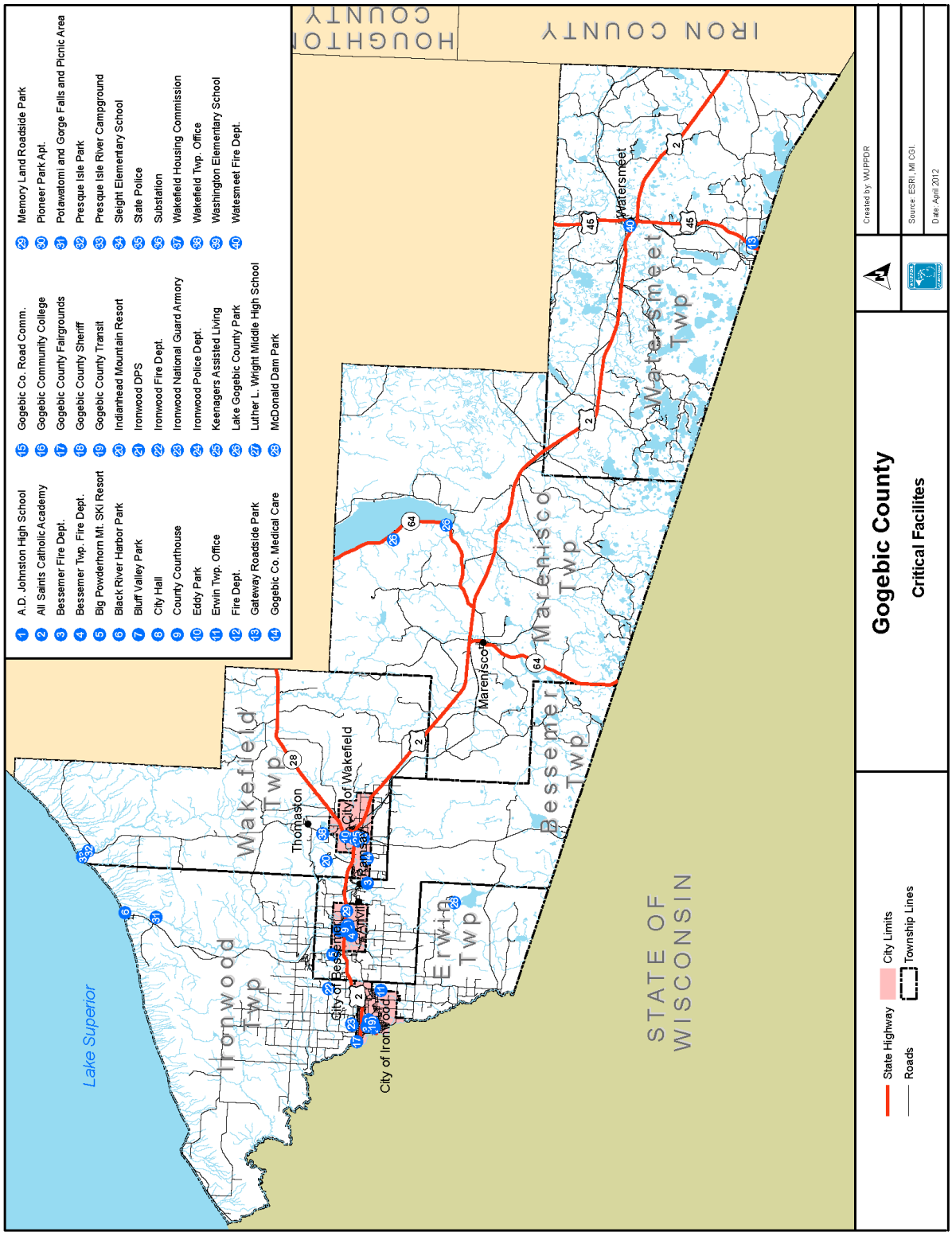
Schools: Public and private

High-Density Population Facilities: Housing facilities, casinos, and theaters

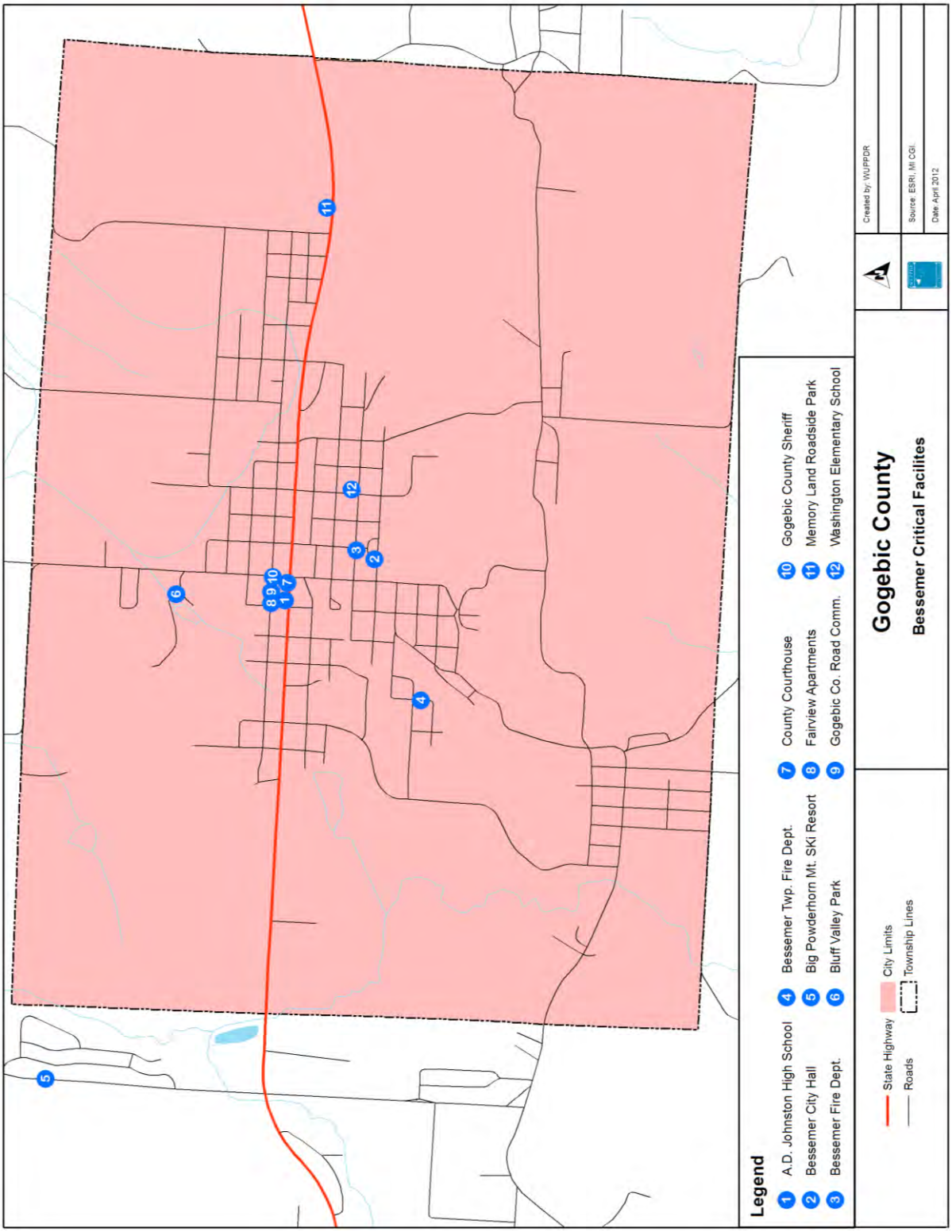
Hazardous materials sites: Factories and landfills

The following Critical Facilities Maps (See **Maps 1.8, 1.9, 1.10** and **1.11**) identify the number and the distribution of critical facilities in Gogebic County.

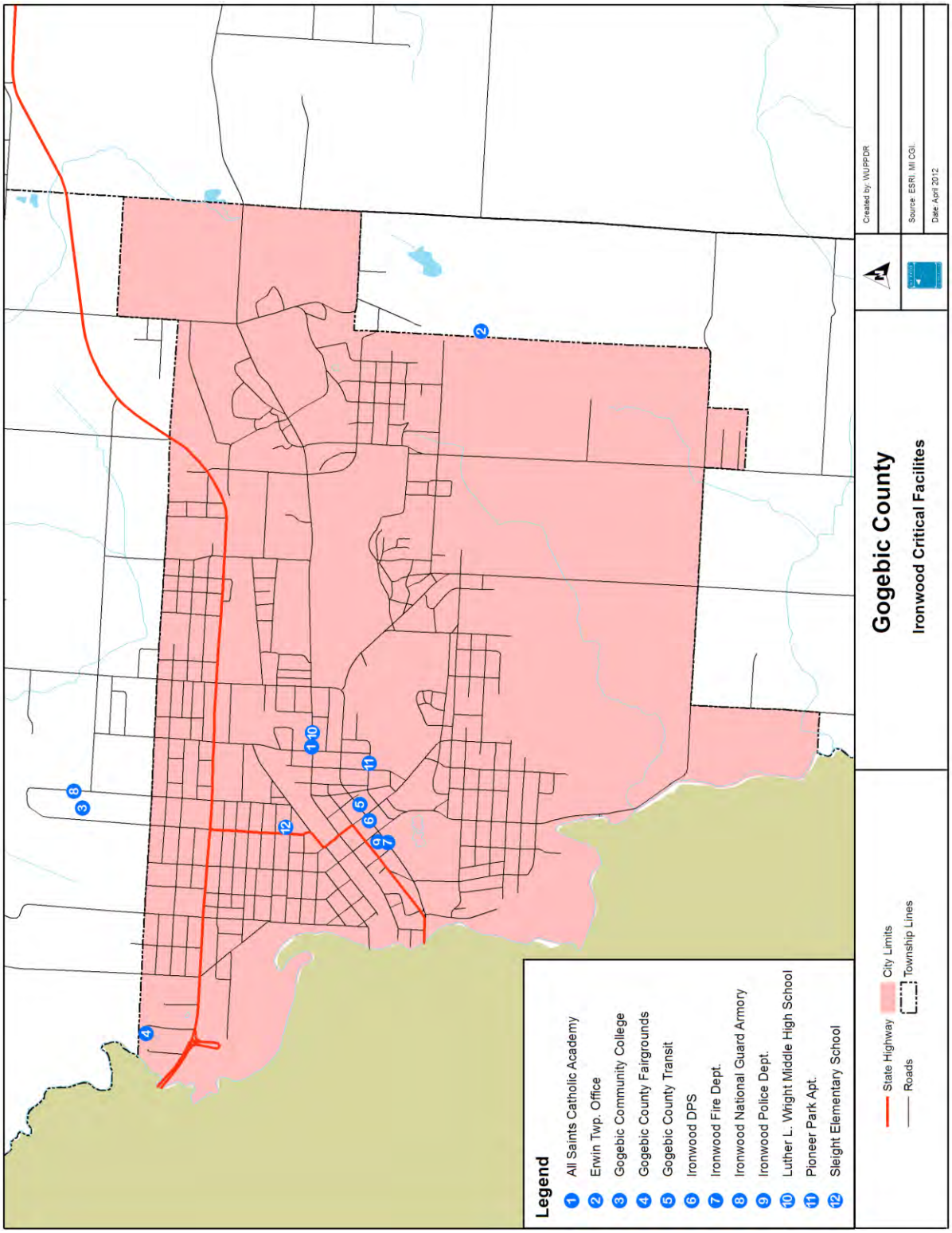
Map 1.8. Gogebic County Critical Facilities



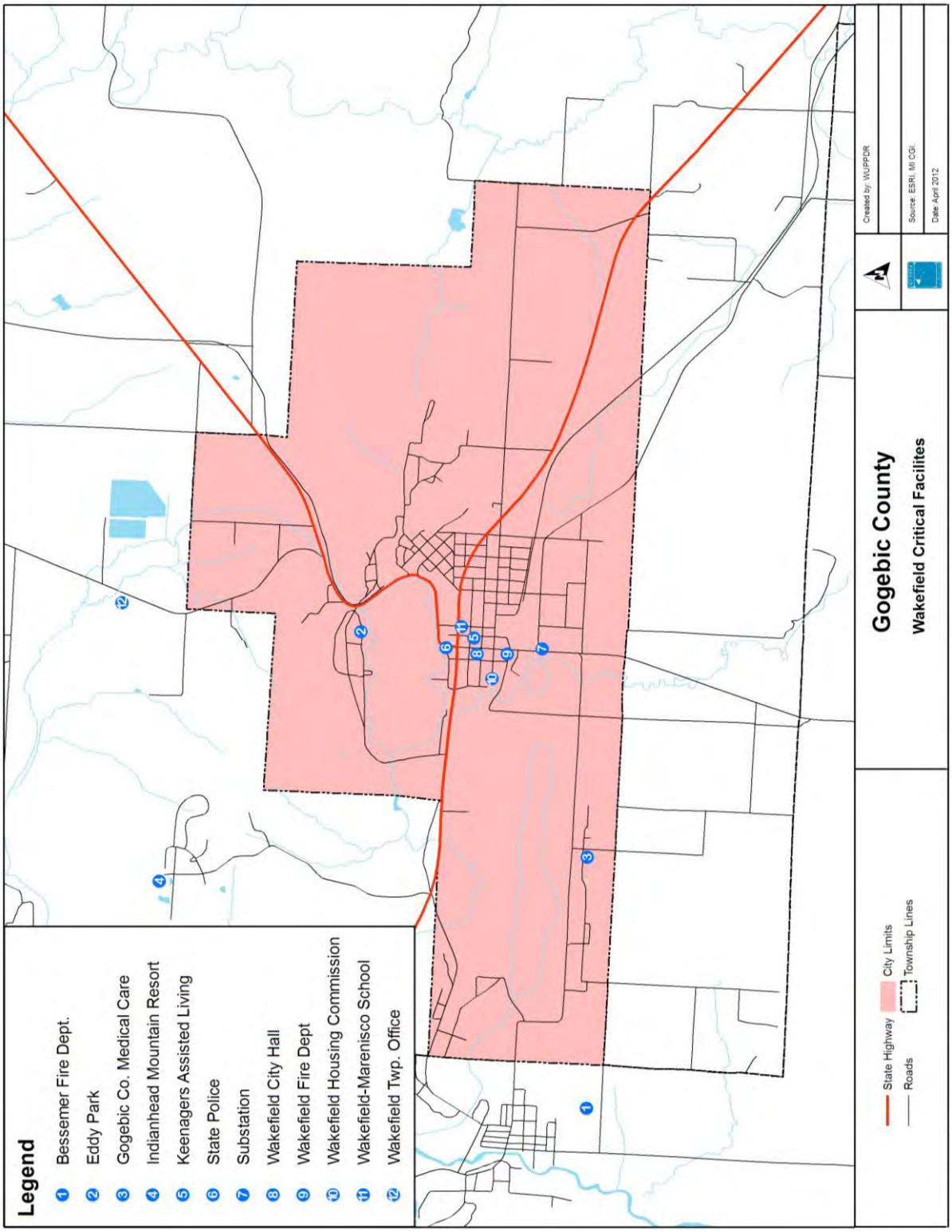
Map 1.9. City of Bessemer Critical Facilities



Map 1.10. City of Ironwood Critical Facilities



Map 1.11. City of Wakefield Critical Facilities



Section 2:

Hazard Profile

Examining Our Threats

There are three categories of hazards evaluated in this plan including natural, technological, and social/societal hazards. Natural hazard threats to Michigan include flooding, fire, tornadoes, lightning, thunderstorms, severe winds, and severe winter weather. Technological hazard threats to Michigan include hazardous material incidents, transportation accidents, infrastructure failure, and petroleum and natural gas pipeline incidents. Social/societal hazard threats include public health, civil disturbances, and terrorism/sabotage.

The following hazard profile for Gogebic County includes a general description of potential hazards and background for each hazard within Gogebic County. Hazard potential within Gogebic County varies depending on geography, population and infrastructure. The following hazard profile for Gogebic County includes a general description of potential hazards and background for each hazard within Gogebic County. Hazard potential within Gogebic County varies depending on geography, population, and infrastructure. In accordance with FEMA guidelines, in each discussion of risk and vulnerability subsequent to the descriptions and background information, ratings of severity (or extent, which is used interchangeably) and probability of occurrence are assigned.

Severity (extent) ratings are defined as follows:

Extreme- Facilities/infrastructure in the affected area are damaged or contaminated beyond habitable use. Critical services are damaged beyond 75 percent of capacity. Most items/assets are lost or damaged beyond repair.

High- Facilities/infrastructure in the affected area are partially damaged or contaminated. Critical services are damaged up to 50 percent of capacity. Some items/assets are damaged, but structures and infrastructure remain mostly intact.

Moderate- Facilities or infrastructure in the affected area are temporarily closed. A limited number of assets may be damaged, but the majority of assets are not affected. Critical services are damaged up to 25 percent of capacity.

Low- Facilities/infrastructure in the affected area experience less than a four-hour impact on operations, with no major assets lost.

Probability of future occurrences is estimated based on one or more of the following categories of previous events: 1) in Gogebic County over the past 6 to 12 years (depending on available data), 2) in Michigan and/or the United States, and 3) as predicted based on local situation and/or factors recently changed or developed. Generally an "event" is an occurrence formally recorded/declared by an appropriate authority or documented by the media, but undeclared events of a lesser magnitude (e.g. snowstorms that have significant consequences but for which warnings or advisories are not issued) may also be taken into account. Probability ratings are defined as follows:

Very Low- Little possibility of occurrence

Low- At least one event in past 10 years OR foreseeable possibility of occurrence based on current local conditions

Moderate- Approximately one event per average year

High- 2 to 9 events in average year

Very High- 10 or more events in average year

More detailed assessments of severity and vulnerability are presented in the matrices in the **Appendix**. General hazard **impacts**, which are discussed in the narratives, are also addressed explicitly in the matrices. Risk and vulnerability themselves are not quantitatively defined but arise from the severity and probability ratings. **Risk** is the overall degree of hazard concern based on a combination of severity and probability. **Vulnerability** is related to risk but also takes preparedness into account; i.e. a community that is ill-prepared for a high-risk disaster is highly vulnerable. Lack of preparedness for a low-risk disaster is less of a concern but still indicates a degree of vulnerability.

2.1 Natural Disasters

Dam Failure

Dam failure is a breach or collapse of an impoundment resulting in flooding downstream. Dam failure can result in extensive damage to property and natural resources miles downstream from the failure. Failure can occur during flood events which cause overtopping of the dam and resulting structural damage. Failure can also result from operational error, lack of maintenance, and vandalism. Most failures are catastrophic, because they are unexpected and do not allow time for evacuation. Michigan has had over 260 dam failures in its history.

Background

Gogebic County has a number of dams within its boundaries that have been built over the years for hydroelectric generation and recreation. The following are documented dams in Gogebic County: Bessemer Township Park, Black River, Cisco, McDonald Lake, Saxon Falls, Superior Falls, and Wolf Lake, as well as the Wood Bire – Presque Isle Wildlife Dam. The Cisco (S. Branch Ontonagon River), Saxon Falls (Montreal River), and Superior Falls (Montreal River) Dams are used for power generation. These dams are at most severe risk. There are a number of spillways that also provide for miscellaneous water retention purposes, including Sunday Lake.

In April 2002, when Gogebic County and seven other Upper Peninsula counties were inundated with springtime flooding, the Wood Bire – Presque Isle Wildlife Dam near Marenisco experienced a partial failure when a ten-foot section of the dam was washed out. While it was determined the failure caused increased flows on the Presque Isle River, damage estimates were impossible to separate from those caused by the preceding floodwaters. The McDonald Lake Dam in Erwin Township was also put at risk of failing during this event.

Risk and Vulnerability

Evacuation plans are in place for those affected by failure of the power generation dams. Probability is highest (but still low) and severity high along

populated stream reaches and communities downstream from these dams, particularly Erwin Township from McDonald Lake, Ironwood Township from the Montreal River dams, and Marenisco Township from the Wood Bire-Presque Isle wildlife dam. Currently at highest risk is the City of Wakefield, which has had flooding problems exacerbated by a non-functioning floodgate at Sunday Lake. Failure of this mechanism could result in a high-severity flood event. The floodgate problem makes the City of Wakefield, as well as downstream Wakefield and Bessemer Townships, more vulnerable than most others to dam failure. However, in early 2013 the city received Department of Natural Resources grant funding to fix the floodgate and alleviate the risk. Other jurisdictions are much less vulnerable, with low probability but potentially moderate severity of dam failure.

Riverine and Urban Flooding

Flooding in this section is discussed on a countywide basis. The Ironwood Flood Mitigation Annex following the body of this Plan discusses issues specific to the City of Ironwood.

Riverine flooding is defined as periodic occurrence of overbank flows of streams and rivers resulting in the inundation of the adjacent floodplain. Riverine floods are caused by prolonged, intense rainfall, snowmelt, ice jams, failure of man-made or beaver dams, or any combination of these factors. Natural overbank flows may occur on a regular basis, especially on river systems that drain large geographic areas and many river basins. Floods on large river systems may extend several days. Many areas of Michigan are subject to riverine flooding. Risk is greatest along non-artificially channeled streams with high rates of flow.

Flash floods are brief, heavy flows on small streams or normally dry creeks and differ from riverine floods in extent and duration. The usual cause of flash floods is locally intense thunderstorms with significant rainfall resulting in high-velocity water, which often carries large amounts of debris. These conditions can be exacerbated by secondary or cascading events such as beaver dam failure. Spring is the time of highest risk, which results from quickly changing

temperatures, intense precipitation, rapid snowmelt, and saturated or frozen ground with little infiltration capacity.

Urban flooding—the overflow of municipal storm sewer systems—is usually caused by inadequate drainage following heavy rainfall or rapid snowmelt. This type of flooding may be diminished through proper infrastructure planning and investment. This type of flooding often occurs as a result of the other two types.

Background

Gogebic County has been affected by one major and two minor flood events from 2006 to 2013. Two earlier major events occurred in 2002 and 2003, based on a review of storm incidents recorded by NOAA's National Climatic Data Center. Therefore, the probability of occurrence in any given year is 45 percent. Within the county, the City of Wakefield has been most severely affected and has had a Flood Mitigation Plan in effect since 2007. Such a plan has also been developed for the City of Ironwood as an Annex to this plan. Previous occurrences since 2002 are as follows:

04/12/2002 – Spring runoff due to record temperatures resulted in **flooding** along the Black River, Montreal River, and Ontonagon River, which were all above flood stage. Ironwood and Wakefield were the hardest hit. Damage exceeding $1.2 million affected 166 homes and businesses, the vast majority of which were in Wakefield, and 200 people were evacuated. Highways U.S. 2, M-28, M-64, and 25 local and county roads were closed. Partial failure of the Presque Isle Wildlife Dam occurred on the Presque Isle River. This flooding was a regional event, with over $10 million in damages to public infrastructure reported in five U.P. counties, including Gogebic. Total regional property damage was $18.5 million.

City of Ironwood flooding caused by excessive spring runoff and limited storm sewer capacity

- 04/17/2002 – A **flash flood** in Marenisco associated with the above event did not cause damage.

- 05/11/2003 – **Flooding** occurred due to significant rainfall along the Black River. Widespread flooding throughout the Western U.P. resulted in $2.0 million in damage.

- 07/27/2010 – A minor **flood** event in Ironwood caused $10,000 in property damage.

- 05/30/2011 – A minor **flash flood** in June caused $1,000 in property damage.

- Late April to Mid-May 2013 – **Flooding** throughout the county occurred due to moderately fast melting of significant snowpack; winter had been characterized by much greater snowfalls than in other recent years. M-28 was closed in the City of Wakefield for three days due to inundation by Sunday Lake. Water was pumped past the lake's spillway and still-non-functioning floodgate in order to prevent backflow into the city along M-28. Also in Wakefield, the sanitary sewer lift station was temporarily flooded. Some flooding and near-flooding of streets occurred in the City of Ironwood. Public works employees battled flooding amid a snowstorm that dropped over a foot of snow on May 2 and 3. As in 2002, the Presque Isle Wildlife Dam in Marenisco Township suffered damage when a door broke on May 11. In Ironwood Township, many roadways were inundated throughout the county, and some culverts were washed out.

  
  Snow-covered sandbags await placement in Wakefield

  By May 5, water levels had significantly fallen at Sunday Lake. By May 14, flooding had receded. A state disaster declaration was issued near the end of the flooding, and early damage estimates were $2 million for Gogebic County.

General consensus as reported by media indicated better preparation and thus less severe flooding than in 2002.

In the past, riverbanks and areas with inadequate culverts have been overburdened, leading to flooding and washouts. Contributing to the problems in many areas are steep grades that increase both the velocity of the runoff and the potential for ice jams. To address these concerns, culvert replacements and storm sewer upgrades are ongoing activities in the county. However, natural events including snow buildup with insufficient cleanup can decrease the effectiveness of drainage systems and increase flooding.

In Gogebic County four communities participate in the FEMA National Flood Insurance Program (NFIP): the Cities of Bessemer, Ironwood, and Wakefield, and Ironwood Township. There are 20,000 communities nationwide that participate in the program. The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in communities that adopt and enforce floodplain management ordinances. NFIP puts special focus on mediation of insured structures that have suffered more than one loss of at least $1,000 within a rolling 10-year period since 1978; these are referred to as "repetitive loss properties." Gogebic County has no such properties insured under NFIP.

Rates are determined based on a Flood Insurance Study and Flood Insurance Rate Map (FIRM), which FEMA develops during a flood hazard assessment. The FIRM is used by lenders to determine flood insurance requirements and by insurance agents to determine flood insurance premiums for specific properties. The FIRM includes areas within the 100-year flood boundary, which are termed "Special Flood Hazard Areas" (SFHAs).

A 100-year flood does not refer to a flood that occurs every 100 years but to a flood level with a one percent or greater chance of being equaled or exceeded in any given year (see **Maps 2.1, 2.2, 2.3, and 2.4)**. As can be expected, then, in any given year probability of such a flood is very low but severity potentially extreme in all areas.

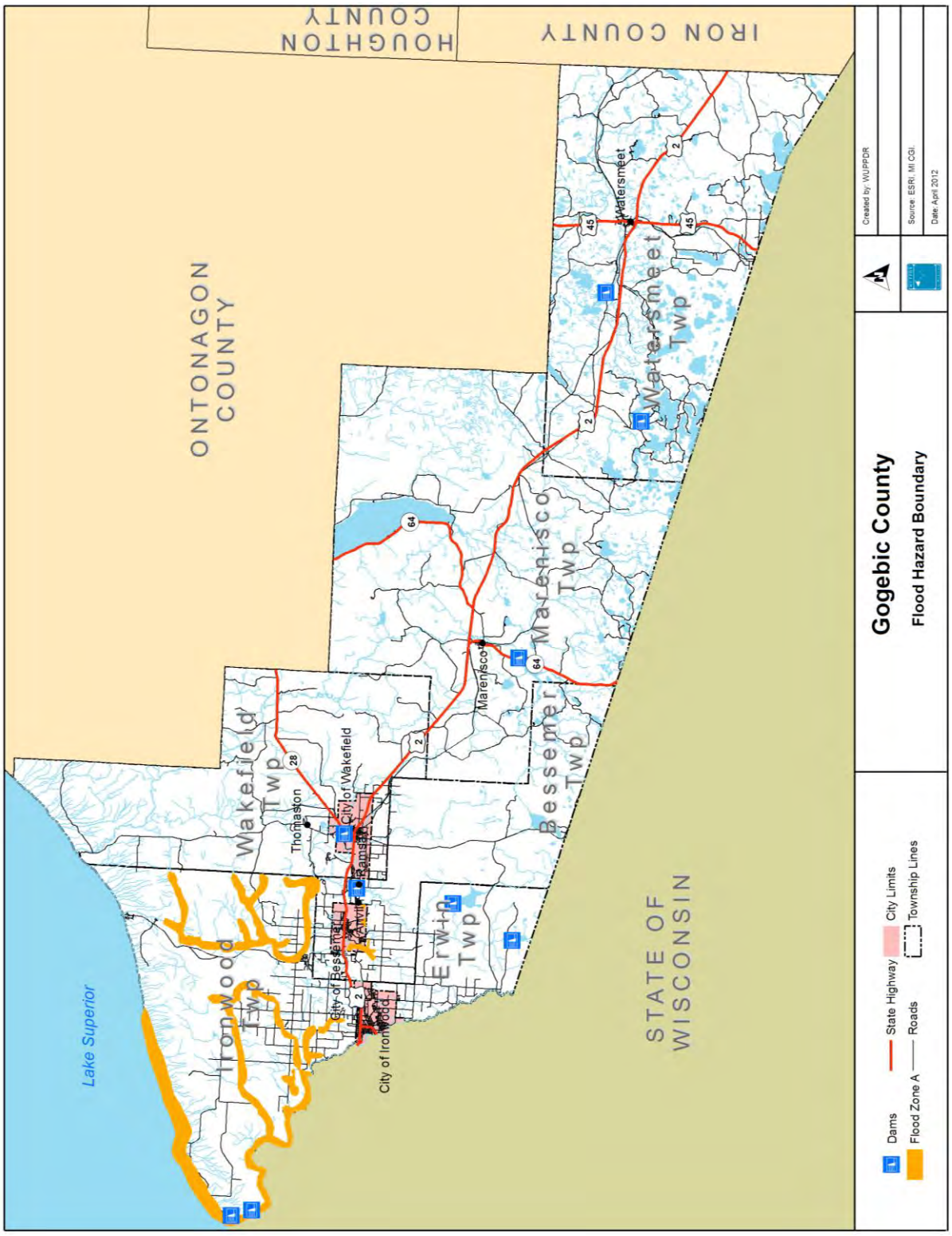
Besides maintaining the required flood protection ordinances, insured communities in Gogebic County are taking a variety of steps to remain in compliance with NFIP. The City of Ironwood has developed a Flood Mitigation Annex to this plan to examine flood issues and mitigation possibilities in depth. The City of Wakefield was recently awarded funding to fix a malfunctioning floodgate that has exacerbated past flooding. This project had been pursued for several years prior. The City of Bessemer has traditionally had fewer problems with flooding than either of the other two cities. Ironwood Township is addressing problems as they emerge. Uninsured communities have not been severely affected by past flooding.

Risk and Vulnerability

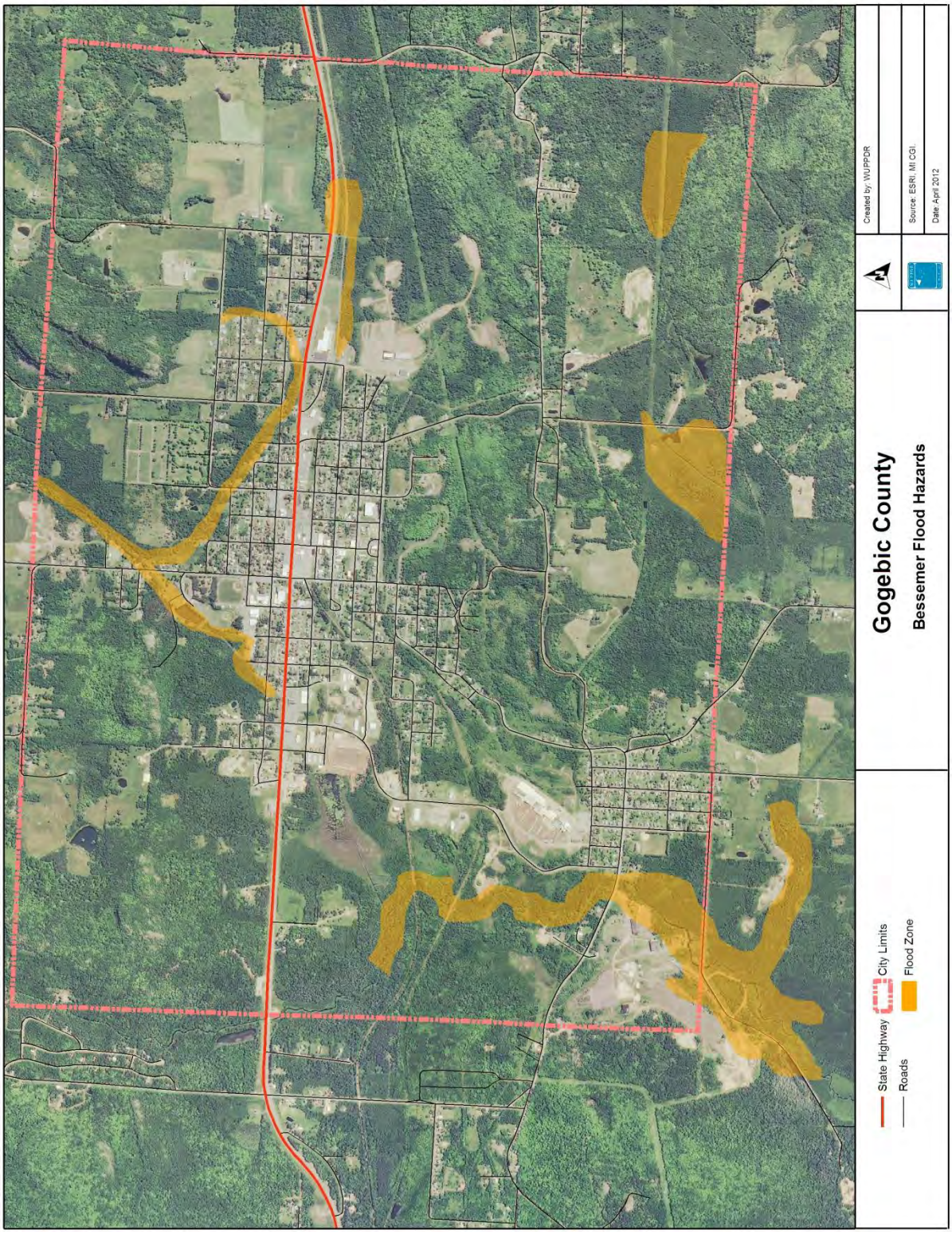
Riverine and urban flooding is a moderate risk within Gogebic County because it can affect a number of major population areas. Most areas of Gogebic County have moderate probability of flooding generally of low severity. The Montreal River in Ironwood consistently causes seasonal flooding of low severity, which can, under the right conditions, broaden to become highly severe and affect a larger region. To exacerbate this problem, Erwin Township is subject to lowland flooding that can submerge roads and hamper evacuation from Ironwood. The City of Wakefield also has special potential for high-severity flooding due to the non-functioning Sunday Lake floodgate, which could limit outflow of an overburdened Little Black River. Other areas of concern are along the Black River (City of Bessemer, Ironwood Township, and City of Wakefield) and Presque Isle River (Wakefield and Marenisco Townships) and their tributaries.

Another risk is to urban areas, where storm sewers can be rapidly overwhelmed during high rain and/or melting and runoff, causing significant erosion problems, contamination, and flooded buildings. To alleviate this problem, the City of Wakefield separated its storm and sanitary systems after the flooding of 2002. Ironwood has been doing the same since 2011, with most work already completed. Also, Lac Vieux Desert has installed drainage systems to draw water away from its Tribal operations buildings in Watersmeet.

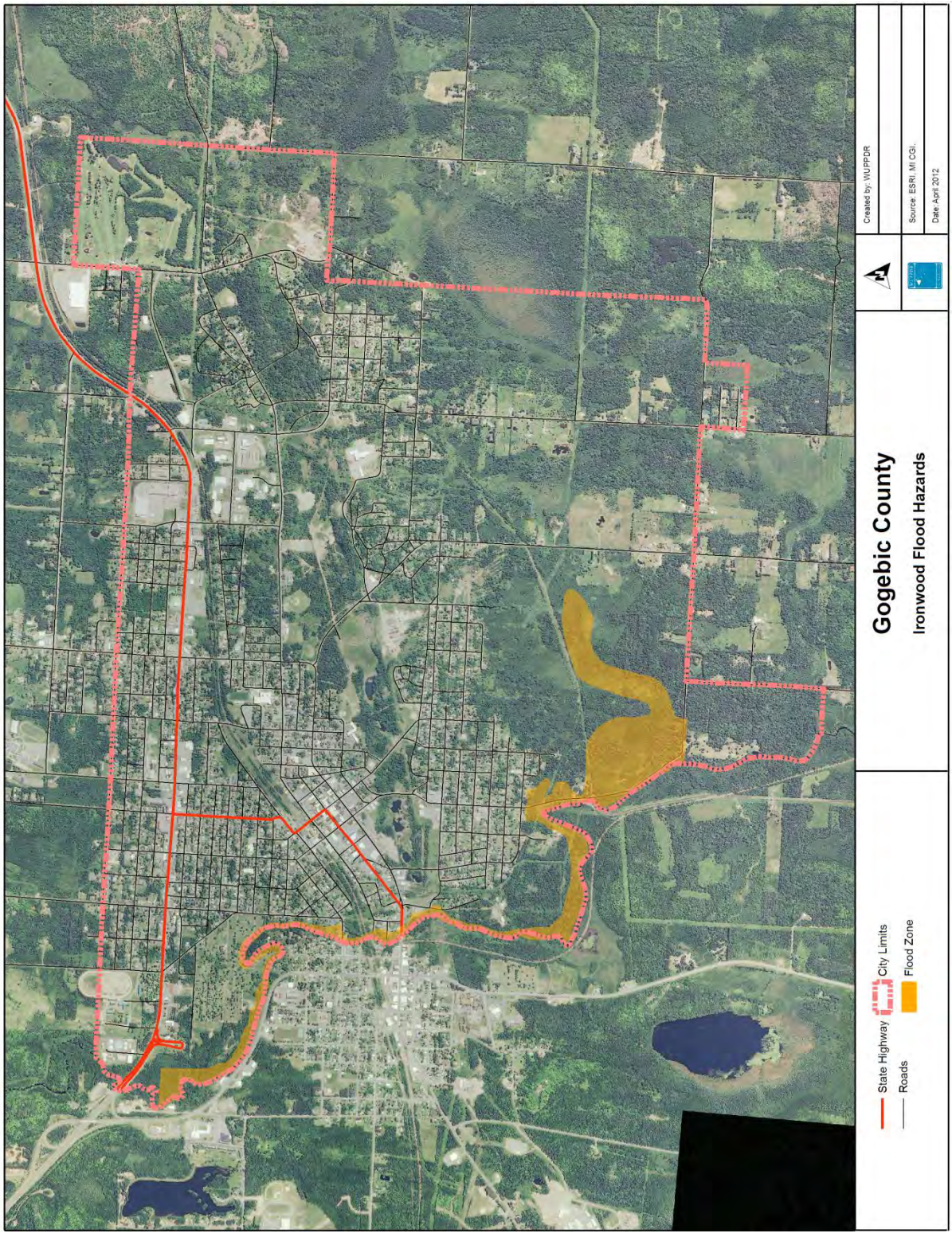
Map 2.1. Gogebic County Flood Hazard Boundary



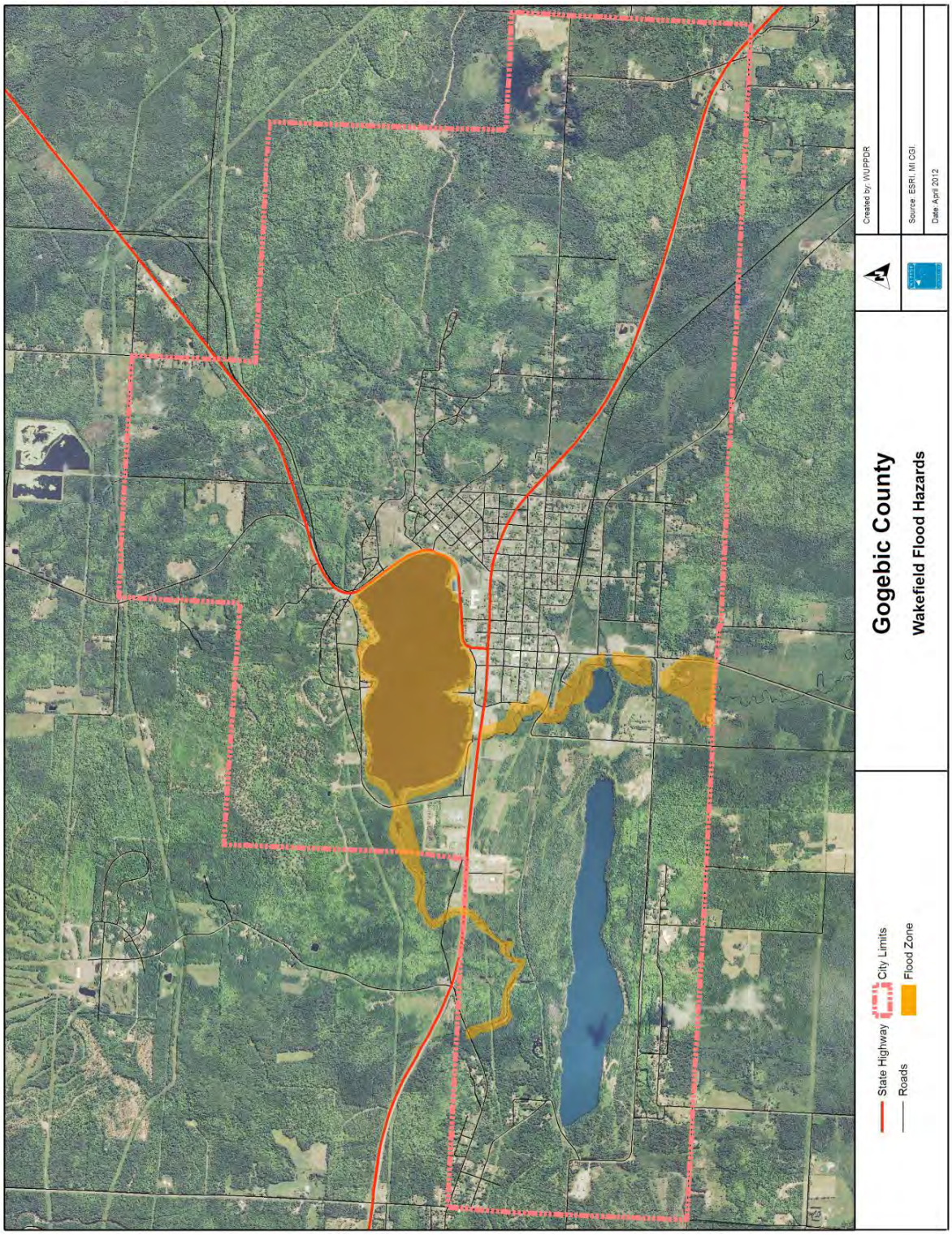
Map 2.2. City of Bessemer Flood Hazard Boundary



2.3. City of Ironwood Flood Hazard Boundary



2.4. City of Wakefield Flood Hazard Boundary



Communities within the county recognize the problems associated with their locations and drainage systems and continue to take steps to prevent further loss by upgrading facilities to deal with the flood risk. Overall, however, the county remains highly vulnerable to a future event. The 2002 flood had an $18.5-million impact on the region. Public and private buildings, infrastructure, and emergency services were all affected, with 166 homes and 18 businesses damaged or destroyed and 200 persons evacuated. Future mitigation steps are necessary to prevent the same from reoccurring.

Shoreline Flooding and Erosion

Flooding and erosion along the Lake Superior shoreline are typically a result of high water levels, storm surges, or high winds. These are natural processes that can occur at normal or even low water levels. However, during periods of high water, flooding and erosion are more frequent and serious, causing damage to homes, businesses, roads, water distribution and treatment facilities, and other structures in coastal communities.

Storm surges that drive lake water inland over large areas occur when windstorms and differences in barometric pressure temporarily tilt the surface of a lake up at one end, in extreme cases by as much as eight feet. In November 1998, 8- to 15-foot waves that occurred during a windstorm resulted in pronounced beach erosion along the western shore of Lake Superior. A storm surge can escalate into a "seiche" when a change in barometric pressure or sudden loss of wind speed causes water to repeatedly slosh back and forth across the lake surface from the high water end to the low water end.

Background

Lake Superior levels have fluctuated since prehistoric times. Accurate measurements of this fluctuation are available for the last 160 years. According to research conducted by the U.S. Geological Survey, the peaks of this fluctuation have been higher during this century than they were in the past. The modern range of fluctuation between periods of high and low water is one meter. Such episodes of higher and lower levels result from natural climate changes in

the region and will continue. The impact of climate change on the magnitude and frequency of water level changes remains uncertain.

Changes in the surface of the earth also affect lake levels. The land in the Great Lakes region is slowly recovering from the last glacial period when ice loaded and depressed the land surface. The land is rebounding from the weight of glaciers at different rates. The outlet channel from Lake Superior at Sault Ste. Marie is rising more rapidly than most other points along the U.S. shore, resulting in a tilting of the lake. The amount of inundation is greatest at Duluth, Minnesota where as much as 5.4 meters of inundation has occurred over the past 2,000 years. Maximum inundation over this period for the Michigan shore occurs near Ontonagon, which sees as much as three meters.

The current level of Lake Superior is approximately 600 feet. This is 10 inches below what is considered normal and only 4 inches above the lowest level recorded, which was measured in 1926.

Risk and Vulnerability

Gogebic County has a couple areas of high-risk erosion identified by the DEQ (see **Map 2.5**). These areas have mandatory and recommended setback regulations in place to mitigate losses due to erosion. Areas of concern include property along Little Girls Point and near the mouth of the Black River in Ironwood Township. Erosion is an ongoing and unavoidable process—one that has very high probability but low severity. Approximately two miles or seven percent of the county's Lake Superior shoreline are officially designated high risk areas, and long stretches of adjacent shoreline are also continually threatened by this hazard. Still, imminent risk of property damage is minimal. Even damage to the natural environment is generally gradual and a result of a natural process.

The mandatory setbacks required for shoreline development minimize the vulnerability of Gogebic County to this hazard. There is no history of shoreline flooding in Gogebic County, and probability remains very low, though the coastal areas of both Ironwood and Wakefield Townships are potentially at risk of low-severity flooding. Mandatory setbacks keep flood risk as low as possible.

Scrap Tire Fires

A scrap tire fire is a large uncontrolled fire that burns scrap tires that are being stored for recycling or re-use. Michigan alone generates 7.5 to 9 million scrap tires annually. Tires end up at disposal sites, both legal and illegal—some of which store up to several hundred thousand tires. Scrap tire fires are dangerous because they can require significant resources to control and extinguish, often beyond the capability of local government; the environmental consequences are significant; and the extreme heat from the fire converts a standard passenger vehicle tire into about two gallons of oily residue which can leach into soil or migrate to streams.

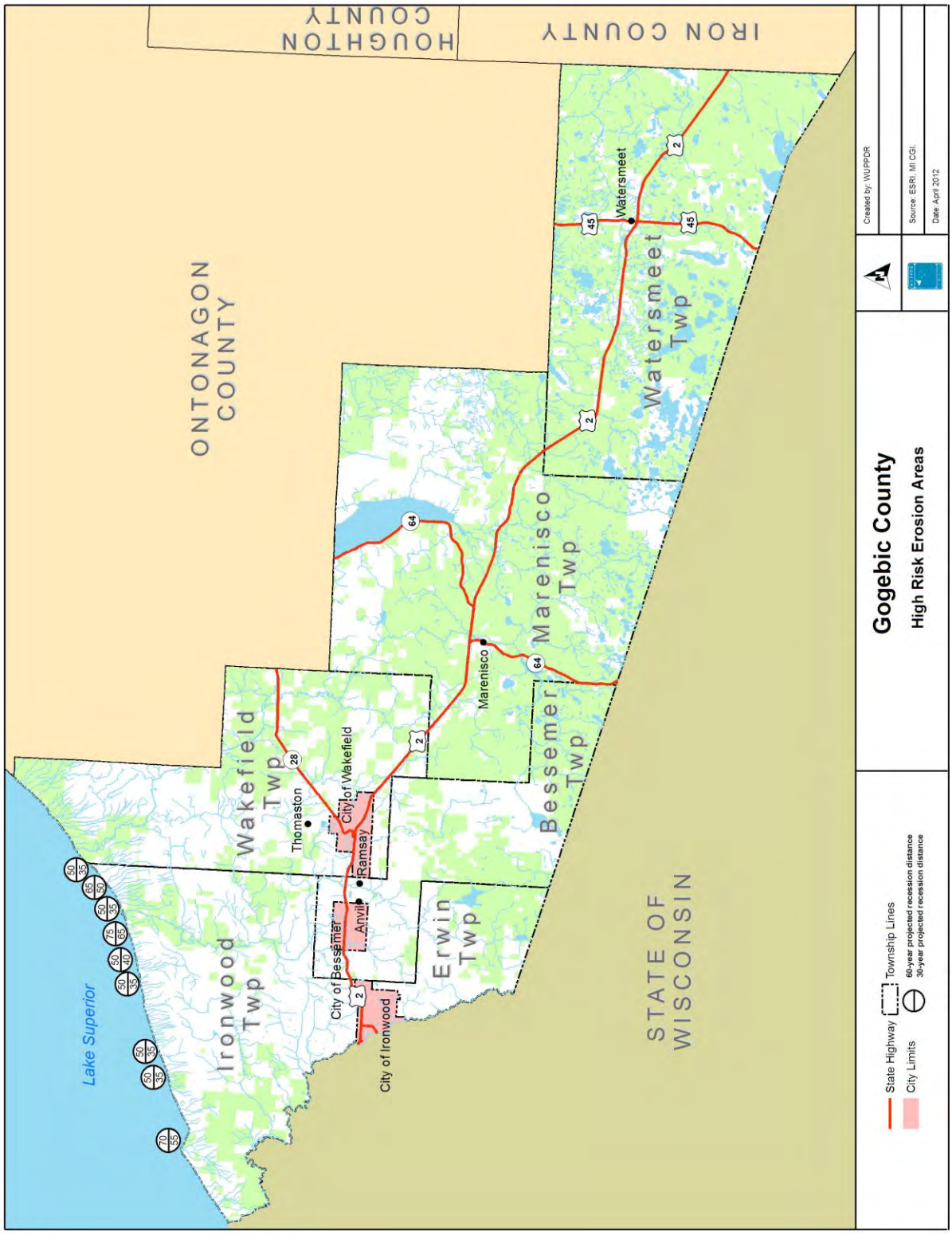
Background

Gogebic Range Solid Waste Management Authority, located in Ironwood, is a registered scrap tire collection site. Registered sites are required to meet strict storage and transportation requirements, including isolation from potentially hazardous materials from tires due to the possibility of fire. However, not all sites are registered, and other unknown sites may be located in Gogebic County.

Risk and Vulnerability

There have been no known scrap fire tire incidents in Gogebic County. Risk is low due to heavy regulation of scrap tire collection sites. An additional but unknown risk exists due to the possibility of unknown and unlicensed storage areas. Although probability of a scrap tire fire is very low, severity is high, as a small misstep on either a registered or unregistered site can spark a severe fire – particularly where regulation is lax.

Map 2.5. High-Risk Erosion Areas



Structural Fires

A structural fire is any instance of uncontrolled burning resulting in structural damage to residential, commercial, industrial, institutional, or other properties in developed areas. In terms of average annual loss of life and property, structural fires are by far the most significant hazard facing most communities in Michigan and across the country.

The vast majority of deaths resulting from structural fires occur in homes. An estimated 46.3 percent of accidental fires result through neglect or carelessness with items such as candles, cigarettes, cigars, pipes, matches, lighters, and fireworks – especially when in the hands of children. Another major cause is improper use or maintenance of items such as clothes dryers, holiday decorations, and cooking equipment. The home – the place where most people feel the safest – accounts for 92 percent of fire fatalities nationally. Many fires could be prevented through awareness and education.

Background

The most recent years for which detailed statewide fire statistics are available are 2002 and 2003. In 2003, over 40 percent of all reported fires in the state started inside buildings, while the rest occurred outside or caused damage to mobile property. The percentage of indoor fires was similar in 2000, when nearly 75 percent of building fires occurred in dwellings as opposed to commercial structures.

According to the state fire marshal, in 2002 there were 45 fires resulting in damage amounting to $307,150. In 2003 there were 46 fires resulting in $72,900 in damage. Structural fires are of special concern in Gogebic County because almost half of the buildings were built before 1940. Many of these older homes, as well as numerous camps and cabins in the woods, are also heated by wood-burning stoves. Michigan has a relatively high fire death rate at 16.4 deaths per million people, whereas the national rate is 11 per million (both as of 2009). Michigan's rate has not consistently fallen as the national rate has.

Risk and Vulnerability

Due to an old housing stock, compact development in downtown areas, and remote development elsewhere, Gogebic County is susceptible to fire. Probability of structural fires is very high and severity highly variable. Frequency is 45.5 per year based on an average from occurrences in 2002 to 2003. The nature of fire risk and vulnerability is based on location and structural characteristics. Areas with a large amount of old housing stock—all jurisdictions in the county, but particularly the three cities—and other aging buildings are particularly subject to events of extreme severity. Average property losses per year for 2002 to 2003 were approximately $190,000 (unfortunately more recent records are unavailable), but damage varies greatly from year to year.

The County has a number of fire departments available to respond and cooperative agreements in place to deal with structural fires. Education and operational fire detectors can help mitigate the loss from this type of hazard.

Wildfires

A wildfire is an uncontrolled fire in grass, brush, or forested areas. The most immediate dangers from wildfires are the potential injury or death of persons who live or recreate in the affected area and the destruction of homes, timber, and wildlife. Long-term effects include scorched and barren land (and resulting loss of wildlife habitat), soil erosion, landslides, water sedimentation, and loss of recreational opportunities.

Background

Forests cover approximately 85 percent of Gogebic County (refer back to **Map 1.5**). This forest cover is an asset for both industry and recreation, but it also leaves the county highly vulnerable to wildfires. Increased development in and around rural areas has changed the nature of the threat from wildfires. Not only can acres of valuable timber and wildlife habitat be lost but also life and property. Although most wildfires are very small, at just a few acres, any one wildfire can burn out of control under the right conditions and multiply annual burned acreage many times over.

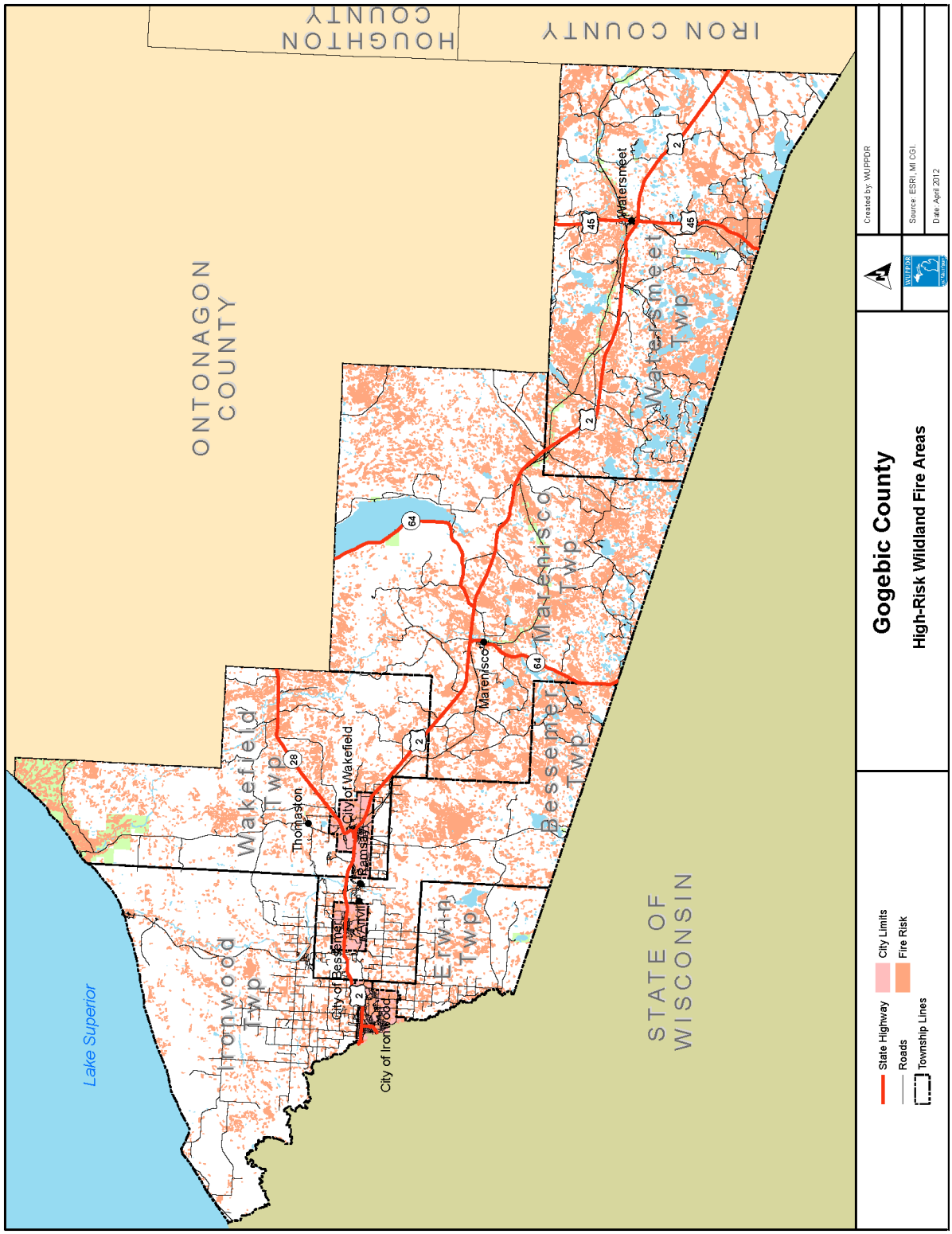
Risk and Vulnerability

From 1981 through 2010 the Michigan DNR reported 116 wildfires in Gogebic County under DNR jurisdiction. Each fire was very small, however, with only 245.4 total acres burned. Gogebic County has an ongoing risk of wildfires due to the tremendous amount of forest cover and increasing hazard due to urban infringement in rural areas. Development in rural areas can intensify overall damage from wildfires. Ensuring that new development has adequate emergency access and protective buffers is one way to mitigate risk.

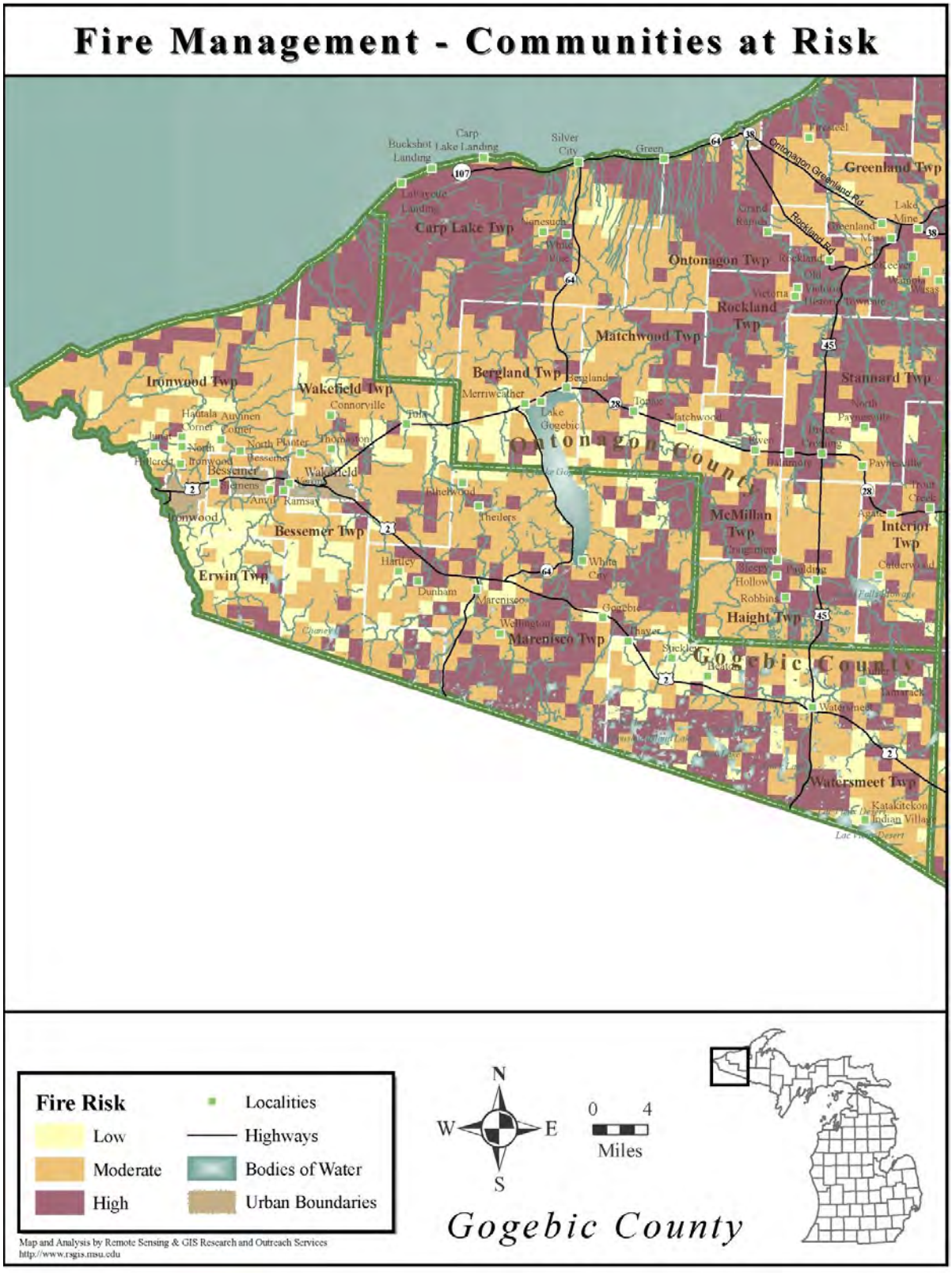
All areas of the county have some vulnerability to wildfires, but extent varies greatly by location and season. The wildland-urban interface presents an increasing hazard as urban development infringes on rural areas. High-risk ground cover is an even more severe threat and has the greatest possible extent. Two sources from different years (see **Maps 2.6** and **2.7**) highlight high-risk areas 1) most of southern Gogebic County, primarily in a belt through Watersmeet and Marenisco Townships in the Ottawa National Forest and 2) in northern Wakefield Township within the Porcupine Mountains Wilderness. These sources confirm that ground cover is the most pertinent factor, as areas that are most vulnerable to catastrophic fires are those with limited development. Wildfires of greater extent are also of course more likely during drought periods. Any fire in such an area would significantly affect natural resources but would pose little threat to human life and property.

Wildfire probability in Gogebic County is high, with a frequency of approximately six per year, and severity is potentially extreme. The county has been fortunate in recent years to experience an average of only 12 acres per year lost to forest fires, but, as demonstrated by a number of major Upper Peninsula wildfires in the last decade, the possibility of a catastrophic wildfire is always present.

Map 2.6. High-Risk Wildland Fire Areas, ESRI/State of Michigan, 2012



Map 2.7. High-Risk Wildland Fire Areas, Michigan State University, 2008



Subsidence (Ground Collapse)

Subsidence is defined as depressions, cracks, and sinkholes in the ground surface, which can threaten people and property. While the sudden collapse of the ground surface to form sinkholes poses an immediate threat to life and property, subsidence depressions normally occur over a period varying from many days to a few years. Collapses continue until the underground voids stabilize. They may damage structures with low strain tolerances, such as dams and utility infrastructure.

Nationally, the greatest risk of subsidence is related to changes in water content of surface or subsurface layers of earth. The primary processes affecting water content are aquifer depletion (which lowers the supporting water table) and drainage of moisture from organic soils. Both of these occur mainly as a result of human activity (development and agriculture, respectively). Aquifer depletion can have the same consequences as deterioration of subsurface layers of earth since liquid serves much the same role as solids in supporting overlying earth.

A lesser water-related cause of subsidence, but one that has become prominent in media coverage in recent years, is dissolution of certain types of rock into groundwater. The rock types most susceptible to this process are salt and gypsum, but limestone is the type most closely associated in popular knowledge with subsidence. Over time, dissolution of rock into the aquifer can create a void subject to sudden and catastrophic collapse, creating a sinkhole.

In Michigan, the greatest risk of subsidence is associated with underground mining. The population most at risk lives in areas where industrial or residential development has occurred above active or abandoned mines where underground cavities are present near the surface. Strain from geological movements and additional loading on the surface can cause the ground above and around the old mines to sink or collapse. Vibrations from truck traffic and other industrial machinery can destabilize areas underground. The roof of a hollow area may slowly erode, particularly when flowing water is present, causing the depth of the layer over the cavern to decrease. The roofs of the old mine tunnels were often supported by timbers or pillars, which may have deteriorated over the course of 100 years, placing them at risk of structural failure. Lateral

flow of subsurface materials, which can occur on the thick glacial clay deposits in the Great Lakes region, results in gradual lowering of the ground surface as load bearing walls slowly move away from one another.

Background

In the 1880s Gogebic County became a focus of iron ore mining. The Gogebic Range was the last U.P. iron range to be opened and at the peak of the mining era in 1920 produced 7 million tons annually. Mining activity ended in 1966 when the Peterson mine closed. The Gogebic Range and associated areas of previous mining activity run approximately concurrent with Highway U.S. 2 from Ironwood to Wakefield.

There are over 800 underground mines in Michigan with more than 2,300 shafts or other openings to the surface. Many opened in the 1840s, and even though many mine sites have been inspected by a county mine inspector, some are still unknown and/or unmarked. There are very limited records of the locations of shafts, and the extent of the mine voids and proximity to the surface may be unknown. To make matters worse, Gogebic County does not currently employ a mine inspector, due in part to a lack of qualified individuals interested in doing the job.

Risk and Vulnerability

Subsidence will continue to pose some risk in the future because of both known and unknown potential hazards. A Michigan Abandoned Underground Mine Inventory was completed in late 1998 and includes information on about 800 mine locations with nearly 2,000 openings to the surface. Copies of the reports were limited to the DNR and the County Mine Inspectors, or related agencies, for the counties containing the old mines. Distribution was limited to prevent the materials from becoming guides to potentially dangerous locations for adventurous people who may enter unsafe areas and be hurt or killed.

In 1999, a study identified over 130 shafts that were in need of immediate mitigation throughout the Western Upper Peninsula. Mines on State of Michigan land were addressed through a FEMA grant; however, most shafts are on private lands and continue to pose a risk. Unfortunately, at present there is no mine

inspector on Gogebic County staff to direct county response to potential problem areas. Probability of a noted occurrence is low, not accounting for incidents that may go unreported each year, and severity is highly variable depending on location, land use, and other unknown factors. Greatest risk is probably in the historic mining areas concentrated along the U.S. 2 corridor and adjacent areas of surrounding townships. Large geographic extent and inability to prepare due to lack of information make the county highly vulnerable to subsidence.

2.2 Weather Hazards

Weather hazards are perhaps the single greatest natural hazard anywhere in the world due to climate change. Most authorities predict rising temperatures in all areas, with warm temperatures emanating from the Equator and pushing various species of flora and fauna north in the Northern Hemisphere. Along with these temperatures come overall changing weather patterns, causing events such as more frequent and severe hurricanes and winters that fluctuate toward either extreme: warm with light snowfall or cold with heavy snowfall.

Weather hazards in Gogebic County already vary greatly by season and from year to year. In winter, Gogebic County has a reputation for heavy and frequent snowfalls, especially throughout interior parts of the county. Residents are acclimated to severe winter weather, and damage is well controlled by snow management. However, transportation is a hazard and is discouraged during severe winter weather events. Collapsing roofs are another of the primary winter hazards and are dependent on the age of buildings and building codes.

Thunderstorms, hail, high winds, and extreme temperatures are more variable and less location-dependent. Due to the variability and inability to control these types of storm events, response plans are the best mitigation.

Overall Risk and Vulnerability

Because of its unique location, Gogebic County sees low temperatures, harsh winds, and large quantities of winter snow. The average high temperature in January is about 20 degrees Fahrenheit, while the average low is about one degree. Cold winds passing over the warmer waters of Lake Superior produce

large quantities of lake-effect snow—156 inches per year on average. The population concentration located from Ironwood to Wakefield along U.S. 2 is regularly affected.

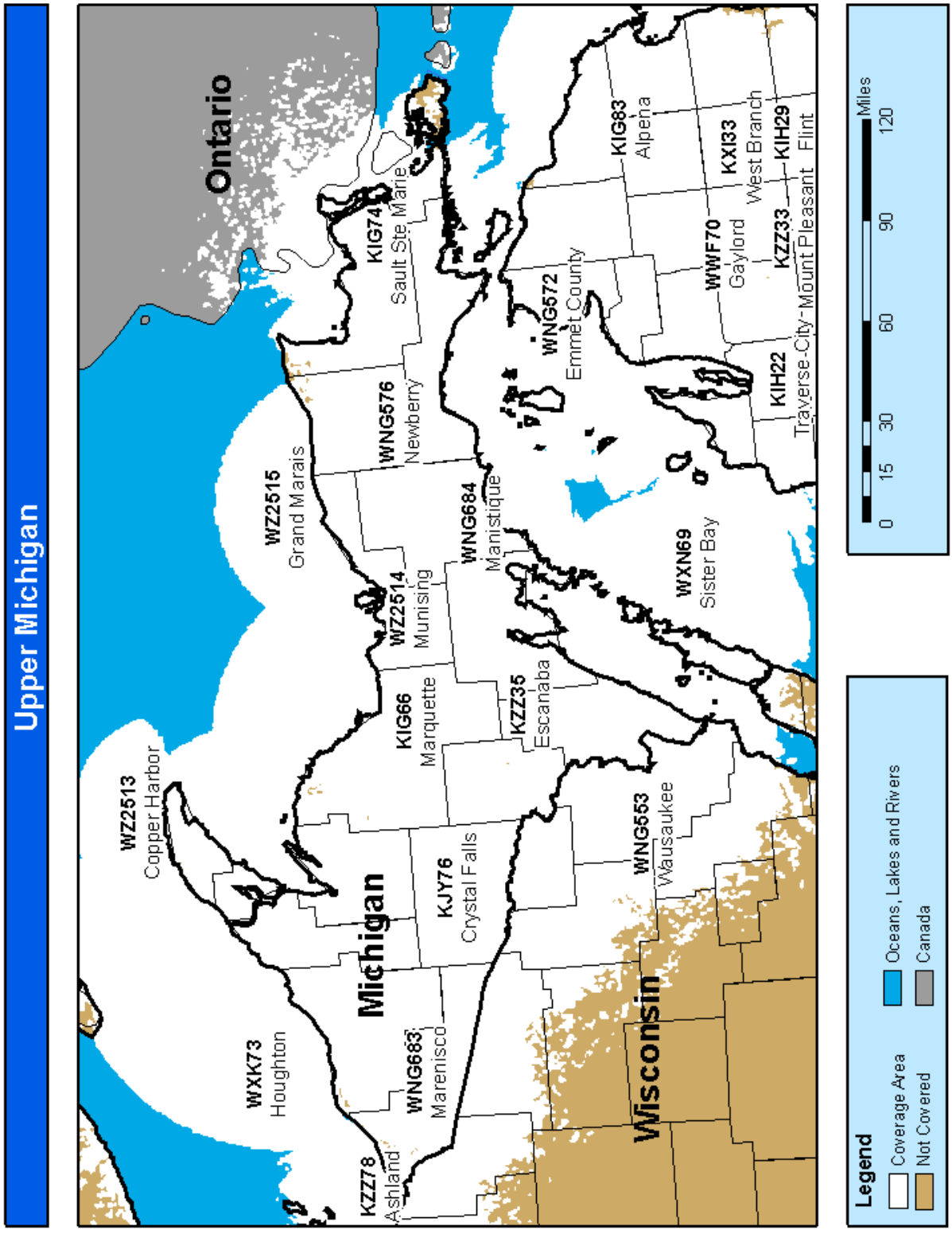
For the most part residents and businesses are accustomed to the climate. The Gogebic County Road Commission has a fleet of dedicated snowplows and related equipment charged with plowing and sanding the numerous county roads and state trunkline. However, in recent decades dwindling funds have delayed response to snow events, and lack of resources to clean up after snowstorms has reduced the effectiveness of drainage systems, increasing the severity of flooding. Occasionally ice storms, high winds, or rapid accumulation of snow result in utility outages and closure of roads, businesses, and schools.

A review of weather incidents recorded by NOAA's National Climatic Data Center shows that 139 events were reported in Gogebic County from 2006 through 2012. Recordable damage totaling $177,000 resulted from 25 of these events. No deaths or injuries resulted. Most of the events involved flooding, winter weather, or wind. Other severe weather events include hail, extreme temperatures, heavy rain, and thunderstorms. Gogebic County has local NOAA weather radio coverage based in Marenisco, a central location from which signals are receivable throughout the county (see **Map 2.8**). Recordable weather incidents of all types have very high probability and generally moderate severity throughout the county. The frequency of weather events with recordable damage is 3.6 events per year. Profiles of each weather hazard are provided below.

Drought

A *drought* may occur during a prolonged period of well-below-average precipitation, especially in agricultural areas during key planting and growing seasons. Drought can directly affect urban areas that are dependent on reservoirs for water if water levels decrease due to low precipitation, which can results in use restrictions. No Gogebic County utility areas fall into this category, however. The timing and length of droughts are difficult to predict. Increased pumping of groundwater and surface irrigation during drought periods can result in land subsidence in some areas of the country. Nearly all areas of the country are impacted by drought through reduced agricultural outputs, reduced water

Map 2.8. Upper Peninsula NOAA Radio Coverage



supply, land subsidence, power outages caused by excessive energy use, increase in wildfire risk, reduced marine navigation capabilities, and other effects. The arid Southwest and Great Plains are most vulnerable. A particularly severe nationwide drought in 2012 had severe economic effects on all aspects of life.

Risk and Vulnerability

Although Gogebic County has not had a localized drought severe enough to be recorded, the United States Midwest has been significantly affected by drought in five years since 1981. These wide-ranging droughts have little long-term impact on wild flora and fauna, and since Gogebic County has little cultivated land, drought does not significantly affect agriculture. Although stream and reservoir levels may drop, the county has not faced a critical power shortage resulting from interruption of hydroelectric generation. (The power grid has a high degree of regional interconnectivity.) Furthermore, the county has no drinking water sources dependent on surface water, and temporary droughts have not diminished groundwater reserves to a notable extent. However, even a minor drought is one of the primary factors of wildfire potential and is a major hazard for that reason alone. Countywide risk of other drought effects is minimal, with low probability of a recordable (moderately severe) drought but much higher incidence of less severe conditions.

Extreme Temperatures

Extreme temperatures refers to prolonged periods of very low or very high temperatures, often exacerbated by conditions such as high humidity with lack of rain or heavy snowfall with high winds. Extreme temperatures primarily affect the most vulnerable segments of the population, including the elderly, children, impoverished, and those in poor health. Threats from extreme heat include heat stroke, which is a medical emergency, and heat exhaustion. Extreme heat is a particular problem in urban areas, where the high temperature and humidity can be more intense.

Threats of extreme cold are hypothermia, which is a medical emergency, and frostbite. All areas of Michigan are subject to extreme temperatures. Gogebic County's inland locations can experience high temperatures and severe cold

temperatures. Monetary damages are generally minimal, though schools are often closed for these events. Another risk during winter months is freezing pipes due to limited snow cover insulation. Historically, the state, including Gogebic County, incurred major damage from such an event in 01/13/1994. Record **cold temperatures** in many areas of the U.P. and statewide resulted in frozen pipes, with a total estimated loss of $2,000,000.

Risk and Vulnerability

All areas of Michigan, including Gogebic County, are subject to extreme temperatures. Five incidents of *extreme* cold/wind chill (not including five other less extreme events) were recorded between 2006 and 2012. There were no documented instances of heat or excessive heat during this period. Probability of an extreme temperature event in any given year is thus moderate. Despite the likelihood of such an event in any given year, severity is low countywide as resident behaviors are effective in limiting damage to life and property.

Hail

Hail is a condition under which atmospheric water particles from thunderstorms form rounded or irregular lumps of ice that fall to the earth. Hail is a product of strong thunderstorms and usually falls near the center of a storm along with the heaviest rain. At times strong winds at high altitudes in the thunderstorm blow the hail away from the storm center, causing hazards in unexpected places. Whether in predictable locations or not, instances of hail can be very narrowly localized—to an area as small as a few city blocks. Hailstones can be the size of a pea to a golf ball but are sometimes larger than baseballs. Hailstones can damage crops, dent autos, and injure wildlife and people. Hail causes $1 billion in damage nationwide annually.

Risk and Vulnerability

In Gogebic County, hail events were recorded 19 times from 2006 through 2012 – a frequency of was 2.7 events per year. There was no damage recorded for these events; hail damages in Gogebic County are generally minor and incurred by individual property owners. Probability is thus high and severity variable from low to moderate.

Ice and Sleet Storms

Severe winter weather hazards include *ice and sleet storms*. Sleet storms occur when frozen raindrops or ice pellets fall from the sky. Though sleet does not stick to tires, sleet in sufficient depths does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes upon contact with a cold surface, coating the ground, trees, buildings, and overhead wires with ice and at times causing extensive damage.

Risk and Vulnerability

No ice and sleet storms were recorded from 2006 through 2011; this indicates a probability that is low but not near zero, as three events occurred between 2002 and 2006. Severity is also variable but generally low to moderate. Vulnerability is high, as very little can be done to the impact of these events, which primarily involve temporary failure of critical utilities and infrastructure. Notably, icy weather conditions can slow emergency response travel.

Lightning

The discharge of electricity from a thunderstorm is *lightning*. Lightning is often perceived as a minor hazard, but it damages many structures and kills and injures more people in the United States each year, on average, than tornadoes or hurricanes. Michigan ranks second in the nation in both lightning-related deaths and injuries. Many deaths and injuries could be avoided if people were educated about the threat of lightning.

Risk and Vulnerability

No lightning events causing death or injury were recorded during the study period of 2006 through 2011, suggesting a probability near zero, but two events occurred between 2002 and 2006. Lightning of a lower level, of course, occurs much more frequently. Probability of a recordable damage event is low, but visual events with no tangible impact are ubiquitous during thunderstorms and sometimes snowstorms. Although the likelihood of a particular lightning event causing damage to human life or property is negligible, when a damaging event does occur its severity is extreme at the site of discharge. Effects of diminishing

severity may occur at varying distance from the site. All aspects of nature can be devastated if a lightning strike starts a wildfire.

High Winds

Winds 58 miles per hour or greater are classified as a *windstorm* by the National Weather Service and are a common occurrence in many areas of Michigan. Locally, lesser events termed high winds and thunderstorm winds can cause much the same damage. Along the Great Lakes shoreline, high winds of a lower magnitude occur regularly, as do hurricane-velocity gusts on occasion. Severe winds cause damage to homes and businesses, power lines, trees, and agricultural crops. Power outages can result in the need to shelter persons left without power for extended periods. Along with the Great Lakes shorelines, windstorms in Michigan occur most often in the central and southern parts of the Lower Peninsula.

Risk and Vulnerability

Historically in Gogebic County, windstorms are rarely a singular event. They usually accompany other severe weather – particularly thunderstorms and occasional blizzards. The largest wind gust recorded in Gogebic County from 1950 through 2011 was 76 knots (87 miles per hour) in 1998. This event was the result of a deep low pressure system. Luckily the event did not cause any significant structural damage, though it did damage minor elements such as signage, power lines, and timber. The same has been true for most events from 2006 through 2012 as recorded by NOAA:

- 10/07/2007 – **High winds** caused downed tree branches near Ironwood and Bessemer, power outage in Ironwood, downed power lines in Wakefield, and recorded property damage of $1,000.
- 06/12/2008 – **High winds** caused downed trees near Ironwood and caused recorded property damage of $2,000.
- 10/26/2010 – **High winds** caused numerous downed trees and power lines and required a temporary shelter to be set up; property damage was $5,000.

- 05/09/2011 – **High winds** resulting from a wake low caused downed trees near Little Girls Point in Western Gogebic County as well as recorded property damage of $3,000.
- 09/29/2011 – **High winds** throughout the county resulting from a deep low pressure system caused heavy rain, damaging north winds, downed trees and power outages throughout the county. Recorded property damage was $10,000.
- 06/14/2012 – **High winds** resulting from a wake low produced damaging winds and fallen trees in areas throughout the Western U.P. Recorded property damage was $3,000.
- 20 **thunderstorm wind** events over the same time period caused similar types of damage, generally with low monetary value. The most severe damage was during a July 11, 2008 incident at Cisco Lake with $40,000 damage to roofs and vehicles, followed by a July 2, 2012 incident in the border town of Hurley, WI with $10,000 damage resulting from downed trees.

Most high wind events are classified as thunderstorm winds. From 2006 through 2012, 26 high wind events were recorded in Gogebic County, of which 20 were associated with thunderstorms. High and thunderstorm winds, then, have high probability, with a frequency of 3.7 per year for all wind events. Individual events have generally moderate severity throughout the county. The Lake Superior shoreline in Wakefield and (especially) Ironwood Townships faces particular risk, but high wind events are far from being localized to that area; events beginning in 2006 were disbursed fairly evenly throughout the county. Vulnerability is highly variable depending on the prevalence of winds and concurrent property protection in different locations. Many events cause no monetary damage, and a few cause a substantial amount of damage, with an average damage cost of $3,800 per event.

Snowstorms

A *snowstorm* is defined as a period of rapid accumulation of snow that is often accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all snowstorms, as the snow is accompanied by low temperatures and strong winds. Blizzard snow comes in the form of fine,

powdery particles windblown in such great quantities that at times visibility is reduced to only a few feet.

Risk and Vulnerability

Gogebic County has experienced 72 winter weather events (winter weather, winter storms, heavy snow, and lake-effect snow) from 2006 through 2012; therefore, probability is very high, with an event frequency of 10.3 per year. Overall, severity is moderate and vulnerability low thanks to preparedness of residents and their property. The impact of a typical snowstorm is sometimes difficult to estimate, as a series of small events can have the financial impact of one large event.

Due to weather patterns, severity of different types of snowstorms varies somewhat throughout the county. "System snow," which results from weather fronts moving across the country, tends to produce slightly heavier snowfalls in the inland northern part of Gogebic County than in the southeastern part. "Lake-effect snow" is almost exclusively focused on areas close to Lake Superior. As a rule, however, snowstorms are considered both frequent and severe throughout the county.

Blizzards (not a formal designation in weather records) occur less frequently than other winter weather events. A typical blizzard in Gogebic County produces roughly one foot of snow and winds between 30 and 40 miles per hour. Gogebic County experienced 22 recorded winter storms from 2006 to 2012. Some of the most severe in wind, snow totals, and/or property damage are below:

- 10/11/2006 – **Winter storm** produced total snowfall of 10 to 14 inches throughout the county and caused minor traffic accidents.
- 10/22/2006 – **Lake-effect snow** totaled 13 to 16 inches in the Wakefield area.
- 12/2/2006 – **Lake-effect snow** totaled 13 inches in Wakefield to 18 inches in Marenisco.
- 1/27/2007 – **Lake-effect snow** totaled 12.5 inches in Ironwood in under 24 hours.

- 3/1 to 3/3/2007 – **Winter storm** system affecting most of the Upper Peninsula produced 30-mph wind gusts resulting in high drifts and whiteout conditions; snowfall in Gogebic County ranged from 13 inches in Watersmeet to 23 inches in Bessemer.
- 12/22/2007 – **Heavy snow** totaled 12 to 15 inches in the western half of the county, with several traffic accidents resulting.
- 1/13/2008 – **Lake-effect snow** totaled 20.5 inches in Ironwood.
- 4/19/2009 – **Winter storm** affecting the West and Central U.P. left between 12 inches at Thousand Island Lakes and 20.8 inches in Watersmeet. Damaged trees, downed power lines, power outages, and school closings resulted.
- 12/8 to 12/9/2009 – **Winter storm** affecting the West and Central U.P. left between 11 inches of snow in Watersmeet and 30 inches in Ironwood and resulted in school closings.
- 12/31/2009 to 1/1/2010 – **Lake-effect snow** left 15 inches in Ironwood in 24 hours.
- 1/12/2011 – **Lake-effect snow** produced 12 to 16 inches in Wakefield in 24 hours
- 12/16/2011 – **Winter weather** producing several inches of lake-effect snow caused a two-car accident and property damage totaling $40,000.
- 1/1/2012 – **Winter storm** produced snow ranging from 12 inches in Wakefield to 17 inches in Ironwood and was accompanied by 35-mph wind gusts causing blowing and drifting.
- 1/17/2012 – **Lake-effect snow** totaled 8 inches in less than 12 hours in Ironwood; car accidents were attributed to snow and blowing snow, with total damage of $15,000.
- 2/28 to 2/29/2012 – **Winter storm** produced snow ranging from 10 inches to 14.5 inches across the county with wind gusts of 30 mph causing blowing and drifting.

Tornadoes

A tornado is a violently rotating column of air extending to the ground from a cumulonimbus cloud. The funnel associated with a tornado may have winds up to

300 miles per hour and interior air pressure that is10-20 percent below that of the surrounding atmosphere. The typical length of a tornado path is 16 miles but tracks up to 200 miles have been reported. Widths of a path are typically less than a quarter-mile but can be over a mile. Historically tornadoes have resulted in a greater loss of life than any natural hazard, with national average death toll of 111 persons. Property damage resulting from tornadoes totals hundreds of millions of dollars every year. The average annual number of tornadoes in Michigan is 18 with most occurring in the southern Lower Peninsula.

Risk and Vulnerability

There have only been three tornadoes recorded in Gogebic County since 1950. The tornadoes included an F1 in April 1984 that resulted in $25,000 property damage, an F0 in August 1988 with no property damage reported, and an F1 in June 2005 that resulted in $25,000 property damage. Vulnerability to tornadoes is very high due to their unpredictability and accordant lack of preparedness in the county. Because of the infrequence of tornadoes, probability is low, but potential severity is highly variable, ranging from low to extreme.

2.3 Technological Hazards

Hazardous Materials: Fixed Site Incident

A *fixed site incident* is an uncontrolled release of hazardous materials from a stationary location, capable of posing a risk to health, safety, property, and the environment. Hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other community facilities. Hazardous materials or substances pose a threat to life, health, property, and environment if released because of their chemical, physical, or biological nature. Hazardous materials are carefully regulated by the government in order to reduce risk but accidental releases can occur during the manufacture, transport, storage, use, and disposal of the materials. Areas at highest risk are within a one- to five-mile radius of identified hazardous material

sites. Many communities have detailed response plans in place to mitigate the harm to people, property, and the environment from hazardous materials.

Background

There are no facilities within Gogebic County with supplies of Extremely Hazardous Substances that require reporting under the Superfund Amendments and Reauthorization Act (SARA) Title III. Title III identifies what steps facilities, the state, and local communities must take to protect the public from hazardous materials accidents.

Risk and Vulnerability

Chemicals being used in Gogebic County are isolated and in relatively small quantities with no required reporting. Risk to the general public is minimal, as is vulnerability, since few if any applicable sites exist. Probability of a fixed-site incident is very low, but severity, if an event were to occur, can range from moderate to high.

Hazardous Materials: Transportation Incident

A *transportation incident* is the uncontrolled release of hazardous materials during transport, capable of posing a risk to health, safety, property, or the environment. Highway, railroad, seaway, airway, and pipeline systems are carrying thousands of hazardous materials shipments on a daily basis through local communities. A transportation incident with hazardous materials could cause a local emergency. Areas at risk are those within one to five miles from major transportation routes. The U.S. Department of Transportation regulates the transport and shipping of over 18,000 different materials. All areas of Michigan are vulnerable to a hazardous materials transportation incident, while more urbanized and industrialized areas are at greater risk due to high population concentration and a large number of transportation routes in these areas.

Background

Highways U.S. 2 and M-28 through Gogebic County are major transportation routes for trucks traveling to and from Canada. The types and amounts of

hazardous materials transported on trucks traveling this route are often unknown. While there are State and Federal restrictions for the transport of hazardous materials, this information is not required to be passed on to the local units of government potentially affected by a transportation accident.

The Illinois Central Railroad crosses part of the west end the county from Wakefield to White Pine (in Ontonagon County). The railroad may carry certain types of hazardous freight materials. Gogebic County also has many miles of shoreline susceptible to shipping accidents on Lake Superior.

Risk and Vulnerability

Though probability is low based on history, there is considerable risk of a hazardous materials transportation incident in Gogebic County based on the high level of Canadian and American trucking traffic, its proximity to shipping channels, and gasoline transmission lines within the county. Areas most susceptible are the transportation corridors, where severity is also highest. Considering the combination of potential severity and lack of knowledge of vehicle contents, vulnerability in the county is quite high.

Infrastructure Failure and Secondary Technological Hazards

Infrastructure failure is a failure of critical public or private transportation or utility infrastructure resulting in temporary loss of essential functions and/or services. Public and private utilities provide essential services such as electric power, heating and air conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of the utility systems fails due to a disaster or other cause (even for a short time) it can have devastating consequences. During power outages, people can die in their homes from extreme heat or cold. When water or wastewater treatment facilities are inoperable, serious health problems can arise, and action must be taken immediately to prevent outbreaks of disease. If infrastructure failure results from a natural hazard event, it is termed a *secondary* or *cascading technological hazard.*

Background

Though many of the hazards considered in this plan could result in infrastructure failures, these failures are dangerous in and of themselves due to the harsh climate and remoteness of the county. The County is served by a number of systems including power, water treatment, and phone, and loss of any or all of these systems can have a detrimental impact on the functioning of the County. Failure of infrastructure or utilities can include anything from power outages (the most common type, generally producing a minor interruption of everyday life but potentially causing more severe problems over a long time period) to water treatment failure. Failure of a fuel pipeline may also constitute an infrastructure failure in that access to the powered utility is lost.

Risk and Vulnerability

Electric service in Gogebic County is provided by Xcel Energy and WE-Energies. Loss of power to the area grid can affect the entire region. Due to the rural nature of the County, trees can fall on power lines in remote locations causing a delay in restoration of service. Water systems, wastewater systems, and phone service can also be affected by failure or secondary failure and may be compromised by aging facilities. Creating redundant systems and outfitting systems with generators lessens the impact of such a failure. Probability of infrastructure failure is high, based mainly on two or more power outages per year. Numerous factors contribute to the impact of an infrastructure failure, including services affected, weather conditions, response capabilities, and time of day. Therefore, severity is highly variable. Probability is similar countywide, but severity may be more pronounced in urban areas that are most reliant on modern conveniences and systems served by utilities.

Transportation Accidents (Passenger)

A *transportation accident* is a crash or accident involving an air, land or water-based commercial passenger carrier resulting in death or serious injuries. The most vulnerable areas are those near facilities including airports with commercial passenger service, railroads with commercial rail passenger service, commercial marine passenger ferry services, and commercial intercity, local transit, or school

bus service. A serious accident involving any of these modes of transportation could result in mass casualties, requiring immediate life-saving response. A marine accident would require water rescue possibly on dangerous Great Lakes conditions. Michigan has 19 airports with commercial passenger service, 130 certified intercity bus carriers serving 220 communities, 72 local bus transit systems serving 85 million passengers, 19 marine passenger ferry services, and 3 intercity rail passenger corridors composed of 568 miles of track and serving 22 communities.

Background

Gogebic County has Indian Trails regional passenger bus service along U.S. 2, school bus service, casino buses, public transit service along U.S. 2, and an airport with scheduled commercial passenger service. There is no history of a large passenger transportation accident in Gogebic County.

Risk and Vulnerability

Though Gogebic County-based transportation conveyances susceptible to major passenger accidents are few, the risk presented by pass-through traffic on the two east-west highway routes is considerable. Probability is nevertheless low, but severity is potentially high. Both are highest along the major transportation routes passing through all jurisdictions. However, a relatively low volume of commercial traffic means that any incident would likely be isolated and of a small scale. Still, vulnerability to even a small, isolated accident can be considered high, as mitigating potential accidents is difficult due to the unpredictability of such events. In addition, the authority for local traffic regulation is limited. Emergency response plans and awareness of hazardous intersections and roadways are ways to prepare for this type of hazard.

Petroleum and Natural Gas Incidents

These incidents result in the uncontrolled release of petroleum, natural gas, or hydrogen sulfide, a poisonous by-product. Often overlooked as a threat because much of the petroleum and gas infrastructure in the state is located underground, petroleum and gas pipelines can leak, erupt, or explode, causing property

damage, environmental contamination, injuries, and loss of life. In addition, if hydrogen sulfide is released, besides its toxicity even at very small amounts, it is explosive when mixed with air at temperatures of 500^{o}F or above. These dangers can be found around oil and gas wells, pipeline terminals, storage facilities, and transportation facilities, as well as in pipelines themselves.

Oil and gas are produced from fields in over 60 counties in the Lower Peninsula with over 40,000 wells in those counties. Of that total, approximately 20,000 wells produce oil or gas. Over 1.1 billion barrels of oil and 3.6 trillion cubic feet of gas have been withdrawn from these wells.

Background

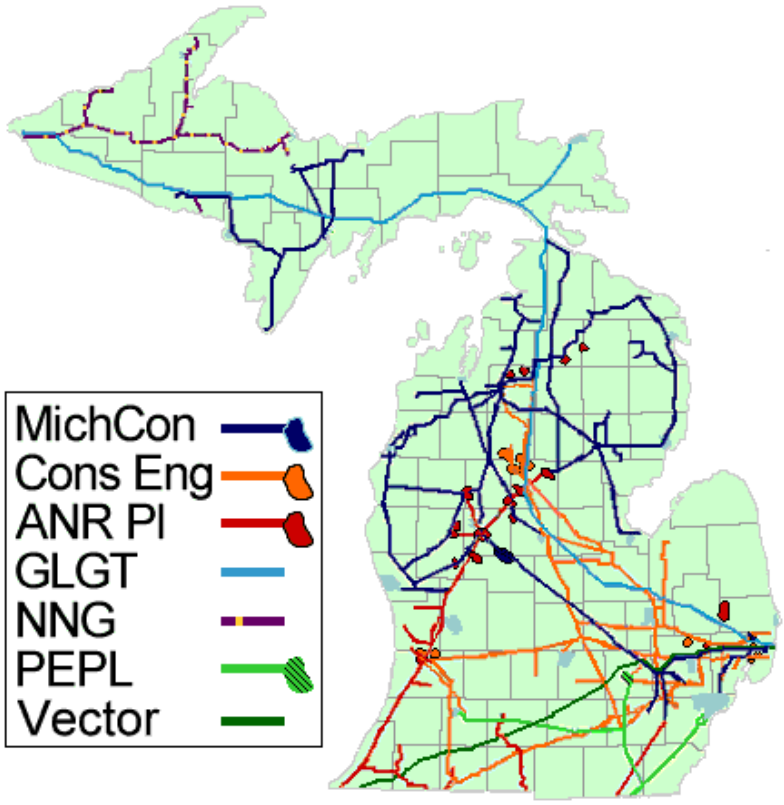
Gogebic County is fully bisected by a Great Lakes Gas Transmission line, and a Northern Natural Gas line crosses the northern portion of the County (see **Map 2.9**). All local jurisdictions except Erwin Township are traversed by one or both pipelines. These high-pressure natural gas pipelines transport and deliver gas to local and regional markets. No petroleum pipelines exist in Gogebic County.

Propane storage facilities in Gogebic County include Lakes Gas Company on S. Suffolk and Columbia Propane on E. Cloverland, both in Ironwood.

Risk and Vulnerability

There is a risk of a natural gas pipeline or fixed-site propane or petroleum incident in Gogebic County due to aging transmission, accident, or sabotage. The transmission lines may be at greatest risk due to the remoteness of the area, allowing a leak to go undetected for an extended period of time. Minor leaks occur routinely and are quickly detected and addressed as a matter of course, occasionally with the need to evacuate small numbers of people within a three-mile radius of the site. Probability of a more severe incident is low, but vulnerability is high, as leak frequency is higher than optimal due to the condition of aging lines.

Map 2.9. Natural Gas Pipelines in Michigan



***Source*: Michigan Public Service Commission**

Severity could also be high. Outside urban areas, the major effects would be ecological or environmental—but arguably no less significant than those directly impacting human life and property—as most transmission lines are located underground and in undeveloped or sparsely developed areas. In addition to a potential pipeline leak or rupture, the city of Ironwood is also vulnerable to a potential propane storage facility incident, and widely dispersed gasoline storage locations are vulnerable to an accordant leak, fire, or explosion.

2.4 Human-Related Hazards

Civil Disturbances

A *civil disturbance* is a public demonstration or gathering, or an uprising in a prison or other institution, resulting in some disruption of essential community functions or in rioting, looting, arson, or other unlawful behavior. Large scale disturbances, though rare, are typically the result of labor disputes, controversial

or high-profile judicial proceedings, governmental actions or implementation of controversial laws, resource shortages due to a catastrophic event, disagreements by special interest groups, or a perceived unjust injury or death of a person held in high regard by a segment of society.

Places that may be subject to or impacted by this type of disturbance include government buildings, military bases, universities, businesses, nuclear power plants, and critical service facilities such as police and fire stations. Prison uprisings occur when inmates are upset over rules, operating procedures and living conditions, or during altercations between rival groups or gangs within the facility.

Background

Gogebic County is the home of the Ojibway Correctional Facility which is located in Marenisco Township on Ojibway Road off of M-64. The Level I (minimum security) facility has five housing units that can accommodate up to 960 prisoners. The facility is secured by two perimeter fences with razor ribbon wire and an electronic detection system, and the perimeter is patrolled by armed guards. The county has seen little impact from Ojibway; in January 2013 an inmate was beaten to death by others inside the facility, but the incident was not a threat to the off-site community. Gogebic County is also home to Gogebic Community College and a number of federal, state, and local offices. In the past decade there have only been minor concerns affecting the general population, including a Rainbow Family gathering in the area and a KKK rally by members from Mercer, Wisconsin, which is near that state's northeastern border.

Risk and Vulnerability

The risk for a civil disturbance exists in Gogebic County because of governmental, education, and other activities in the area. The main threat is the Ojibway Correctional Facility, located in low-population Marenisco Township. Although the immediate risk to human life of an escape is minimal, this undeveloped area could also hinder capture. A riot or similar incident would threaten the community at a greater level. Still, this or any other civil disturbance would likely be moderated by internal response plans that are in place.

Probability of such an incident is low throughout the county but perhaps slightly higher in Marenisco Township and in the urban areas along the U.S. 2 corridor. Severity is highly variable and follows the same population pattern. The small scale of recently recorded events indicates the vulnerability of the county to such an event is negligible.

Public Health Emergencies

A *public health emergency* is the result of a widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public. Public health emergencies can take many forms: disease epidemics; large-scale food or water contamination; extended periods without adequate water or sewer services; harmful exposure to chemical, radiological, or biological agents; or large-scale infestations of disease-carrying insects or rodents. Public health emergencies can occur by themselves or may be secondary events caused by other emergencies or disasters such as floods or hazardous materials incidents. Public health emergencies can be statewide, regional, or localized in scope and magnitude, but the common characteristic is that they adversely impact or have the potential to impact a large number of people. An additional effect of public health emergencies is the number of "worried well" who can overwhelm the system by seeking unnecessary treatment.

Background

There is no recent history of widespread public health emergencies. Small incidences of flu outbreaks and similar do occur, but the extent of the emergencies has been limited. There is potential in Gogebic County for disease outbreaks and contamination as an isolated event or as a secondary event to flooding or other incidents.

Risk and Vulnerability

Gogebic County is aware of and prepared to deal with risks associated with public health emergencies. While awareness and planning are the key, a large-magnitude epidemic could overload facilities that are inadequately equipped to

deal with this type of emergency. The remoteness of the County could also be problematic during a large-scale emergency. The county's greatest susceptibility to most types of public health emergency is along the Cities of Ironwood, Bessemer, and Wakefield corridor. However, events dealing with contamination of natural resources, for example, could affect these populated areas but originate in more rural outlying areas.

The Western Upper Peninsula District Health Department is responsible for addressing and trying to prevent public health emergencies in Gogebic County. It does so by distributing public information for both preparedness and notification, establishing a regional hotline in the event regular telephone systems are overwhelmed, and of course distributing and administering vaccines or countermeasures if necessary. Another important function of the Health Department is to protect and treat emergency responders – a responsibility that has implications for every other hazard. In addition, the Department has sole power of quarantine should it become necessary.

The most likely public health threat in Gogebic County is influenza-type illness, by far the most common communicable disease, with an average mortality rate of 13.4 per 100,000 residents from 1996 to 1998 in Keweenaw, Houghton, Baraga, Ontonagon, and Gogebic Counties was nearly identical to Michigan's rate of 13.0. However, influenza rarely rises to the level of a public health emergency, and the vulnerability of the county to a true such emergency is difficult to calculate. The hazard has potential to impact the entire population, either through illness, injury, or death. Probability of a public health emergency is low, and severity is unpredictable but could potentially be extreme.

Sabotage/Terrorism

Sabotage/terrorism is an intentional, unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political, social, or religious objectives. Sabotage/terrorism can take many forms, including bombings; assassinations; organized extortion; use of nuclear, chemical, and biological weapons; information warfare; ethnic, religious, and gender intimidation (hate crimes);

advocacy of overthrow of the U.S. Government; and disruption of legitimate scientific research or resource-related activities (eco-extremism).

Because sabotage/terrorism objectives are so widely varied, so are the potential targets of such actions. Virtually any public facility, place of public assembly, or business engaged in controversial activities can be considered a potential target. Large computer systems operated by government agencies, financial institutions, large businesses, healthcare facilities, and universities are at risk.

Background

There is no recorded history of sabotage or terrorism in Gogebic County.

Risk and Vulnerability

Probability of sabotage and terrorism in Gogebic County is very low but should not be ignored, as these incidents can occur at any level. Most potential target facilities are located in the populated areas along the U.S. 2 corridor. Earlier-mentioned natural gas pipelines running through the county are another possible target. Other threatened locations are impossible to identify, especially since widely dispersed rural areas are increasingly perceived by both authorities and terrorists as vulnerable to the element of surprise. If an incident does occur, severity is impossible to predict.

2.5 Gogebic County Hazard Risk Assessment

Currently, there is no reliable way to accurately estimate costs associated with many hazards that affect Gogebic County. Numerous variables can affect the vulnerability of the County to hazards, including location, scale, and time of day. The time of year also affects risk, as the population in many jurisdictions varies by season and response capabilities are often compromised in winter.

While Gogebic County is susceptible to many types of hazards, the jurisdictions vary in their levels of vulnerability to certain hazards. Vulnerability to most weather hazards, structural fire hazards, seasonal riverine flooding (but not one-time extreme events), and most technological and societal hazards is not specific to individual jurisdictions. For detailed information by jurisdiction, see Section 3.

Table 2.1 provides a summary of the hazards within the County and notes hazards of disproportionately high risk in individual jurisdictions.

Table 2.1. Differential Vulnerabilities by Jurisdiction

Jurisdiction (Population)	Vulnerability Summary
Gogebic County (17,370)	*Hazards of similar concern to most or all of Gogebic County are:* Civil Disturbance Drought Hazardous materials High winds Ice and sleet storm Lightning Sabotage/terrorism Scrap tire fire Snowstorm Structural fire Subsidence Tornado
Bessemer Twp. (1,270)	Flood – riverine – along Black River & tributaries
Erwin Township (357)	Flood – riverine – along Montreal River
Ironwood Twp. (2,330)	Petroleum/natural gas accident Dam failure – Montreal River Shoreline erosion – Little Girls Point and mouth of Black River Flood – riverine – along Black River, Montreal River, and tributaries
Marenisco Twp. (1,051)	Petroleum/natural gas accident Dam failure – Cisco & Wood Bire-Presque Isle Flood – riverine – along Presque Isle River and tributaries Wildfire
Wakefield Twp. (364)	Petroleum/natural gas accident Flood – riverine – along Presque Isle River and tributaries Wildfire
Watersmeet Twp. (1,472)	Petroleum/natural gas accident Dam failure – Cisco Wildfire
Bessemer City (2,148)	Flood – riverine – along Black River & tributaries Flood – urban Infrastructure failure/secondary technological hazard Petroleum/natural gas accident Public health emergency Hazardous materials – transportation incident Subsidence
Ironwood City (6,293)	Flood – riverine – along Montreal River Flood – urban Infrastructure failure/secondary technological hazard Petroleum/natural gas accident Public health emergency

Jurisdiction (Population)	Vulnerability Summary
	Hazardous materials – transportation incident Subsidence
Wakefield City (2,085)	Flood – riverine – along Montreal River Flood – urban Infrastructure failure/secondary technological hazard Petroleum/natural gas accident Dam failure – Sunday Lake Floodgate Public health emergency Hazardous materials – transportation incident Subsidence

Technical expertise is necessary to estimate the costs of each potential hazard. The value of property in Gogebic County and its communities can, at a minimum, provide an overview of property that can be affected by hazards. **Table 2.2** below shows the State Equalized Value (SEV) of properties in Gogebic County by location and class. Vulnerability estimates that are provided in this plan were based on a most likely scenario.

Table 2.2. State Equalized Value in Gogebic County

*****Real*******						Total Real	Personal	Total Real & Personal
Township/ City	Agri-culture	Commercial	Industrial	Residential	Timber-Cutover			
Bessemer	0	3,501,787	69,429	39,007,784	5,187,693	47,766,693	4,731,853	52,498,546
Erwin	0	0	1,900	12,334,130	2,033,814	14,369,844	195,260	14,565,104
Ironwood	846,088	8,479,865	2,939,882	87,991,696	9,624,077	109,881,608	7,297,598	117,179,206
Marenisco	0	2,141,873	849,431	69,113,912	4,470,434	76,575,650	7,510,580	84,086,230
Wakefield	0	913,308	1,150,798	15,336,181	6,032,112	23,432,399	16,827,383	40,259,782
Watersmeet	91,440	5,338,043	582,370	247,412,240	3,033,100	256,457,193	13,074,850	269,532,043
Bessemer City	0	3,891,898	839,991	24,613,851	0	29,345,740	1,925,988	31,271,728
Ironwood City	0	38,602,070	2,799,930	72,461,780	0	113,863,780	8,620,710	122,484,490
Wakefield City	0	2,872,085	412,419	22,110,263	315,266	25,710,033	1,011,630	26,721,663

Source: Michigan Department of Treasury, 2011

2.6 Countywide Hazard Priority Ranking

Mitigation activities for Gogebic County are prioritized by hazard ranking based on the following criteria: probability of occurrence, affected areas, speed of onset, population impact, economic effects, duration, predictability, collateral damage, availability of warnings, and mitigation potential. (Seasonal pattern is notably omitted as such a pattern may be seen as both positive and negative.) The rankings pertain to risk as a composite of both probability and extent.

In order to develop hazard rankings, first a score of 1 (least impact) to 10 (greatest impact) was assigned to each disaster type for each criterion. Then the criteria were assigned weights based on how great an effect each would be expected to have on disaster severity. The 1-to-10 scores for each criterion were multiplied by a weight factor of 5, 10, or 15 percent, with 5 having the least and 15 having the greatest impact. The grand total score for each type of disaster was used for hazard ranking.

The following list shows the numeric scales and weights of each hazard criterion.

- **Probability of Occurrence (15%)**: Low (1) – Extremely High (10)
- **Affected Areas (10%)**: Single Site (1) – Large Area (10)
  Considered in proportion to the area of the individual jurisdiction
- **Speed of Onset (5%)**: Greater than 24 hours (1) – Minimal/No Warning (10)
- **Population Impact (15%)**: Very Low (1) – Very High (10)
  Considered in proportion to the population of the individual jurisdiction
- **Economic Effects (15%)**: Very Low (1) – Very High (10)
  Considered in proportion to the economy of the individual jurisdiction
- **Duration (10%)**: Short Duration (1) – Long Duration (10)
- **Predictability (5%)**: Highly Predictable (1) – Unpredictable (10)
- **Collateral Damage (10%)**: Very Little (1) – Very Much (10)
  Considered in proportion to the collateral of the individual jurisdiction
- **Availability of Warnings (5%)**: Warnings Available (1) – Not Available (10)
- **Mitigation Potential (10%)**: Easy to Mitigate (1) – Impossible to Mitigate (10)

Following are **weighted** and un-weighted countywide hazard vulnerability scores, respectively, representing the results of hazard priority ranking by the Gogebic County Hazard Mitigation Committee. *Earthquakes and Nuclear Power Plant Accidents are not included in this plan or evaluation because there is virtually no chance of them occurring in Gogebic County.*

Wildfires (**7.30**, 71)
Snow Storms (**6.50**, 59)
Riverine & Urban Flooding (**6.30**, 57)
Drought (**6.20**, 54)
Petroleum/Natural Gas Accident (**6.10**, 69)
Infrastructure Failure/Secondary Technological Hazard (**5.85**, 61)
Hail (**5.75**, 63)
Structural Fires (**5.75**, 64)
Dam Failure (**5.60**, 62)
Ice & Sleet Storms (**5.45**, 57)
Extreme Temperatures (**5.35**, 47)
High Winds (**5.10**, 48)
Public Health Emergency (**4.80**, 53)
Subsidence (**4.6**, 55)
Sabotage/Terrorism (**4.55**, 56)
Hazardous Materials: Transportation Incident (**4.50**, 56)
Tornadoes (**4.25**, 52)
Passenger Accident (**4.10**, 53)
Civil Disturbance (**3.95**, 47)
Hazard Materials: Fixed Site Incident (**3.60**, 46)
Lightning (**2.95**, 40)
Scrap Tire Fires (**2.95**, 39)
Shoreline Flooding/Erosion (**2.70**, 29)

See **Appendix B** for hazard matrices containing all assigned scores for the County and for each jurisdiction.

Narrowing the Landscape

The local units of government in Gogebic County have different operational arrangements and in some cases are subject to different hazard types. These two factors interact to produce a unique set of circumstances that much be addressed locally. In areas where particular hazard characteristics warrant action items at a local level, the corresponding action items in Section 5 are referenced at the end of the jurisdiction's description.

All local units of government in the County are overseen by five-member legislative bodies. The three cities in the County, as well as Ironwood Charter Township, have considerable home-rule powers of land regulation and taxation, opening the door to mitigation projects in areas where the most residents are impacted, whereas the townships have a lower level of operational control. Townships experience somewhat different hazard threats associated with their less developed land bases, dispersed populations, greater diversity, and natural resources. The local governments address their hazards based on their powers and resources. The following overviews set community context and disaster priorities to determine what efforts limited resources should generally be devoted to.

3.1 City of Bessemer

Address: 411 S. Sophie Street, Bessemer, MI 49911
2010 Population: 1,905

The City of Bessemer is one of three cities along the shared highway and utility corridor of U.S. 2/M-28. Bessemer is within the Black River watershed and contains minor tributary streams, causing some flood potential. Bessemer is also located in prime "snow country," as the most severe winter weather and heavy snowfall tends to parallel the corridor. As a result of this corridor and a concentration of population, Bessemer is especially subject to resulting collateral damage, logistical difficulties, and infrastructural interruptions.

Bessemer is bisected by the heavily traveled U.S. 2/M-28, and a natural gas pipeline runs concurrent with this route. Bessemer is thus at high risk of transportation-related and natural gas accidents. Furthermore, like any other concentration of population, Bessemer is a relatively likely target of terrorism and sabotage, is subject to significant impacts from infrastructure and utility loss or interruption, and would be disproportionately impacted by public health emergencies. Finally, the city is located within an historic mining range running along the U.S. 41/M-28 corridor. The old underground mines, many of which are not known or marked, pose a risk of subsidence affecting overlying homes and other structures.

Localized Action Items (Section 5.2): 3, 12, 13

3.2 City of Ironwood

Address: 213 S. Marquette Street, Ironwood, MI 49938
2010 Population: 5,387

Ironwood shares similar disaster risk to Bessemer in most respects. The main differences are 1) largest population of any jurisdiction in the county, 2) presence of an additional major highway (US-51, which runs south within the city and west to Wisconsin) and 3) border on the Montreal River, which floods seasonally and has potential to flood severely and inundate large parts of the city.

In comparison with the other cities, Ironwood's larger population increases most hazard impacts across the board (not reflected by the matrices due to the comparison method), and increased traffic flow raises related hazard risks. Flooding is the foremost risk, however. The most severe event in recent history occurred in spring 2002. The 2002 flooding led to commercial and residential property damage, long-distance traffic rerouting, and the necessity of outside emergency support. Regional property damage totaled $18.5 million. To reduce the risk of flooding of this magnitude, this Plan includes an Annex specific to flooding in the city. Urban flooding also occurs along U.S. 41/M-28 as a consequence of heavy rains, though this susceptibility has been reduced by recent storm sewer reconstruction. Major flooding also occurred in 2013, but severity was mitigated by better preparedness and quick reaction of local officials to imminent risk.

Localized Action Item (Section 5.2): 14

3.3 City of Wakefield

Address: 311 Sunday Lake Street, Wakefield, MI 49968

2010 Population: 1,851

Wakefield shares similar disaster risks to Ironwood, though its lower population decreases some hazard impacts. Like Ironwood, Wakefield is served by two major transportation routes, M-28 and U.S. 2, which join in the city to form a concurrent route. Wakefield is also at risk of flooding of Sunday Lake and its tributaries. Outflow from Sunday Lake is hampered by a non-functioning floodgate, which can either back up water flow or potentially fail, creating the greatest and most localized risk of dam failure of any jurisdiction. Wakefield suffered severe flooding at the same time as, and with similar consequences to, Ironwood in 2002. Flooding recurred in spring 2013; water backed up due to the floodgate and required closure of Highway M-28, but impact was alleviated by pumping beyond the roadway. Wakefield was covered by a Flood Mitigation Plan from 2007 to 2012. During this time, the City applied for FEMA funding to fix the Sunday Lake floodgate but was unsuccessful.

Localized Action Item (Section 5.2): 1

3.4 Bessemer Township

Address: N10338 Mill Street, PO Box 304, Ramsay, MI 49959

2010 Population: 1,176

Bessemer Township surrounds the city of Bessemer, extending to the borders of the Cities of Ironwood to the west and Wakefield to the East. The Township's major land base extends to the south and east of Bessemer and Wakefield. As a rural jurisdiction with significant corridor development in one section, Bessemer Township is a microcosm of the county and has similar disaster risk priorities. Sections of the township are susceptible to subsidence because of the northern section's centralization along the former mining range, transportation incidents because of the U.S. 2/M-28 corridor, and petroleum/natural gas incidents due to the gas lines running concurrent with the corridor. A segment of the Black River is located in the Township, putting it at possible risk from flooding upstream.

3.5 Erwin Township

Address: North 5445 Van Buskirk Road, Ironwood, MI 49938

2010 Population: 326

Erwin Township is similar to the county in its primary disaster risks. The Township's rural nature with no major transportation routes or pipelines decreases its susceptibility to human-caused incidents such as transportation and petroleum/natural gas accidents. There are two dams located in the Township that also may affect downstream reaches outside of the jurisdiction.

3.6 Ironwood Charter Township

Address: N10892 Lake Road, Ironwood, MI 49938

2010 Population: 2,333

Ironwood Township is subject to a unique array of hazards. The township has the longest Lake Superior shoreline in the county, and significant shoreline flooding and erosion occurs along this stretch. High winds also have a slightly higher likelihood to occur here, though this is only minimally reflected in the hazard risk matrix.

The lower reaches of the Black and Montreal Rivers are located in the township. These rivers, along with many smaller streams throughout the township, subject the township to a relatively high risk of riverine flooding. The Township was impacted by heavy area flooding in 2002 and 2013. Flooding in 2002 was most severe, but in 2013, several culverts were blown out and many local roadways submerged. Flooding is seen largely as a natural and, to some extent, unavoidable risk. However, part of the impact is attributable to poor drainage through culverts and blocked or non-existent ditches.

Dam failure is a related risk. Two hydroelectric dams are situated on the lower Montreal River (at Saxon and Silver Falls). They are both near the mouth of the river at Lake Superior and are not known to be at risk of failure. Furthermore, hydroelectric dams have plans in place to address such an event.

Finally, southern Ironwood Township faces potential consequences of high population-based hazards associated with the City and its transportation routes. Natural gas pipeline runs the length of the Township east-west, some of this being highly populated

and developed. Because of all these factors, Ironwood Township has the highest total hazard risk potential of the Gogebic County townships.

Localized Action Items (Section 5.2): 3, 7, 9

3.7 Marenisco Township

Address: 314 Hall Street, Marenisco, MI 49947
2010 Population: 1,727

Marenisco Township is rural and has little exposure to hazards associated with densely populated areas. Much of the population is seasonal, with over half of housing units designated as such. However, the Township is intersected by two significant regional highway transportation routes – U.S. 2 and M-64. It also hosts a low-security correctional facility (accounting for a large part of the population) which could be subject to escapes. This potential civil disturbance is unique in the county and could possibly threaten area residents. Higher risk of this hazard is localized to Marenisco Township in the hazard matrices, even though it could potentially affect surrounding jurisdictions, because the broader consequences of such an escape are unpredictable. Marenisco contains watercourses that could be subject to flooding and dam failure. Part of the Wood Bire – Presque Isle wildlife dam was washed out during the 2002 flood, and a dam door broke during the 2013 flood, leading to small-scale evacuation but posing a negligible threat to life and property.

Localized Action Items (Section 5.2): 14

3.8 Wakefield Township

Address: 414 North County Road 519, PO Box 154, Wakefield, MI 49968
2010 Population: 305

Wakefield Township has the lowest population of any jurisdiction in Gogebic County but nevertheless has both rural and urban characteristics. The northern half has Lake Superior Shoreline and is subject to slight risk of shoreline flooding and erosion. The southern part almost completely surrounds the City of Wakefield and could see some dispersed effects of urban-associated hazards. Two major natural gas pipelines run through the southern part of the township and intersect within the city. This means that two separate corridors must be prepared for a pipeline accident. The Presque Isle River

runs through much of the township, bringing risk of riverine flooding and possible dam failure upstream. Wakefield Township could also be affected by flooding of Sunday Lake in the city.

Localized Action Items (Section 5.2): 9, 10, 14

3.9 Watersmeet Township

Address: PO Box 306, N4660 US Highway 45, Watersmeet, MI 49969
2010 Population: 1,417

Watersmeet Township has a rural character despite its relatively large population, which, like Marenisco, is largely seasonal. It is located in the far southeast corner of Gogebic County, bordered by Marenisco to the west. The two townships have much in common with regard to hazards, except that Watersmeet does not have a correctional facility. Additionally, much of Watersmeet's land base is federal forestland, including the Sylvania Wilderness, which removes much population from undeveloped sections of the county but also raises the risk of wildfires. Watersmeet Township includes many water bodies but no watercourses subject to a notable risk of flooding or dam failure. It is also important to note that the township includes the Lac Vieux Desert Indian Reservation, which has a population of only 137 but has its own hazard risks, including tribal buildings historically subject to minor flooding (a problem that has been addressed in recent years).

Addressing Our Threats

Goals for the Gogebic County Hazard Mitigation Plan were established to address the highest priority hazards identified in Section 2 of this plan (wildfires, snowstorms, riverine and urban flooding, drought, and petroleum/natural gas accidents) while also considering efforts that could assist with lower-ranking or unknown hazards that may affect the County. Four general goals were established to guide mitigation efforts. The goals are considered comprehensive and give guidance to identifying mitigation activities in Gogebic County.

Goal 1: Protect lives and property within Gogebic County from all known hazards while focusing on priority hazards.

Goal 2: Identify feasible projects throughout the County that will help mitigate future problems.

Goal 3: Be proactive in protecting public facilities and critical facilities through up-to-date response plans and upgrades as needed.

Goal 4: Educate citizens in order to encourage self-help and the mitigation of hazards on private property.

Mitigation activities can fall into a number of categories, including **preventive measures**, **property protection**, **emergency services**, **structural projects**, **natural resource protection**, and **public information**. The following is an overview of potential activities by category and general recommendations within each activity category for Gogebic County.

4.1 Preventive Measures

The purpose of preventive measures is to protect new development from hazards and ensure that potential loss is not increased. Preventive measures are typically guided through planning activities and enforced through zoning and building codes at the local level. A number of activities in the preventive measures category can be implemented at the local level, including:

- Building Codes
- Planning & Zoning
- Subdivision Regulations
- Open Space Preservation
- Storm Water Management

Building Codes: Building codes are an effective way to address many hazards identified in this plan. Through building code enforcement all new and improved buildings can be built or rehabilitated to withstand the impacts of certain hazards such as snow load, high winds, extreme temperatures and flooding.

The Michigan Construction Code Act, Act 230 of 1999, requires all municipalities to administer and enforce statewide codes. These include the Michigan Building Code, Plumbing Code, Mechanical Code, and Residential Building Code, all of 2003, developed by the International Code Council (ICC); and the 2002 National Electric Code published by the National Fire Protection Association. The Act 230 language does not permit local communities to modify the state codes.

Thorough inspection of property during and after construction ensures that builders are incorporating all the current standards and requirements in effect. Administration and enforcement of the statewide codes varies by municipality in Gogebic County.

Planning and Zoning

Planning and zoning guides where development should occur based on suitability and compatibility. Planning and zoning keeps development away from sensitive areas such as floodplains and wetlands, which can protect property from certain types of natural hazards.

Master plans are the primary way for a local unit of government to guide future development within their community. Future development can be guided through a planning process that reviews a community's background, current land use, and projected needs. Unfortunately, master plans serve only as a guide and do not directly regulate land use.

Zoning ordinances are the primary tool to implement master plans and control land use. By identifying different zones or districts a community can guide development within its boundaries. Traditional zoning puts restrictions on use, lot size, setbacks, and other parameters, but it can be combined with more creative regulations such as a planned unit development option that allows more flexibility in the development process. Form-based zoning is a newer type that de-emphasizes the use of a parcel while regulating appearance and dimensional characteristics. Zoning is enforced by the local unit of government and should be based on a master plan for the community. All local jurisdictions in Gogebic County are zoned, but in some of these communities zoning occurs without the support of a master plan. See **Table 4.1**.

Table 4.1. Existing Master Plans and Zoning Ordinances

Entity	Zoning Ordinance Yr.	Master (or similar) Plan	
		In effect?	Year
Bessemer Township	2013	Yes	2011
Erwin Township	2011	Yes	2011
Ironwood Township	2013	Yes	2012
Marenisco Township	2004	No	-
Wakefield Township	2004	No	-
Watersmeet Township	2010	Yes	2008
City of Bessemer	2013	Yes	2012
City of Ironwood	2009	No	Pending; last full update 1991
City of Wakefield	1990	Yes	2000-2020
Gogebic County	N/A	Yes	2009

Land Division (Subdivision) Regulations

In Michigan, the Land Division Act (Public Act 288 of 1967, amended by Public Acts 591 of 1996 and 87 of 1997) calls for all divisions of property to be approved by the local unit of government. The Act regulates the division of land in order to promote the public health, safety, and general welfare; further the orderly layout and use of land; and require the land be suitable for building sites and public improvements. The

new law authorizes municipal approval with basic, objective rules, including lot shape, minimum width and size standards, an adequate description, and safe access. The law sets a 45-day time limit on municipal approval.

Open Space Preservation

Open space preservation is a way to keep hazardous areas free from development and is especially effective in floodplain areas. Prohibiting new development in hazard-prone areas is the best way to mitigate future problems. An additional benefit to open space preservation is the maintenance of agricultural areas and green space and parks. Comprehensive plans can help identify suitable areas to preserve through means such as acquisition, dedication by developers, easements, or regulated setbacks/buffers where development is restricted. In floodplains, zoning ordinances can regulate permitted property use and other characteristics through flood overlay zones, which add additional requirements to an existing base zone.

Storm Water Management

Storm water management is a way to control both urban and riverine flooding. While natural groundcover serves to absorb water, construction and development can increase runoff in a watershed. Increased runoff can cause flooding, overloaded drainage systems, erosion and impaired water quality. An effective method of storm water management is to regulate all development, particularly in floodplains, to manage runoff.

Under the National Flood Insurance Program, participating communities face development and height limitations in a floodplain in order to mitigate future losses. Development regulations can also require that storm water does not leave a new development at a higher rate than pre-development conditions. Storm water can be managed through natural vegetation, buffers, and retention basins.

Higher order initiatives might be promoted by offering incentives (such as density bonuses) to developers. Such initiatives might include permeable pavement, which allows infiltration of surface runoff into soil through surfaces such as parking lots, and rain gardens, which direct runoff into vegetated areas where it can slowly drain into soil while providing attractive natural accents within parking lots. Storm water runoff

impacts an entire watershed, and a coordinated effort amongst affected municipalities is the most effective way to address the larger issue.

Gogebic County Project Recommendations

Gogebic County is guided by a number of plans and regulations currently in place throughout the County. Local planning and zoning officials should place priority on updating these plans and ordinances to address hazard mitigation, as well as updating storm water management plans where needed.

In order to adequately address hazards at the local level, updated data and information is needed for flooding and shoreline erosion mitigation in Gogebic County. Because of changing conditions due to previous mitigation work and natural processes, much of the current hazard data on flooding and erosion is out of date. It is recommended that the County pursue updated flood maps and also new high risk erosion studies for the shoreline.

4.2 Property Protection

The general purpose of property protection measures is to prevent a hazard from damaging a building. Property protection measures are typically implemented by homeowners, but government can often provide technical and sometimes financial assistance. Although hazards can be categorized in many different ways, there are four general activities that can be classified as property protection:

- Keep Hazards Away
- Retrofitting
- Insurance Coverage
- Demolition

Property protection is typically the responsibility of the property owner but can be encouraged through mandates if information and incentives don't encourage property owners to take action. The federal government requires public facilities to be insured as a condition of receiving Federal disaster assistance. Local government is expected to protect critical facilities including fire stations, water treatment plants, and many others that serve the community. Protecting these facilities through retrofitting and sufficient, comprehensive insurance should be a priority.

Financial assistance can also sometimes be provided to property owners by communities in order to assist with protective measures including grants and low-interest or forgivable loans. Often with a little incentive, homeowners will take the initiative to build upon the opportunity with additional work on protective measures.

Outside financial assistance for pre-disaster preventive measures can include:

- FEMA's Pre-Disaster Mitigation (PDM) grants
- FEMA's Flood Mitigation Assistance (FMA) grants
- FEMA's Hazard Mitigation Grant Program
- Community Development Block Grants

Post-disaster financial assistance can include insurance claims, FEMA disaster assistance, Small Business Administration disaster loans (non-governmental properties), FEMA's Hazard Mitigation Grant Program, and Federal Highway Administration (FHWA) Emergency Relief Program and FHWA Emergency Relief for Federal Roads (ERFO).

The government should also take a role as an educator by providing basic information to citizens on property protection measures.

Keep Hazards Away

Hazard impact is typically measured by the amount of damage to people and property. There are a number of ways to keep hazards away from property. Depending on the hazard, this can include erecting a barrier, moving a building from a hazard-prone area, elevating buildings above the flood line, keeping hazardous materials such as fire-prone vegetation away from structures, and the purchase of open space.

Barriers can be erected that keep hazards from reaching structures. Sea walls can restrict shoreline erosion and flooding, while berms can help against shallow flooding. Because barriers are so susceptible to changing environmental conditions, proper design and maintenance are needed for structures to be effective.

Relocating structures is often the best way to prevent future loss. Many flood prone areas are not proper locations for any type of structure. If feasible, relocation to safer

areas can be the best way to protect structures currently in hazard prone areas. Relocation can include moving a structure elsewhere on a lot or completely off site.

Elevating structures is another method to keep structures out of harm's way. Often a base flood elevation (flood line) has been determined and raising a structure above this level prevents the hazard from affecting the property. Elevation can be done during new construction or by raising existing structures and can be more cost effective than relocation.

Structures that are permanently or regularly damaged by hazards can be addressed through demolition. It is often cheaper to relocate residents and build anew than to protect an existing structure that is heavily damaged or regularly affected by hazards such as flooding. Demolition is most effective on properties that are difficult to relocate or dilapidated structures with no salvage value.

Retrofitting

An alternative to keeping a hazard away from a property is modifying or "retrofitting" the building or site to withstand hazard impact. Methods of retrofitting a structure for flooding can include dry flood-proofing (waterproof coating, sealing) or wet flood-proofing (elevate everything that can be damaged and incorporate water resistant materials). Other methods of protecting a home from flooding include adequate floor drains, installation of sump pumps, backflow protection valves, etc.

Retrofitting can also protect homes from high winds, thunderstorms, hailstorms, winter storms, and extreme temperatures. Effective improvements include: tie downs, stronger windows and doors, buried utility lines, storm shutters, lightning rods, stronger roofing materials, improved insulation, indoor water lines, improved sealing, and storm windows.

Insurance Coverage

Although insurance does not mitigate hazards, it does help property owners to rebuild, repair, and, ideally, improve their property. Most homeowner's policies will cover property for damage due to tornado, wind, hail, and winter storms. Some insurance companies also offer sump pump failure and sewer backup coverage that

can be added to an existing policy. However, separate coverage is needed from the National Flood Insurance Program for flooding.

Demolition

The removal through demolition of unsound or susceptible buildings is one way to mitigate loss. In the case of a structure regularly flooded, demolition is a way to prevent further loss specifically when relocation would be too costly and the structure is of no historical value.

Gogebic County Project Recommendations

Gogebic County—specifically Wakefield and Ironwood—has been affected by flooding. Wakefield continues to deal with a long-standing floodgate problem at Sunday Lake. Other than known structural programs like that, the best proactive measure for governments in Gogebic County is to participate in the National Flood Insurance Program, which allows property owners to obtain and maintain insurance if their properties are susceptible to flooding.

For cold weather problems, insulation is a measure to protect public and private pipes/utilities potentially affected by cold weather. Nearly every winter, several communities in the Upper Peninsula have line breaks that could easily be prevented in this way. Measures such as this that provide the greatest benefit for the least cost should be given priority.

4.3 Resource Protection

Resource Protection mitigation activities are a way to enable land to function in a natural way. There are many benefits to naturally functioning watersheds, floodplains, and wetlands, including:

- Reduction in runoff from rainwater and snowmelt
- Infiltration and velocity control during overland flow
- Filtering of excess nutrients, pollutants and sediments
- Floodwater storage
- Water quality improvement
- Groundwater recharge

- Habitat availability
- Recreation and aesthetic qualities

Because many natural areas have been affected by development and will be affected by development in the future there are a number of ways to protect and restore the environment. Resource protection activities can include:

- Wetland protection
- Erosion and sedimentation control
- River restoration
- Best management practices
- Dumping regulations
- Urban forestry
- Farmland protection

Wetlands

Wetlands are a valuable resource that provides a number of mitigation functions including storage of floodwaters, filtration, and habitat for fish, wildlife and plants. Wetlands are regulated in Michigan by Part 303, Wetland Protection, of the Natural Resources and Environmental Protection Act (NREPA; Act 451 of 1995). The Michigan Department of Environmental Quality administers the permit program. In Michigan a permit is required to deposit fill material in a wetland; dredge or remove soil or minerals from a wetland; construct, operate, or maintain any use or development in a wetland; or drain surface water from a wetland. Wetlands are specifically defined under the act, and certain activities are exempted under the act.

Local units of government can play a role in wetland protection and should serve as stewards of their water resources. Wetland protection measures can be implemented on a local level, and public education is vital to protecting this valuable resource.

Erosion and Sedimentation Control

Surface water can easily erode soil in large exposed areas including farmlands, construction sites, and forested areas. In addition to exposed areas, erosion often occurs along stream banks and shorelines with high velocity currents and wave action. The erosion carries sediments and deposits them downstream where they

can cause problems to storm sewers, culverts and ditches by reducing the capacity of those systems. Erosion also results in sediment in the water, which reduces light and oxygen in the water. Heavy metals and other contaminants are the reason that sediment is identified as the number one non-point source pollutant for aquatic life.

Erosion and sedimentation can be controlled through phased construction, minimization of clearing, stabilization of bare ground with vegetation, and other means. Sediment can be captured on-site with traps and filters. Water velocity can be slowed by terraces, temporary cover, constructed wetlands, and impoundment.

Part 91, Soil Erosion and Sedimentation Control, of NREPA, regulates only earth change activity (primarily construction projects disturbing land that is one or more acres in area or within 500 feet of the shoreline of a lake or stream). Part 31 addresses most other sources of sediment. In Gogebic County, the County Forestry & Parks Commission is the Enforcing Agency. Locally, municipalities may adopt additional protection measures dependent on state laws via the NREPA or Planning and Zoning Enabling Acts.

River Restoration

History has proven that returning streams and adjacent land to a natural condition resists erosion. The restoration of vegetation along stream banks protects the water by:

- Reducing the amount of sediment (and pollutants) entering the water
- Provides habitat for wildlife
- Slows the velocity of water, thus reducing flood damage and erosion
- Provides recreational opportunities and aesthetic value
- Reduces long-term maintenance costs

Best Management Practices

Non-point source pollutants, including fertilizers, pesticides, animal wastes, chemicals, and sediment, are washed away by storm water and distributed in storm sewers, ditches, and streams. The term best management practices (BMPs) refers to the design, construction, and maintenance practices and criteria that minimize the impact of storm water runoff.

Dumping Regulations

Dumping regulations attempt to regulate the disposal of solid matter that can end up in streams and wetlands. Solid waste can pollute water, obstruct water flow, and reduce the ability of streams and wetlands to clean storm water. The dumping of waste materials such as garbage and other inorganic materials is illegal, but the dumping of yard waste (leaves, branches) can also affect a watercourse. People often don't realize the impact of obstructing a watercourse. Public information should be a key focus of a dumping enforcement program.

Urban Forestry

Much of the damage caused by wind, ice, and snow storms is to trees. Downed trees and branches can upset power lines, damage buildings, and harm property beneath them. An urban forestry program can reduce the damage potential of trees through maintenance and monitoring. Through better tree selection, proper pruning, and evaluation, communities can also mitigate damage caused by downed trees.

Farmland Protection

The purpose of farmland protection is to provide ways to keep prime, unique, or important agricultural land intact. Farmland is being converted to nonagricultural uses at an alarming rate. This results in residential development that requires more infrastructure and results in increased runoff and emergency management difficulties. Farmland protection parallels open space protection in that it keeps land open for future generations. Other benefits include ecosystem maintenance, scenic enhancement, and mitigation of storm water runoff.

Gogebic County Project Recommendations

Gogebic County should monitor streams, wetlands, groundwater, habitats, and other resources for problems that can be addressed with improved resource protection measures.

4.4 Emergency Services

Emergency services provide protection for people both during and after a disaster. A thorough emergency services program addresses all hazards and includes all response

mechanisms. Local emergency services authorities, resources, and facilities throughout Gogebic County are documented in Section 1 of this plan. Although all authorities are effective in conducting their internal and incident response activities, there is an opportunity to further educate the public about their operations – for example, through dissemination of hazard-related materials. Furthermore, several agencies lack necessary equipment to meet their responsibilities – wildfire response being foremost. The same shortfalls occur in municipal public works and planning operations as well as other functions of local government. Inadequate funding sources will make this a continuing problem.

On the state level, emergency services are supervised by the Michigan State Police and coordinated through county emergency management offices. The components of emergency services include:

- Threat recognition
- Warning
- Response
- Critical facilities protection
- Post-disaster recovery and mitigation

Threat Recognition

The first step in responding to a hazard is being aware that there is potential for an event to occur. With a threat recognition system, adequate warnings can be disseminated and other response actions can be undertaken. Flood threats can be evaluated by measuring rainfall, soil moisture, and stream flows upstream and then calculating flood levels for downstream locations. Discerning the time and height of a potential flood crest allows for more efficient evacuations. Some rivers have gauges that establish threat levels. The National Weather Service (NWS) is the agency that predicts meteorological threats and is able to issue public warnings. Under threat conditions, NWS may issue flash flood watches for affected areas.

Warning

After a threat is identified, the Office of Emergency Management (OEM) notifies municipalities and other agencies that an event is possible or occurring. Early notification

of affected parties is essential. The NWS notifies the public using two levels: "watch" and "warning."

Watch: Conditions are right for flooding, thunderstorms, tornadoes or winter storms.
Warning: A weather event has already started or has been observed.

A more specific warning may be disseminated in a number of ways including:

- Warning Sirens (outdoors and on public safety vehicles)
- Commercial Radio or Television (news and weather channels)
- National Oceanic and Atmospheric Administration (NOAA) Weather Radio
- Mass Telephone Notification (including mobile phone text messaging)
- Tone-Activated Receivers (in key facilities)
- Door-to-Door
- Mobile Public Address Systems
- Internet/E-Mail Notification

All of the systems have their limitations because they reach only certain audiences. Radio and TV can provide information, but this method of notification is only effective if people have those devices on. NOAA radio only reaches those with access to a weather radio. Outdoor warnings can indicate to tune into another information source such as TV or radio, but this type of warning has limited reach and may not be heard by people indoors or in noisy environments. Door-to-door contact is time consuming but preferred when there is sufficient lead time. The best warning system is a redundant system that provides notification via numerous methods in order to reach as much of the population as necessary.

Warning systems should also provide information regarding response actions to take, such as staying indoors during a tornado warning or staying off roads in the event of a severe winter storm.

Response

Effective response, in combination with threat recognition and warnings, is another way for a community to mitigate impact from hazards. Typically a community reacts to hazards through an emergency operations center that coordinates response activities based on an emergency action plan. An emergency action plan ensures

that the community responds efficiently and appropriately to a threat. Emergency Action Plans need regular revision in order to keep contact names and telephone numbers current.

Response activities vary greatly by incident type but may include closing streets and bridges, shutting off power to threatened areas, ordering an evacuation and opening evacuation centers, monitoring water levels, and implementing security measures.

Critical Facilities Protection

Critical Facilities, as identified in Chapter 1, are the vital facilities that keep a community functioning. Critical facilities must be prepared to respond during an emergency situation. Most critical facilities will have their own response plans in place and are also included in Emergency Action Plans of the municipality. The best protections are early warning, response planning, and coordination in the event of an emergency.

Post-Disaster Recovery and Mitigation

Communities must be prepared for recovery and mitigation of future problems after an incident. While the main focus is on recovery, it is also important to recognize mitigation strategies that can prevent an incident from reoccurring at the same magnitude.

During recovery a number of actions take place including patrolling, cleanup, providing services, monitoring impact, and regulating reconstruction. During the recovery time, mitigation activities can include public information efforts aimed at educating residents on how to protect themselves in the future, evaluating methods of reconstruction that include mitigation measures, and seeking funding for recovery efforts.

Gogebic County Project Recommendations

Emergency services are of primary importance in mitigating hazards in Gogebic County. The county should focus on increasing its ability to respond to threats through coordinated response activities. Employing well trained responders and an efficient public notification system lessens the impact of hazards on a community.

Areas to focus on include improved public notification, facility protection, response and backup equipment, and adequate medical supplies and shelter facilities.

4.5 Structural Projects

Structural projects are intended to protect people and infrastructure from damage due to natural hazards. Structural projects are typically used to manage and control flood waters. The complexity and cost of structural projects can vary greatly and are dependent on individual circumstances. Structural projects are undertaken where non-structural measures would not be effective. Such projects, which are geared mostly toward flood protection, may include:

- Reservoirs and Detention Areas
- Roadway and Stream Crossing Improvements
- Levees/Floodwalls/Seawalls
- Drainage and Storm Water Improvements/Maintenance
- Channel improvements

Because of the construction costs, maintenance and impacts of structural projects, they are often undertaken and funded by larger agencies with coordination at the local level. Agencies including the Michigan Department of Natural Resources, U.S. Army Corps of Engineers, and the USDA Natural Resources Conservation Service are often involved in structural projects.

Reservoirs and Detention

Reservoirs are intended to protect development downstream by temporarily storing flood waters. Reservoirs hold water behind dams or in storage/detention basins until flood waters subside. The detained water is then released downstream at a rate the river or stream can accommodate. Reservoirs may be built to address existing problems or to handle increased runoff from new development.

Roadway and Stream Crossings Improvements

Flooding can affect accessibility by overtopping roadways, culverts, bridges, driveways, and other transportation routes. A number of measures can be taken to maintain access when alternatives are not available. These include elevating road

beds, enlarging culverts to increase channel capacity, and replacing culverts with bridges. The biggest concern when undertaking these types of improvements is the impact to downstream locations with the increased capacity of the water system when it is no longer constricted upstream.

Levees, Floodwalls, and Seawalls

One of the most popular flood control measures is the construction of an earth levee or concrete floodwall to protect property. The purpose of these structures is to keep a stream within its channel by providing higher "banks." Levees require extensive design in order to address large floods, erosion, river access and views, and cost of construction and maintenance.

Seawalls are often used to protect from erosion due to storm surges along Lake Superior's edge. Seawalls are built along a property edge and are designed to protect a property from storm surges. Along the Great Lakes they can be significantly impacted by ice movement during the winter months and often have difficulty resisting lake forces.

Drainage and Storm Water Improvements/Maintenance

Man-made ditches and storm sewers assist in guiding runoff where surface drainage is inadequate. These systems allow water to be conveyed quickly to other locations and thus are most appropriate where the receiving location has adequate capacity. Storm sewer improvements may include installing new sewers, enlarging pipes, and preventing back flows. Other improvements, in combination with drainage enhancements, may include wetland detention, vegetated trenches, and practices that reduce the quantity and velocity of runoff.

It is also important to maintain storm water and drainage systems. This includes keeping channels, ditches, and culverts cleared of debris; maintaining overgrowth; and remediating stream bank erosion sites. Debris includes a number of materials, from tree limbs and branches to illegally dumped trash. Maintenance of public drainage systems is the responsibility of government agencies.

Channel Improvements

Channel improvements are another method of increasing the capacity of streams, thereby allowing more water to travel at a faster rate. Improvements can be made through dredging, "channelization," or diversion. Dredging increases stream capacity by removing material at the streambed. Channelization refers to the straightening, widening and/or deepening of a stream. Diversion is the practice of creating a new channel to send floodwaters to an alternative location.

Gogebic County Project Recommendations

Primary structural projects in Gogebic County have focused on improvements to the current drainage system. The Gogebic County Road Commission has identified and upgraded inadequate culverts and problem roadways and continues to do so. It is suggested that the Road Commission band with local municipalities to further the effort to address problem areas. Planned improvements to the Sunday Lake floodgate will alleviate spring runoff problems in Wakefield.

4.6 Public Information

Public information is a mitigation strategy that has broad reaching impact across both the public and private sector. Activities that provide local officials, property owners, renters, and businesses with specially tailored information on how to protect themselves and others from potential hazards may have the greatest impact of all mitigation strategies. Information empowers people to protect their own property and lives.

There are many ways to get information out to the public affected by hazards through community outreach. Community outreach involves disseminating information to the public through radio and television news, community newsletters, direct mailings, presentations, displays, signs, the internet, brochures, and other media. Because methods are diverse, it’s best to analyze each community to find out how people obtain information and use that to build an outreach plan. While in some communities a local newsletter is distributed, other communities may rely on a newspaper to provide and receive information.

While public information on hazards is important, it is also vital to provide people with methods to address the hazard. Outreach projects should include information on hazards, safety, health, and property protection measures at the local level. Community offices and libraries are good places to provide information such as books and pamphlets, while increasing internet use indicates its effectiveness as an information source. Information on a website can easily be linked to an infinite number of available resources.

Technical assistance can further assist people in protecting their property. Assistance can be in the form of hazard identification assistance or through property protection assistance. Resources for technical assistance may include FEMA Flood Map clarification with the assistance of community staff or direction from building department staff.

Gogebic County Project Recommendations

In Gogebic County and all municipalities, education is the key to an informed citizenry. By providing the information and tools necessary, much can be done to further mitigation efforts in Gogebic County. An ongoing education program and the availability of limited technical assistance provide members of the public with the ability to protect themselves. It is recommended that Gogebic County institute additional educational programs within the County for its citizens, businesses, and others that build upon current initiatives.

Section 5:

Action Program

Implementing Change

The final step in the mitigation process is to build upon the general recommendations for mitigation activities suggested in Section 3 and identify specific action items for Gogebic County. All the activities identified in this section are consistent with the Mitigation Goals identified in Section 3:

Goal 1: Protect lives and property within Gogebic County from all known hazards while focusing on priority hazards.

Goal 2: Identify feasible projects throughout the County that will help mitigate future problems.

Goal 3: Be proactive in protecting public facilities and critical facilities through proper maintenance and upgrades.

Goal 4: Educate citizens in order to encourage self-help and the mitigation of hazards on private property.

Projects vary from structural measures to education and are prioritized based on impact to persistent, known hazards and potential resources available to complete the project. Although projects are prioritized on a county-wide basis, this does not limit the County's or a local community's ability to pursue identified projects as funding becomes available. A number of the projects are ongoing action activities that will be accomplished as time and resources permit. Identified action items include a short description of the activity, the responsible agency or agencies, timeline, projected costs if available, and how Gogebic County and its citizens will benefit.

Cost-benefit consideration is a major factor in the prioritization of action items. As a result, action priorities are not entirely consistent with the hazard rankings in the matrices. For example, though snowstorms are rated fairly highly in every jurisdiction, there is little that can be done to prevent them, as extensive actions to reduce their severity or resolve their consequences are already being undertaken.

On the other hand, in most jurisdictions, subsidence is not a highly ranked hazard. However, extensive historical underground mining activity in the county warrants special importance of identifying and limiting access to (barricading) those sites. Counties in former or current mining areas often have a permanent elected position for mine inspector. In Gogebic County, this position is not funded highly enough to be active and effective, so making it a viable position is a high priority.

5.1 Changes from Previous Plan

Some action items are carried over from the 2005 Hazard Mitigation Plan. Many of these are ongoing activities that will continue indefinitely. Some have been completed. Of the first two prioritized items, the first, the Wakefield Dam Floodgate, has recently been funded, and the second, NOAA Weather Radio, has been implemented. Two others have been partially completed, and most of the remaining items are ongoing. Thus, the Action Plan has generally been a success.

As in most of the Upper Peninsula, population in Gogebic County has declined and average age risen since 2005. This does not have a major impact on mitigation items; however, this change in demographics should be considered when carrying out any kind of hazard-related education or public outreach.

No large-scale changes in land development have occurred in Gogebic County since 2005. Most construction has been incremental within or adjacent to already-developed areas. Gradually expanding commercial development along the U.S. 2 highway corridor in the three cities and surrounding townships is a factor in transportation incidents and may, in the future, warrant mitigation actions pertaining to those hazards.

One significant project that should be considered in the future, but which is too tentative to be a factor in action planning at this time, is the Orvana Minerals Corporation Copperwood Project, which is a planned underground copper mine in northern Wakefield Township. This will potentially become a hazardous materials fixed site, bringing the potential for both fixed-site and transportation-related incidents. Mining developments and operations will need to be carefully monitored for incorporation into future hazard mitigation planning.

5.2 Implementation Resources

There are two types of resources: existing institutional establishments, such as government agencies and continuing programs, and funding sources to undertake specific projects. Many of the former are described in Section 1 of the plan. The following list is intended to provide examples of funding sources for both current and future mitigation projects and should not be considered comprehensive. Potential new sources for mitigation funding should be added as identified. Project-specific funding options are included in the respective Action Items identified in Section 5.3.

Federal

- FEMA: Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program
- National Science Foundation (NSF)
- U.S. Department of Agriculture (USDA)
- U.S. Department of Commerce (DOC)
- U.S. Department of Defense: Army Corps of Engineers (USACE)
- U.S. Department of Energy
- U.S. Department of Health and Human Services (DHHS)
- U.S. Department of Homeland Security (DHS)
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Department of the Interior (DOI)
- U.S. Department of Justice (DOJ)
- U.S. Department of Transportation (DOT)
- U.S. Environmental Protection Agency (EPA)
- U.S. Small Business Administration (SBA)

State

- Michigan Department of Environmental Quality (DEQ)
- Michigan Department of Natural Resources (DNR)
- Michigan Department of Transportation (MDOT)
- Michigan Economic Development Corporation (MEDC)
- Michigan State University (MSU) Extension

Other

- Local tax revenues (general fund and special millage/assessment)
- Foundation grants

5.3 Progress on Previous Mitigation Program Action Items

Table 5-1 illustrates the status of mitigation action items from the 2005 Gogebic County Hazard Mitigation Plan

Table 5.1. Progress on Previous (2005) Mitigation Program Action Items

2005 Item	Status	Corresponding 2013 Item
1. City of Wakefield Flood Mitigation Plan and Feasibility Study for Sunday Lake Floodgate	Completed	Deleted
2. NOAA Weather Radio	Completed	Deleted
3. Update Stormwater Management Plans and Flood Maps	Partially Completed	Deleted
4. Review Plans and Development Regulations	Ongoing	14 (Modified)
5. Improved Emergency Response	Ongoing	15
6. Drainage Improvements and Maintenance	Ongoing	7
7. Mine Shaft Safety	Ongoing	6
8. Public Information/Education Program	Not Completed but now Ongoing	9
9. Update Shoreline Erosion Map and Identify Future Mitigation Activities	Not Completed	11
10. Insurance	Ongoing	12
11. Retrofit Underground Pipes	Ongoing	13

5.4 Mitigation Program Action Items

Action Item 1: Repair of Wakefield Sunday Lake Floodgate

The City of Wakefield has identified a non-functional gate on Sunday Lake that, when repaired, will enable the City to release spring runoff to Planters Creek. Following unsuccessful attempts to obtain FEMA funding for this improvement, the City in 2013 was awarded a Department of Natural Resources grant to do the project, which was recommended in the City's 2005 Flood Mitigation Plan. The

improvement will allow for lowering the lake level, which will provide additional lake storage capacity and help to mitigate future flooding problems.

- *Responsible Agency*: City of Wakefield
- *Affected Jurisdiction*: City of Wakefield
- *Deadline:* 2013
- *Cost:* $69,300
- *Funding Source:* DNR Dam Management Grant Program (already funded)
- *Benefits:* Alleviates spring runoff problems associated with the limited storage capacity of Sunday Lake. Greatly reduces the possibility of dam failure.

Action Item 2: Repair of Presque Isle Wildlife Dam

The Presque Isle Wildlife Dam was severely damaged by the 2002 regional floods and was repaired in 2005. During the 2013 flood, one door on the dam was broken. Even though little human property has been threatened as a result, these events present an unnecessary concern to an already difficult situation.

- *Responsible Agency:* United States Forest Service
- *Affected Jurisdictions:* Marenisco Township
- *Deadline:* 2015
- *Cost:* $25,000
- *Potential Funding Sources:* FEMA Hazard Mitigation Grant Program and others unknown
- *Benefits:* Allows for control of spring runoff to reduce risk of dam failure.

Action Item 3: Pipeline Safety Program

All natural gas pipelines in Gogebic County should be inspected proactively on an ongoing basis and replaced as needed.

- *Responsible Agency:* Utilities & DOT
- *Affected Jurisdictions:* All except Erwin Township
- *Deadline:* Ongoing
- *Cost:* Variable
- *Potential Funding Sources:* Utilities, local, and others unknown

- *Benefits:* Prevents leaks from routinely occurring and forcing evacuations by replacing pipelines before structural integrity becomes an issue; identifies areas of concern to alert property owners of ongoing hazard.

Action Item 4: Mobile 911 Boosters

All police vehicles of Gogebic County law enforcement agencies should be outfitted with 911 signal boosters to facilitate in-car computer connectivity in remote areas.

- *Responsible Agency:* Gogebic County Emergency Manager
- *Affected Jurisdictions:* All
- *Deadline:* 2013
- *Cost:* $12,000 ($400 per car)
- *Potential Funding Sources:* County operating funds, countywide millage, FEMA Hazard Mitigation Grand Program, and DOI Abandoned Mines Reclamation Program
- *Benefits:* Allows remote response units to have full capability to send and receive data and non-voice information.

Action Item 5: Mine Inspector

A county mine inspector should be brought on County staff in order to identify and close off subsidence-prone areas on an ongoing basis.

- *Responsible Agency:* Gogebic County Administrator
- *Affected Jurisdictions:* All
- *Deadline:* 2013
- *Cost:* $45,000 annually
- *Potential Funding Sources:* County operating funds, countywide millage, FEMA Hazard Mitigation Grand Program, and DOI Abandoned Mines Reclamation Program
- *Benefits:* Reduces the risk of property damage and injury from subsidence. Allows property owners and local governments to restrict access to hazardous areas. Although subsidence is a relatively low-priority risk in the County, it must be addressed due to its site-specific nature, sudden unforeseeable impacts, and

lack of records that should be made available, and this action is more cost-beneficial than many others.

Action Item 6: Mine Shaft Safety

An ongoing program of mine shaft safety that includes capping and other measures should be implemented. As funding is available, the County will prioritize and address hazardous shafts.

- *Responsible Agency*: Gogebic County/Mine Inspector
- *Affected Jurisdictions*: All; minimal in Marenisco and Watersmeet Townships
- *Deadline*: Ongoing
- *Cost*: $15,000 per shaft/opening
- *Potential Funding Sources:* FEMA - Hazard Mitigation Grant Program and DOI - Abandoned Mines Reclamation Program
- *Benefits*: Action to address numerous abandoned mine shafts throughout the area is necessary to protect people and property. The long history of mining has led to a persistent problem with mine shaft openings and shafts that are reopening due to improper capping (with materials such as rotting logs and rusting cars).

Action Item 7: Drainage Improvements and Maintenance

As an ongoing project in the County, the Gogebic County Road Commission has had an active role in upgrading roads and replacing inadequate culverts in response to previous problems and to mitigate future problems. In addition, ditches must be constructed where needed and kept clear to prevent backups and improper drainage directly into private lots. Regular maintenance and monitoring of critical drainage ways will prevent increased problems due to debris.

- *Responsible Agency*: Gogebic County Road Commission and municipal public works
- *Affected Jurisdictions*: All; particular concern in Ironwood Township
- *Deadline:* Ongoing
- *Cost:* Varies by project; staff time

- *Potential Funding Sources:* FEMA Pre-Disaster Mitigation Program, FEMA Hazard Mitigation Grant Program, and U.S. Army Corps of Engineers
- *Benefits:* Inspection and maintenance of the existing drainage system will prevent flooding caused by plugged culverts, whereas upgrading identified culverts and roads will ensure mitigation of future problems.

Action Item 8: Implement State Line Community Wildfire Protection Plan (CWWP) Action Items

Completed in 2009, the State Line CWPP covers Watersmeet Township, MI and Phelps Town, WI. is the first countywide plan in Michigan. The plan aims to protect human life and reduce property loss. Identified action items include distribution of educational materials (Firewise), brush cleanup, home ignition assessments, installation of dry hydrants, acquisition of new equipment, and regular review and evaluation of the CWPP.

Responsible Agency:	Watersmeet Township, Gogebic County, USFS
Affected Jurisdictions:	Watersmeet Township
Deadline:	Ongoing
Cost:	Unknown; varies by component
Potential Funding Sources:	FEMA, DNR, USDA Forest Service, and organization/agency operating budgets
Benefits:	The entire County will benefit by reducing risk of wildfire in one of the highest-risk areas of the state.

Action Item 9: Public Information/Education Program

Public information is the key to mitigating many of the potential hazards in Gogebic County. A number of projects can help to educate the public on potential hazards and how to protect themselves from hazards. Recommended projects include continuing to prepare and update educational materials on hazards affecting Gogebic County and ways that people can help with mitigation. These materials should be organized and made available at government offices, schools and other easily accessible public facilities and on the internet.

- *Responsible Agency*: Gogebic County Emergency Manager, Western Upper Peninsula District Health Department, MSU Extension, and American Red Cross
- *Affected Jurisdictions*: All
- *Deadline:* Ongoing
- *Cost:* Staff time
- *Potential Funding Sources:* Organization/agency operating budgets
- *Benefits:* Organizing locally applicable materials and making them available to the public promotes mainstream awareness. Through use of newspapers and internet, the public is easily informed and the message is consistent. This action item helps inform the public and provides assistance to people who want to learn more about property protection and how to reduce their risk.

Action Item 10: Update Shoreline Erosion Map and Identify Future Mitigation Activities

Shoreline erosion has been an ongoing problem along Lake Superior in Gogebic County. Current Michigan DEQ erosion studies are almost 30 years old, and new studies are needed to analyze the forces currently at work along Gogebic County shoreline and to ensure current setbacks are adequate for new developments. This project is dependent on state funding which has not been available since the 2005 plan.

- *Responsible Agency*: Gogebic County and Michigan DEQ
- *Affected Jurisdictions*: Ironwood and Wakefield Townships
- *Deadline:* 2015
- *Cost:* Staff time
- *Potential Funding Sources:* Michigan DEQ and others unknown
- *Benefits:* Updated information will enable Gogebic County and its residents to protect property from the forces of Lake Superior. Even though shoreline erosion is a relatively low threat on the County and jurisdiction scales, variable lake levels make this a currently important project—while levels are down, steps should be taken in order to protect property if and when lake levels rise.

Action Item 11: Remedial Road Maintenance

With diminishing transportation funding statewide, the road network has been allowed to deteriorate to the point of presenting real property damage hazards and secondary impacts. Lack of maintenance constitutes infrastructure failure in itself but can also lead to flooding due to poor drainage as well as passenger and hazardous materials incidents. Road maintenance is especially important in rural areas where limited alternate routes are available; however, these are the very areas where maintenance is most deferred. Wakefield Township has been identified as an area of special concern.

- *Responsible Agency*: Gogebic County and municipal public works
- *Affected Jurisdictions*: All; identified as particular concern for Wakefield Township
- *Deadline:* 2015
- *Cost:* Staff time
- *Potential Funding Sources:* MDOT, DEQ, local, and others unknown
- *Benefits:* Maintained roads reduce the risk of flooding and transportation-related accidents. This project also will help to regulate the flow of daily life unimpeded by transportation infrastructure failure.

Action Item 12: Insurance

Not all hazards can be mitigated prior to occurrence, but by maintaining insurance, property owners can protect themselves from loss due to hazards. Insurance is never retroactive, making it essential for property owners to have foresight in planning for future events.

- *Responsible Agency*: All property owners
- *Affected Jurisdictions*: All
- *Deadline:* Ongoing
- *Cost:* Variable/site-specific
- *Potential Funding Sources:* FEMA NFIP, organization/agency operating budgets, and individual property owners
- *Benefits:* All residents benefit by protecting themselves and their community facilities from loss. Conventional insurance policies will protect people from most hazards, while in municipalities participating in NFIP residents must obtain flood

insurance to be protected. The County and municipalities can also educate their citizens on the importance of maintaining adequate property insurance.

Action Item 13: Retrofit Underground Pipes

As work is done on underground utilities, including storm water improvements, municipalities should identify problem areas and insulate pipes as needed to protect them from extreme temperatures.

- *Responsible Agency*: Gogebic County, public works departments
- *Affected Jurisdictions:* All
- *Deadline:* Ongoing
- *Cost:* Variable by project
- *Potential Funding Sources:* FEMA Pre-Disaster Mitigation Program, FEMA Hazard Mitigation Grant Program, USDA Rural Development, and local
- *Benefits:* Burst pipes can result in flooding and temporary loss of water supply. Retrofitted pipes will be less likely to burst in extreme cold temperatures. The level of benefit will vary by project, but in all cases will ensure that future problems will be mitigated.

Action Item 14: Scrap Tire Removal

Although scrap tire fires are not a high countywide risk, some areas have problems with buildup, and it only takes one site for a significant fire to occur. These sites are scattered throughout the county and not always known; however, Erwin Township had a recognized problem in recent years and was awarded state funding. This is potentially a continuing issue and needs to be monitored.

- *Responsible Agency*: Cities of Bessemer, Ironwood, and Wakefield; Bessemer, Erwin, and Ironwood Townships
- *Affected Jurisdictions*: Cities of Bessemer, Ironwood, and Wakefield; Bessemer, Erwin, and Ironwood Townships
- *Deadline:* Ongoing
- *Cost:* Variable by project
- *Potential Funding Sources:* FEMA Pre-Disaster Mitigation Program, FEMA Hazard Mitigation Grant Program, USDA Rural Development, and local

- *Benefits:* Large-scale, site-specific fires, which can produce pollution as well as physical damage, can be prevented by removal of fuel (tire) accumulation.

Action Item 15: Create and Review Plans and Development Regulations

As land use plans, comprehensive plans, zoning, and other plans and regulations are up for revision, include appropriate hazard mitigation provisions. Communities that lack master plans should develop them. Consider plans and regulations that 1) divert new development from identified hazards, 2) include development standards that ensure adequate fire and emergency access, 3) require buried utility lines, and 4) promote open space requirements that protect properties from flooding.

- *Responsible Agency*: Gogebic County and all municipalities
- *Affected Jurisdictions*: All; particular concern in City of Ironwood, which has an obsolete plan, and Marenisco and Wakefield Townships, which lack plans
- *Deadline:* 2014 for new plan development; ongoing as plans and ordinances are reviewed and updated
- *Cost:* Staff time
- *Potential Funding Sources:* Organization/agency operating budgets
- *Benefits:* Citizens of Gogebic County will benefit from plans that protect new development from known hazards and inform municipalities of methods to protect their lands from hazards—specifically known priority hazards.

Action Item 16: Improve Emergency Response Capability

Conduct ongoing reviews of response plans and programs in order to keep emergency contacts up to date, ensure critical facility information is current, and identify/incorporate new and improved methods of warning and response. Adequacy of shelter facilities, response equipment and training can be evaluated during these ongoing reviews. Coordinate efforts with Lac Vieux Desert Tribe.

- *Responsible Agency*: Gogebic County Emergency Manager
- *Affected Jurisdictions*: All
- *Deadline:* Include in annual emergency plan revision process
- *Cost:* Staff time

- *Potential Funding Sources:* FEMA, DHS State Homeland Security Grant Program, Firefighter Assistance Grants, U.S. Department of Health and Human Services, and U.S. Department of the Interior
- *Benefits:* Emergency plans that are up to date and incorporate all available methods of warning and response will be most effective in emergency situations, thus mitigating loss from hazards.

Action Item 17: Early Warning System

Weather hazards are among the greatest threats in Gogebic County. Many of these are considered a part of everyday life, yet high hazard risk is associated with insufficient warnings. Tornadoes, for example, are a weather hazard that is often ignored in the county. An early warning system, which would be composed of various electronic components including a siren, would help to alleviate this threat.

- *Responsible Agency*: Lac Vieux Desert Tribe
- *Affected Jurisdictions*: Watersmeet Township (Lac Vieux Desert Reservation)
- *Deadline:* 2017
- *Cost:* $10,000
- *Potential Funding Sources:* FEMA Pre-Disaster Mitigation Program, FEMA Hazard Mitigation Grant Program, and tribal
- *Benefits:* A early warning system gives sufficient time for people to protect themselves as well as possible in the face of an imminent weather hazard.

5.5 Administrative Action

Action Item 16: Adopt Hazard Mitigation Plan and Update Regularly

By adopting the Gogebic County Hazard Mitigation Plan, the County and its municipalities recognize the need to incorporate hazard mitigation activities into everyday decisions at the County and local level. The plan will be reviewed annually by the Emergency Manager in coordination with the Emergency Action Guidelines to determine if revisions are needed.

The Hazard Mitigation Plan will be updated every 5 years in order to address changing priorities and remain eligible for FEMA mitigation funding programs. The

Emergency Manager will convene a hazard mitigation committee representing local agencies and concerned parties to evaluate progress and update the plan in accordance with FEMA regulations. The Committee will review the plan to determine the sections that need to be updated or modified based on changing conditions or alterations in State or Federal requirements. Goals, objectives and strategies will also be reviewed to determine if they thoroughly address new or changing conditions.

The Emergency Manager will work with Gogebic County to update the plan based on hazard mitigation committee and State Hazard Mitigation Officer recommendations. The public will be notified of any plan updates, and copies will be made available at all local government offices and online. The public will be provided with and notified of comment opportunities during all interim and 5- year plan updates.

- *Responsible Agency*: Emergency Manager
- *Affected Jurisdictions*: All
- *Deadline:* 2013 (ongoing)
- *Cost:* Staff time
- *Potential Funding Sources:* FEMA and organization/agency operating budgets
- *Benefits:* The adoption of the updated Hazard Mitigation Plan commits Gogebic County and its communities to working on mitigation efforts within its boundaries. Through implementation of mitigation strategies in the Plan, the County and municipalities will actively work to prevent future problems within Gogebic County.

Appendix A:

Letters of Intent to Participate

Gogebic County
Board of Commissioners

GOGEBIC COUNTY COURT HOUSE

JULIANE M. GIACKINO
ADMINISTRATOR

AMANDA L. PARKER
CONFIDENTIAL SECRETARY

November 19, 2009

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To whom it may concern,

Gogebic County intends to work with the county Emergency Management Director and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. Gogebic County will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

Thomas F. Gerovac
Chairman, Gogebic County Board of Commissioners

A09025

200 N. MOORE STREET
COURTHOUSE • BESSEMER, MICHIGAN 49911
PHONE: (906) 667-0411 • FAX: (906) 667-1102
EMAIL: JGIACKINO@GOGEBIC.ORG

CITY OF BESSEMER
CITY HALL
411 S. Sophie Street
Bessemer, Michigan 49911

City Clerk (906) 667-0333
City Treasurer (906) 663-4101
City Manager (906) 663-4311
FAX: (906) 667-0467
Michigan Relay TDD: 1-800-649-3777

John J. Frello
Mayor

November 18, 2009

RE: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update
Via facsimile

To Whom It May Concern:

The City of Bessemer intends to work with the County Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. The City of Bessemer will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

Thomas M. Chatel

Thomas M. Chatel, City Manager
City of Bessemer, Gogebic County

CITY OF IRONWOOD

"Live Where You Play"

213 S. Marquette Street
Ironwood, Michigan 49938

Telephone: (906) 932-5050
Fax: (906) 932-5745
www.cityofironwood.org

March 17, 2010

RE: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Ironwood City Commissioners:

The City of Ironwood intends to work with the County Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. The City of Ironwood will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

Scott Erickson
City or Ironwood

CITY MANAGER
(906) 229-5132

CITY OF WAKEFIELD, MICHIGAN
311 SUNDAY LAKE STREET
49968
Member
MICHIGAN MUNICIPAL LEAGUE
Fax (906) 229-5331
TDD (800) 649-3777

CITY CLERK
(906) 229-5131

November 24, 2009

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Whom It May Concern:

The City of Wakefield plans to work with the Gogebic County Emergency Management Coordinator and the Western Upper Peninsula Planning and Development Region to update the County's five year Hazard Mitigation Plan. As in the past, the City of Wakefield will participate in the update process by reviewing materials and providing comments in the planning process.

If you should have any questions, please do not hesitate to contact me.

Sincerely,

John C. Siira
City Manager

JCS/jj
Cc: James Loeper, Gogebic County Emergency Management Coordinator
Jim LaMuth, WUPPDR Transportation Coordinator

BESSEMER TOWNSHIP
GOGEBIC COUNTY, MICHIGAN
Bessemer Township is an equal opportunity provider & employer
BESSEMER TOWNSHIP ...respecting the past, envisioning the future

N10338 Mill Street
P.O. Box 304
Ramsay, Mi. 49959

Phone 906- 667- 0423
Fax 906- 667- 0436

TTD 800 649 3777

April 28, 2010

RE: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Whom it may Concern:

Bessemer Township intends to work with the county Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. Bessemer Township understands their participation will not result in any extra or undue cost to the Township and will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

Jeffery C. Randall
Bessemer Township Supervisor

Cc Jim Loeper - County Emergency Manager
WUPPDER

ERWIN TOWNSHIP
E5796 Pioneer Road
Ironwood, MI 49938

May 13, 2010

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Whom It May Concern:

Erwin Township intends to work with the County Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. Erwin Township will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

Prisilla J. Gerovac
Erwin Township Clerk

Charter Township of Ironwood

ironwoodtownship.org
(906) 932-5089 fax

N10892 Lake Road
Ironwood, MI 49938
(906) 932-5800

March 17, 2010

Re: Letter of Intent for Gogebic County 5-year Hazard Mitigation Plan Update

To Whom It May Concern,

The Charter Township of Ironwood intends to work with the County Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. The Charter Township of Ironwood will gladly participate in the update process by reviewing materials and providing comments in the planning process. Thank you for the opportunity to participate.

Sincerely,

Kim Mattson
Supervisor

Marenisco Township
314 Hall Street
PO Box 198
Marenisco, MI 49947
Office 906-787-2463 Fax 906-787-2244

May 17, 2010

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Whom It May Concern:

Marenisco Township intends to work with the county Ernergency Manager and Western Upper Peninsula Planning and Developrnent Region to update the County's 5-year Hazard Mitigation Plan. Marenisco Township will participate in the update process by reviewing rnaterials and providing comments in the planning process.

Sincerely,

Richard Bouvette
Marenisco Township Supervisor

TOWNSHIP OF WAKEFIELD
Gogebic County
Office Located at: 414 No. Co. Rd. 519
Wakefield, Michigan 49968
Phone 906 224-8551
Fax 906 229-5278

November 18, 2009

Jim LaMuth
Transportation Coordinator / Planner
Western Upper Peninsula Planning and Development Region (WUPPDR)
PO Box 365
Houghton, MI 49931-0365

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To whom it may concern,

Wakefield Township intends to work with the county Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. Wakefield Township will participate in the update process by reviewing materials and providing comments in the planning process.

Sincerely,

John Cox

Supervisor, Wakefield Township

Township of Watersmeet

WATERSMEET, MICHIGAN 49969

April 28, 2010

Re: Letter of Intent to Gogebic County 5-year Hazard Mitigation Plan Update

To Whom It May Concern:

Watersmeet Township intends to work with the county Emergency Manager and Western Upper Peninsula Planning and Development Region to update the County's 5-year Hazard Mitigation Plan. Watersmeet Township will participate in the update process by reviewing and providing comments in the planning process.

Sincerely,

Frank Kuchevar

Frank Kuchevar-Supervisor
Watersmeet Township

Appendix B:

Hazard Ranking Matrices

Overview

Included in this Appendix are rankings of hazard priorities for each local jurisdiction. For each page, hazards are scored and displayed in three ways:

- At top left: Chart shows the raw scoring of various hazard factors with 10 being most impactful or severe. Detailed explanations of the 1-10 scale range for each respective factor are available in the annotated electronic Microsoft Excel spreadsheet.
- At bottom left: Chart shows weighted scoring of each factor based on relative impact or importance of each factor.
- At bottom right: Chart shows final ranking of hazard priority based on weighted scores. Total score at bottom of each chart can generally be disregarded. It represents total impact of all hazards on the community (highest in urbanized areas).

Preceding the hazard ranking pages for each local jurisdiction are 1) a list of categorized hazards and color key for the priority ranking and 2) countywide hazard ranking.

Hazard List

Natural Disasters
DAM FAILURE
RIVERINE & URBAN FLOODING
SHORELINE FLOODING/EROSION
SCRAP TIRE FIRES
STRUCTURAL FIRES
WILDFIRES
SUBSIDENCE

Weather
DROUGHT
EXTREME TEMPERATURES
HAIL
ICE & SLEET STORMS
LIGHTNING
HIGH WINDS
SNOW STORMS
TORNADOES

Technological
HAZMAT: FIXED SITE INCIDENT
HAZMAT: TRANSPORTATION INCIDENT
INFRA FAILURE/2NDARY TECH HAZARD (infrastructure failure or resulting event)
PASSENGER ACCIDENT
PETROLEUM/NATURAL GAS ACCIDENT
NUCLEAR POWER PLANT ACCIDENT

Human-Related
CIVIL DISTURBANCES
PUBLIC HEALTH EMERGENCY
SABOTAGE/TERRORISM

Color Key for Final Hazard Ranking

RED	Highest-Ranked Hazard	
PINK	High Risk:	>=6 Rating
YELLOW	Moderate Risk:	4-<6 Rating
GREEN	Low Risk:	<4 Rating

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Countywide

	Probability/Frequency	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	2	5	9	4	7	4	9	10	7	5	62
STRUCTURAL FIRES	10	2	10	2	5	3	10	8	10	4	64
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	7	4	4	9	3	6	8	61
WILDFIRES	8	8	6	6	9	7	8	7	5	7	71
RIVERINE & URBAN FLOODING	6	7	2	7	9	6	5	8	3	4	57
HIGH WINDS	9	9	3	6	2	3	5	5	3	3	48
PETROLEUM/NATURAL GAS ACCIDENT	5	7	10	3	4	4	10	10	8	8	69
PUBLIC HEALTH EMERGENCY	2	5	8	8	2	7	9	2	5	5	53
HAIL	10	5	10	3	3	1	9	5	8	9	63
HAZMAT: FIXED SITE INCIDENT	1	3	10	2	2	3	10	5	5	5	46
SABOTAGE/TERRORISM	1	3	9	3	4	3	10	5	10	8	56
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	3	7	5	2	5	8	3	9	3	47
SUBSIDENCE	3	5	8	2	4	2	10	5	9	7	55
HAZMAT: TRANSPORTATION INCIDENT	3	2	10	2	4	3	10	5	9	7	55
ICE & SLEET STORMS	2	9	8	9	2	3	6	6	4	8	57
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	3	10	2	2	2	10	3	10	9	53
DROUGHT	4	10	1	10	5	10	1	2	1	10	54
TORNADOES	1	4	8	4	2	1	9	5	9	9	52
LIGHTNING	2	2	10	1	1	1	7	2	8	6	40
SHORELINE FLOODING/EROSION	2	2	2	1	3	7	5	2	3	2	29
SCRAP TIRE FIRES	1	1	10	1	2	3	5	3	8	5	39

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.30	0.50	0.45	0.60	1.05	0.40	0.45	1.00	0.35	0.50	5.60
STRUCTURAL FIRES	1.50	0.20	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.75
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	1.05	0.60	0.40	0.45	0.30	0.30	0.80	5.85
WILDFIRES	1.20	0.80	0.30	0.90	1.35	0.70	0.40	0.70	0.25	0.70	7.30
RIVERINE & URBAN FLOODING	0.90	0.70	0.10	1.05	1.35	0.60	0.25	0.80	0.15	0.40	6.30
HIGH WINDS	1.35	0.90	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	5.10
PETROLEUM/NATURAL GAS ACCIDENT	0.75	0.70	0.50	0.45	0.60	0.40	0.50	1.00	0.40	0.80	6.10
PUBLIC HEALTH EMERGENCY	0.30	0.50	0.40	1.20	0.30	0.70	0.45	0.20	0.25	0.50	4.80
HAIL	1.50	0.50	0.50	0.45	0.45	0.10	0.45	0.50	0.40	0.90	5.75
HAZMAT: FIXED SITE INCIDENT	0.15	0.30	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.60
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.45	0.60	0.30	0.50	0.50	0.50	0.80	4.55
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.30	0.35	0.75	0.30	0.50	0.40	0.30	0.45	0.30	3.95
SUBSIDENCE	0.45	0.50	0.40	0.30	0.60	0.20	0.50	0.50	0.45	0.70	4.60
HAZMAT: TRANSPORTATION INCIDENT	0.45	0.20	0.50	0.30	0.60	0.30	0.50	0.50	0.45	0.70	4.50
ICE & SLEET STORMS	0.30	0.90	0.40	1.35	0.30	0.30	0.30	0.60	0.20	0.80	5.45
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.30	0.50	0.30	0.30	0.20	0.50	0.30	0.50	0.90	4.10
DROUGHT	0.60	1.00	0.05	1.50	0.75	1.00	0.05	0.20	0.05	1.00	6.20
TORNADOES	0.15	0.40	0.40	0.60	0.30	0.10	0.45	0.50	0.45	0.90	4.25
LIGHTNING	0.30	0.20	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.95
SHORELINE FLOODING/EROSION	0.30	0.20	0.10	0.15	0.45	0.70	0.25	0.20	0.15	0.20	2.70
SCRAP TIRE FIRES	0.15	0.10	0.50	0.15	0.30	0.30	0.25	0.30	0.40	0.50	2.95

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	7.30
SNOW STORMS	6.50
RIVERINE & URBAN FLOODING	6.30
DROUGHT	6.20
PETROLEUM/NATURAL GAS ACCIDENT	6.10
INFRA FAILURE/2NDARY TECH HAZARD	5.85
HAIL	5.75
STRUCTURAL FIRES	5.75
DAM FAILURE	5.60
ICE & SLEET STORMS	5.45
EXTREME TEMPERATURES	5.35
HIGH WINDS	5.10
PUBLIC HEALTH EMERGENCY	4.80
SUBSIDENCE	4.60
SABOTAGE/TERRORISM	4.55
HAZMAT: TRANSPORTATION INCIDENT	4.50
TORNADOES	4.25
PASSENGER ACCIDENT	4.10
CIVIL DISTURBANCE	3.95
HAZMAT: FIXED SITE INCIDENT	3.60
LIGHTNING	2.95
SCRAP TIRE FIRES	2.95
SHORELINE FLOODING/EROSION	2.70
TOTAL	114.2

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Bessemer Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	1	5	9	4	8	4	9	7	7	5	59
STRUCTURAL FIRES	10	1	10	2	5	3	10	8	10	4	63
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	6	4	4	9	3	6	8	60
WILDFIRES	8	8	6	7	9	7	8	7	5	7	72
RIVERINE & URBAN FLOODING	5	7	2	7	9	6	6	8	3	3	56
HIGH WINDS	8	9	3	6	2	3	5	5	3	3	47
PETROLEUM/NATURAL GAS ACCIDENT	6	5	10	6	6	4	10	10	8	8	73
PUBLIC HEALTH EMERGENCY	2	8	8	8	2	7	9	2	5	5	56
HAIL	4	5	10	3	3	1	9	5	8	9	57
HAZMAT: FIXED SITE INCIDENT	1	2	10	2	2	3	10	5	5	5	45
SABOTAGE/TERRORISM	1	3	9	3	4	3	10	5	10	8	56
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	3	7	5	2	5	8	3	9	3	47
SUBSIDENCE	4	7	8	3	6	2	10	5	9	7	61
HAZMAT: TRANSPORTATION INCIDENT	3	4	10	3	5	3	10	5	9	7	59
ICE & SLEET STORMS	2	9	8	9	4	3	6	7	4	8	60
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	4	10	2	2	2	10	3	10	9	54
DROUGHT	4	10	1	9	5	10	1	2	1	10	53
TORNADOES	1	4	8	5	2	1	9	5	9	9	53
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SCRAP TIRE FIRES	2	1	10	2	2	3	5	3	8	4	40

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.15	0.50	0.45	0.60	1.20	0.40	0.45	0.70	0.35	0.50	5.30
STRUCTURAL FIRES	1.50	0.10	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.65
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	0.90	0.60	0.40	0.45	0.30	0.30	0.80	5.70
WILDFIRES	1.20	0.80	0.30	1.05	1.35	0.70	0.40	0.70	0.25	0.70	7.45
RIVERINE & URBAN FLOODING	0.75	0.70	0.10	1.05	1.35	0.60	0.30	0.80	0.15	0.30	6.10
HIGH WINDS	1.20	0.90	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	4.95
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.50	0.50	0.90	0.90	0.40	0.50	1.00	0.40	0.80	6.80
PUBLIC HEALTH EMERGENCY	0.30	0.80	0.40	1.20	0.30	0.70	0.45	0.20	0.25	0.50	5.10
HAIL	0.60	0.50	0.50	0.45	0.45	0.10	0.45	0.50	0.40	0.90	4.85
HAZMAT: FIXED SITE INCIDENT	0.15	0.20	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.50
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.45	0.60	0.30	0.50	0.50	0.50	0.80	4.55
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.30	0.35	0.75	0.30	0.50	0.40	0.30	0.45	0.30	3.95
SUBSIDENCE	0.60	0.70	0.40	0.45	0.90	0.20	0.50	0.50	0.45	0.70	5.40
HAZMAT: TRANSPORTATION INCIDENT	0.45	0.40	0.50	0.45	0.75	0.30	0.50	0.50	0.45	0.70	5.00
ICE & SLEET STORMS	0.30	0.90	0.40	1.35	0.60	0.30	0.30	0.70	0.20	0.80	5.85
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.40	0.50	0.30	0.30	0.20	0.50	0.30	0.50	0.90	4.20
DROUGHT	0.60	1.00	0.05	1.35	0.75	1.00	0.05	0.20	0.05	1.00	6.05
TORNADOES	0.15	0.40	0.40	0.75	0.30	0.10	0.45	0.50	0.45	0.90	4.40
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SCRAP TIRE FIRES	0.30	0.10	0.50	0.30	0.30	0.30	0.25	0.30	0.40	0.40	3.15

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	7.45
SNOW STORMS	6.50
RIVERINE & URBAN FLOODING	6.10
DROUGHT	6.05
ICE & SLEET STORMS	5.85
PETROLEUM/NATURAL GAS ACCIDENT	5.70
INFRA FAILURE/2NDARY TECH HAZARD	5.70
STRUCTURAL FIRES	5.65
SUBSIDENCE	5.40
EXTREME TEMPERATURES	5.35
DAM FAILURE	5.30
PUBLIC HEALTH EMERGENCY	5.10
HAZMAT: TRANSPORTATION INCIDENT	5.00
HIGH WINDS	4.95
HAIL	4.85
SABOTAGE/TERRORISM	4.55
TORNADOES	4.40
PASSENGER ACCIDENT	4.20
CIVIL DISTURBANCE	3.95
HAZMAT: FIXED SITE INCIDENT	3.50
SCRAP TIRE FIRES	3.15
LIGHTNING	2.85
TOTAL	111.55

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Erwin Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	2	6	9	5	5	4	9	8	8	5	61
STRUCTURAL FIRES	10	1	10	1	5	3	10	8	10	4	62
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	7	4	4	9	3	6	8	61
WILDFIRES	5	6	6	7	9	7	8	7	5	7	67
RIVERINE & URBAN FLOODING	6	7	2	7	9	6	6	8	3	4	58
HIGH WINDS	8	9	3	6	2	3	5	5	3	3	47
PETROLEUM/NATURAL GAS ACCIDENT	1	1	10	2	3	4	10	3	10	10	54
PUBLIC HEALTH EMERGENCY	2	9	8	8	2	7	9	2	5	5	57
HAIL	4	5	10	5	3	1	9	5	8	9	59
HAZMAT: FIXED SITE INCIDENT	1	3	10	2	2	3	10	5	5	5	46
SABOTAGE/TERRORISM	1	3	9	4	4	3	10	5	10	8	57
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	4	7	6	2	5	8	3	9	3	49
SUBSIDENCE	3	2	8	1	5	2	10	4	9	7	51
HAZMAT: TRANSPORTATION INCIDENT	2	1	10	2	4	3	10	5	9	7	53
ICE & SLEET STORMS	2	9	8	9	2	3	6	6	4	8	57
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	1	1	10	2	2	2	10	3	10	8	49
DROUGHT	4	10	1	9	5	10	1	2	1	10	53
TORNADOES	1	4	8	6	2	1	9	5	9	9	54
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SCRAP TIRE FIRES	2	2	10	2	2	3	5	3	8	4	41

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.30	0.60	0.45	0.75	0.75	0.40	0.45	0.80	0.40	0.50	5.40
STRUCTURAL FIRES	1.50	0.10	0.50	0.15	0.75	0.30	0.50	0.80	0.50	0.40	5.50
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	1.05	0.60	0.40	0.45	0.30	0.30	0.80	5.85
WILDFIRES	0.75	0.60	0.30	1.05	1.35	0.70	0.40	0.70	0.25	0.70	6.80
RIVERINE & URBAN FLOODING	0.90	0.70	0.10	1.05	1.35	0.60	0.30	0.80	0.15	0.40	6.35
HIGH WINDS	1.20	0.90	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	4.95
PETROLEUM/NATURAL GAS ACCIDENT	0.15	0.10	0.50	0.30	0.45	0.40	0.50	0.30	0.50	1.00	4.20
PUBLIC HEALTH EMERGENCY	0.30	0.90	0.40	1.20	0.30	0.70	0.45	0.20	0.25	0.50	5.20
HAIL	0.60	0.50	0.50	0.75	0.45	0.10	0.45	0.50	0.40	0.90	5.15
HAZMAT: FIXED SITE INCIDENT	0.15	0.30	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.60
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.60	0.60	0.30	0.50	0.50	0.50	0.80	4.70
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.40	0.35	0.90	0.30	0.50	0.40	0.30	0.45	0.30	4.20
SUBSIDENCE	0.45	0.20	0.40	0.15	0.75	0.20	0.50	0.40	0.45	0.70	4.20
HAZMAT: TRANSPORTATION INCIDENT	0.30	0.10	0.50	0.30	0.60	0.30	0.50	0.50	0.45	0.70	4.25
ICE & SLEET STORMS	0.30	0.90	0.40	1.35	0.30	0.30	0.30	0.60	0.20	0.80	5.45
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.15	0.10	0.50	0.30	0.30	0.20	0.50	0.30	0.50	0.80	3.65
DROUGHT	0.60	1.00	0.05	1.35	0.75	1.00	0.05	0.20	0.05	1.00	6.05
TORNADOES	0.15	0.40	0.40	0.90	0.30	0.10	0.45	0.50	0.45	0.90	4.55
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SCRAP TIRE FIRES	0.30	0.20	0.50	0.30	0.30	0.30	0.25	0.30	0.40	0.40	3.25

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	6.80
SNOW STORMS	6.50
RIVERINE & URBAN FLOODING	6.35
DROUGHT	6.05
INFRA FAILURE/2NDARY TECH HAZARD	5.85
STRUCTURAL FIRES	5.50
ICE & SLEET STORMS	5.45
DAM FAILURE	5.40
EXTREME TEMPERATURES	5.35
PUBLIC HEALTH EMERGENCY	5.20
HAIL	5.15
HIGH WINDS	4.95
SABOTAGE/TERRORISM	4.70
TORNADOES	4.55
HAZMAT: TRANSPORTATION INCIDENT	4.25
CIVIL DISTURBANCE	4.20
SUBSIDENCE	4.20
PETROLEUM/NATURAL GAS ACCIDENT	4.20
PASSENGER ACCIDENT	3.65
HAZMAT: FIXED SITE INCIDENT	3.60
SCRAP TIRE FIRES	3.25
LIGHTNING	2.85
TOTAL	108.00

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Ironwood Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	2	6	10	5	5	4	9	6	10	5	62
STRUCTURAL FIRES	10	1	10	2	5	3	10	8	10	4	63
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	6	4	4	9	3	6	8	60
WILDFIRES	6	7	6	7	9	7	8	7	5	7	69
RIVERINE & URBAN FLOODING	9	7	4	7	9	6	7	8	3	4	64
HIGH WINDS	10	10	3	8	2	3	5	5	3	3	52
PETROLEUM/NATURAL GAS ACCIDENT	6	5	10	6	6	4	10	10	8	8	73
PUBLIC HEALTH EMERGENCY	2	8	8	8	2	7	9	2	5	5	56
HAIL	4	5	10	4	3	1	9	5	8	9	58
HAZMAT: FIXED SITE INCIDENT	1	2	10	2	2	3	10	5	5	5	45
SABOTAGE/TERRORISM	1	3	9	3	4	3	10	5	10	8	56
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	4	7	5	2	5	8	3	9	3	48
SUBSIDENCE	3	2	8	2	4	2	10	4	9	7	51
HAZMAT: TRANSPORTATION INCIDENT	2	1	10	2	4	3	10	5	9	7	53
ICE & SLEET STORMS	2	9	8	9	4	3	6	7	4	8	60
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	1	1	10	2	2	2	10	4	10	9	51
DROUGHT	4	10	1	9	5	10	1	2	1	10	53
TORNADOES	1	4	8	6	2	1	9	5	9	9	54
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SHORELINE FLOODING/EROSION	9	2	2	3	5	10	2	4	3	8	48
SCRAP TIRE FIRES	2	2	10	2	3	3	5	3	8	3	41

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.30	0.60	0.50	0.75	0.75	0.40	0.45	0.60	0.50	0.50	5.35
STRUCTURAL FIRES	1.50	0.10	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.65
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	0.90	0.60	0.40	0.45	0.30	0.30	0.80	5.70
WILDFIRES	0.90	0.70	0.30	1.05	1.35	0.70	0.40	0.70	0.25	0.70	7.05
RIVERINE & URBAN FLOODING	1.35	0.70	0.20	1.05	1.35	0.60	0.35	0.80	0.15	0.40	6.95
HIGH WINDS	1.50	1.00	0.15	1.20	0.30	0.30	0.25	0.50	0.15	0.30	5.65
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.50	0.50	0.90	0.90	0.40	0.50	1.00	0.40	0.80	6.80
PUBLIC HEALTH EMERGENCY	0.30	0.80	0.40	1.20	0.30	0.70	0.45	0.20	0.25	0.50	5.10
HAIL	0.60	0.50	0.50	0.60	0.45	0.10	0.45	0.50	0.40	0.90	5.00
HAZMAT: FIXED SITE INCIDENT	0.15	0.20	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.50
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.45	0.60	0.30	0.50	0.50	0.50	0.80	4.55
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.40	0.35	0.75	0.30	0.50	0.40	0.30	0.45	0.30	4.05
SUBSIDENCE	0.45	0.20	0.40	0.30	0.60	0.20	0.50	0.40	0.45	0.70	4.20
HAZMAT: TRANSPORTATION INCIDENT	0.30	0.10	0.50	0.30	0.60	0.30	0.50	0.50	0.45	0.70	4.25
ICE & SLEET STORMS	0.30	0.90	0.40	1.35	0.60	0.30	0.30	0.70	0.20	0.80	5.85
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.15	0.10	0.50	0.30	0.30	0.20	0.50	0.40	0.50	0.90	3.85
DROUGHT	0.60	1.00	0.05	1.35	0.75	1.00	0.05	0.20	0.05	1.00	6.05
TORNADOES	0.15	0.40	0.40	0.90	0.30	0.10	0.45	0.50	0.45	0.90	4.55
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SHORELINE FLOODING/EROSION	1.35	0.20	0.10	0.45	0.75	1.00	0.10	0.40	0.15	0.80	5.30
SCRAP TIRE FIRES	0.30	0.20	0.50	0.30	0.45	0.30	0.25	0.30	0.40	0.30	3.30

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	7.05
RIVERINE & URBAN FLOODING	6.95
PETROLEUM/NATURAL GAS ACCIDENT	6.80
SNOW STORMS	6.50
DROUGHT	6.05
ICE & SLEET STORMS	5.85
INFRA FAILURE/2NDARY TECH HAZARD	5.70
STRUCTURAL FIRES	5.65
HIGH WINDS	5.65
DAM FAILURE	5.35
EXTREME TEMPERATURES	5.35
SHORELINE FLOODING/EROSION	5.30
PUBLIC HEALTH EMERGENCY	5.10
HAIL	5.00
TORNADOES	4.55
SABOTAGE/TERRORISM	4.55
HAZMAT: TRANSPORTATION INCIDENT	4.25
SUBSIDENCE	4.20
CIVIL DISTURBANCE	4.05
PASSENGER ACCIDENT	3.85
HAZMAT: FIXED SITE INCIDENT	3.50
SCRAP TIRE FIRES	3.30
LIGHTNING	2.85
TOTAL	117.40

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Marenisco Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	2	3	9	4	6	4	9	7	7	5	56
STRUCTURAL FIRES	10	1	10	2	5	3	10	8	10	4	63
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	5	4	4	9	3	6	8	59
WILDFIRES	8	10	7	9	9	7	8	7	5	7	77
RIVERINE & URBAN FLOODING	5	5	2	4	5	6	6	5	3	5	46
HIGH WINDS	8	8	3	6	2	3	5	5	3	3	46
PETROLEUM/NATURAL GAS ACCIDENT	6	6	10	4	4	4	10	10	8	8	70
PUBLIC HEALTH EMERGENCY	2	6	8	7	2	7	9	2	5	5	53
HAIL	4	5	10	2	3	1	9	5	8	9	56
HAZMAT: FIXED SITE INCIDENT	1	2	10	2	2	3	10	5	5	5	45
SABOTAGE/TERRORISM	1	3	9	3	4	3	10	5	10	8	56
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	3	6	8	7	2	6	8	3	9	3	55
SUBSIDENCE	1	1	8	1	4	2	10	4	9	7	47
HAZMAT: TRANSPORTATION INCIDENT	3	2	10	3	4	3	10	8	9	7	59
ICE & SLEET STORMS	2	9	8	8	2	3	6	6	4	8	56
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	2	10	2	2	2	10	3	10	9	52
DROUGHT	4	10	1	9	5	10	1	2	1	10	53
TORNADOES	1	4	8	4	2	1	9	5	9	9	52
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SCRAP TIRE FIRES	1	1	10	1	2	3	5	3	8	5	39

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.30	0.30	0.45	0.60	0.90	0.40	0.45	0.70	0.35	0.50	4.95
STRUCTURAL FIRES	1.50	0.10	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.65
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	0.75	0.60	0.40	0.45	0.30	0.30	0.80	5.55
WILDFIRES	1.20	1.00	0.35	1.35	1.35	0.70	0.40	0.70	0.25	0.70	8.00
RIVERINE & URBAN FLOODING	0.75	0.50	0.10	0.60	0.75	0.60	0.30	0.50	0.15	0.50	4.75
HIGH WINDS	1.20	0.80	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	4.85
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.60	0.50	0.60	0.60	0.40	0.50	1.00	0.40	0.80	6.30
PUBLIC HEALTH EMERGENCY	0.30	0.60	0.40	1.05	0.30	0.70	0.45	0.20	0.25	0.50	4.75
HAIL	0.60	0.50	0.50	0.30	0.45	0.10	0.45	0.50	0.40	0.90	4.70
HAZMAT: FIXED SITE INCIDENT	0.15	0.20	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.50
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.45	0.60	0.30	0.50	0.50	0.50	0.80	4.55
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.45	0.60	0.40	1.05	0.30	0.60	0.40	0.30	0.45	0.30	4.85
SUBSIDENCE	0.15	0.10	0.40	0.15	0.60	0.20	0.50	0.40	0.45	0.70	3.65
HAZMAT: TRANSPORTATION INCIDENT	0.45	0.20	0.50	0.45	0.60	0.30	0.50	0.80	0.45	0.70	4.95
ICE & SLEET STORMS	0.30	0.90	0.40	1.20	0.30	0.30	0.30	0.60	0.20	0.80	5.30
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.20	0.50	0.30	0.30	0.20	0.50	0.30	0.50	0.90	4.00
DROUGHT	0.60	1.00	0.05	1.35	0.75	1.00	0.05	0.20	0.05	1.00	6.05
TORNADOES	0.15	0.40	0.40	0.60	0.30	0.10	0.45	0.50	0.45	0.90	4.25
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SCRAP TIRE FIRES	0.15	0.10	0.50	0.15	0.30	0.30	0.25	0.30	0.40	0.50	2.95

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	8.00
SNOW STORMS	6.50
PETROLEUM/NATURAL GAS ACCIDENT	6.30
DROUGHT	6.05
STRUCTURAL FIRES	5.65
INFRA FAILURE/2NDARY TECH HAZARD	5.55
EXTREME TEMPERATURES	5.35
ICE & SLEET STORMS	5.30
DAM FAILURE	5.25
HAZMAT: TRANSPORTATION INCIDENT	4.95
HIGH WINDS	4.85
CIVIL DISTURBANCE	4.85
RIVERINE & URBAN FLOODING	4.75
PUBLIC HEALTH EMERGENCY	4.75
HAIL	4.70
SABOTAGE/TERRORISM	4.55
TORNADOES	4.25
PASSENGER ACCIDENT	4.00
SUBSIDENCE	3.65
HAZMAT: FIXED SITE INCIDENT	3.50
SCRAP TIRE FIRES	2.95
LIGHTNING	2.85
TOTAL	108.55

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Wakefield Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	2	6	7	4	5	4	9	5	7	5	54
STRUCTURAL FIRES	10	1	10	2	5	3	10	8	10	4	63
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	6	4	4	9	3	6	8	60
WILDFIRES	8	9	6	8	9	7	8	7	5	7	74
RIVERINE & URBAN FLOODING	5	7	3	7	9	6	6	8	3	4	58
HIGH WINDS	9	9	3	7	2	3	5	5	3	3	49
PETROLEUM/NATURAL GAS ACCIDENT	6	6	10	5	5	4	10	10	8	8	72
PUBLIC HEALTH EMERGENCY	2	5	8	8	2	7	9	2	5	5	53
HAIL	4	5	10	3	3	1	9	5	8	9	57
HAZMAT: FIXED SITE INCIDENT	1	2	10	2	2	3	10	5	5	5	45
SABOTAGE/TERRORISM	1	3	9	4	4	3	10	5	10	8	57
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	4	7	5	2	5	8	3	9	3	48
SUBSIDENCE	3	2	8	1	5	2	10	4	9	7	51
HAZMAT: TRANSPORTATION INCIDENT	3	2	10	4	6	3	10	5	9	7	59
ICE & SLEET STORMS	2	9	8	9	2	3	6	6	4	8	57
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	3	10	3	2	2	10	3	10	9	54
DROUGHT	4	10	1	9	5	10	3	4	1	9	56
TORNADOES	1	4	8	5	2	1	9	5	9	9	53
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SHORELINE FLOODING/EROSION	3	1	2	2	3	4	5	2	3	2	27
SCRAP TIRE FIRES	1	1	10	1	2	3	5	3	8	5	39

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.30	0.60	0.35	0.60	0.75	0.40	0.45	0.50	0.35	0.50	4.80
STRUCTURAL FIRES	1.50	0.10	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.65
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	0.90	0.60	0.40	0.45	0.30	0.30	0.80	5.70
WILDFIRES	1.20	0.90	0.30	1.20	1.35	0.70	0.40	0.70	0.25	0.70	7.70
RIVERINE & URBAN FLOODING	0.75	0.70	0.15	1.05	1.35	0.60	0.30	0.80	0.15	0.40	6.25
HIGH WINDS	1.35	0.90	0.15	1.05	0.30	0.30	0.25	0.50	0.15	0.30	5.25
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.60	0.50	0.75	0.75	0.40	0.50	1.00	0.40	0.80	6.60
PUBLIC HEALTH EMERGENCY	0.30	0.50	0.40	1.20	0.30	0.70	0.45	0.20	0.25	0.50	4.80
HAIL	0.60	0.50	0.50	0.45	0.45	0.10	0.45	0.50	0.40	0.90	4.85
HAZMAT: FIXED SITE INCIDENT	0.15	0.20	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.50
SABOTAGE/TERRORISM	0.15	0.30	0.45	0.60	0.60	0.30	0.50	0.50	0.50	0.80	4.70
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.40	0.35	0.75	0.30	0.50	0.40	0.30	0.45	0.30	4.05
SUBSIDENCE	0.45	0.20	0.40	0.15	0.75	0.20	0.50	0.40	0.45	0.70	4.20
HAZMAT: TRANSPORTATION INCIDENT	0.45	0.20	0.50	0.60	0.90	0.30	0.50	0.50	0.45	0.70	5.10
ICE & SLEET STORMS	0.30	0.90	0.40	1.35	0.30	0.30	0.30	0.60	0.20	0.80	5.45
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.30	0.50	0.45	0.30	0.20	0.50	0.30	0.50	0.90	4.25
DROUGHT	0.60	1.00	0.05	1.35	0.75	1.00	0.15	0.40	0.05	0.90	6.25
TORNADOES	0.15	0.40	0.40	0.75	0.30	0.10	0.45	0.50	0.45	0.90	4.40
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SHORELINE FLOODING/EROSION	0.45	0.10	0.10	0.30	0.45	0.40	0.25	0.20	0.15	0.20	2.60
SCRAP TIRE FIRES	0.15	0.10	0.50	0.15	0.30	0.30	0.25	0.30	0.40	0.50	2.95

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	7.70
PETROLEUM/NATURAL GAS ACCIDENT	6.60
SNOW STORMS	6.50
DROUGHT	6.25
RIVERINE & URBAN FLOODING	6.25
INFRA FAILURE/2NDARY TECH HAZARD	5.70
STRUCTURAL FIRES	5.65
ICE & SLEET STORMS	5.45
EXTREME TEMPERATURES	5.35
HIGH WINDS	5.25
HAZMAT: TRANSPORTATION INCIDENT	5.10
HAIL	4.85
DAM FAILURE	4.80
PUBLIC HEALTH EMERGENCY	4.80
SABOTAGE/TERRORISM	4.70
TORNADOES	4.40
PASSENGER ACCIDENT	4.25
SUBSIDENCE	4.20
CIVIL DISTURBANCE	4.05
HAZMAT: FIXED SITE INCIDENT	3.50
SCRAP TIRE FIRES	2.95
LIGHTNING	2.85
SHORELINE FLOODING/EROSION	2.60
TOTAL	113.75

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

Watersmeet Township

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	1	3	9	4	5	4	9	4	7	5	51
STRUCTURAL FIRES	10	1	10	2	5	3	10	8	10	4	63
INFRA FAILURE/2NDARY TECH HAZARD	7	5	8	5	4	4	9	3	6	8	59
WILDFIRES	8	10	7	10	9	7	8	7	5	7	78
RIVERINE & URBAN FLOODING	3	3	2	3	3	5	5	3	4	5	36
HIGH WINDS	8	9	3	7	2	3	5	5	3	3	48
PETROLEUM/NATURAL GAS ACCIDENT	6	6	10	4	5	4	10	10	8	8	71
PUBLIC HEALTH EMERGENCY	2	5	7	7	5	7	9	2	5	5	54
HAIL	4	5	10	2	3	1	9	5	8	9	56
HAZMAT: FIXED SITE INCIDENT	1	2	10	2	2	3	10	5	5	5	45
SABOTAGE/TERRORISM	1	2	9	3	4	3	10	5	10	8	55
SNOW STORMS	10	10	4	10	3	4	4	4	3	7	59
CIVIL DISTURBANCE	2	3	7	4	2	5	8	3	9	3	46
SUBSIDENCE	1	1	8	1	4	2	10	4	9	7	47
HAZMAT: TRANSPORTATION INCIDENT	3	2	10	3	4	3	10	4	9	7	55
ICE & SLEET STORMS	2	9	8	8	2	3	6	6	4	8	56
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	1	10	2	2	2	10	3	10	9	51
DROUGHT	4	10	1	10	5	10	1	2	1	10	54
TORNADOES	1	4	8	4	2	1	9	5	9	9	52
LIGHTNING	2	1	10	1	1	1	7	2	8	6	39
SCRAP TIRE FIRES	1	1	10	1	2	3	5	3	8	5	39

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.15	0.30	0.45	0.60	0.75	0.40	0.45	0.40	0.35	0.50	4.35
STRUCTURAL FIRES	1.50	0.10	0.50	0.30	0.75	0.30	0.50	0.80	0.50	0.40	5.65
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.50	0.40	0.75	0.60	0.40	0.45	0.30	0.30	0.80	5.55
WILDFIRES	1.20	1.00	0.35	1.50	1.35	0.70	0.40	0.70	0.25	0.70	8.15
RIVERINE & URBAN FLOODING	0.45	0.30	0.10	0.45	0.45	0.50	0.25	0.30	0.20	0.50	3.50
HIGH WINDS	1.20	0.90	0.15	1.05	0.30	0.30	0.25	0.50	0.15	0.30	5.10
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.60	0.50	0.60	0.75	0.40	0.50	1.00	0.40	0.80	6.45
PUBLIC HEALTH EMERGENCY	0.30	0.50	0.35	1.05	0.75	0.70	0.45	0.20	0.25	0.50	5.05
HAIL	0.60	0.50	0.50	0.30	0.45	0.10	0.45	0.50	0.40	0.90	4.70
HAZMAT: FIXED SITE INCIDENT	0.15	0.20	0.50	0.30	0.30	0.30	0.50	0.50	0.25	0.50	3.50
SABOTAGE/TERRORISM	0.15	0.20	0.45	0.45	0.60	0.30	0.50	0.50	0.50	0.80	4.45
SNOW STORMS	1.50	1.00	0.20	1.50	0.45	0.40	0.20	0.40	0.15	0.70	6.50
CIVIL DISTURBANCE	0.30	0.30	0.35	0.60	0.30	0.50	0.40	0.30	0.45	0.30	3.80
SUBSIDENCE	0.15	0.10	0.40	0.15	0.60	0.20	0.50	0.40	0.45	0.70	3.65
HAZMAT: TRANSPORTATION INCIDENT	0.45	0.20	0.50	0.45	0.60	0.30	0.50	0.40	0.45	0.70	4.55
ICE & SLEET STORMS	0.30	0.90	0.40	1.20	0.30	0.30	0.30	0.60	0.20	0.80	5.30
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.10	0.50	0.30	0.30	0.20	0.50	0.30	0.50	0.90	3.90
DROUGHT	0.60	1.00	0.05	1.50	0.75	1.00	0.05	0.20	0.05	1.00	6.20
TORNADOES	0.15	0.40	0.40	0.60	0.30	0.10	0.45	0.50	0.45	0.90	4.25
LIGHTNING	0.30	0.10	0.50	0.15	0.15	0.10	0.35	0.20	0.40	0.60	2.85
SCRAP TIRE FIRES	0.15	0.10	0.50	0.15	0.30	0.30	0.25	0.30	0.40	0.50	2.95

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
WILDFIRES	8.15
SNOW STORMS	6.50
PETROLEUM/NATURAL GAS ACCIDENT	6.45
DROUGHT	6.20
STRUCTURAL FIRES	5.65
INFRA FAILURE/2NDARY TECH HAZARD	5.55
EXTREME TEMPERATURES	5.35
ICE & SLEET STORMS	5.30
HIGH WINDS	5.10
PUBLIC HEALTH EMERGENCY	5.05
HAIL	4.70
HAZMAT: TRANSPORTATION INCIDENT	4.55
SABOTAGE/TERRORISM	4.45
DAM FAILURE	4.35
TORNADOES	4.25
PASSENGER ACCIDENT	3.90
CIVIL DISTURBANCE	3.80
SUBSIDENCE	3.65
RIVERINE & URBAN FLOODING	3.50
HAZMAT: FIXED SITE INCIDENT	3.50
SCRAP TIRE FIRES	2.95
LIGHTNING	2.85
TOTAL	105.75

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

City of Bessemer

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	1	1	7	3	5	4	9	1	6	5	42
STRUCTURAL FIRES	10	2	10	3	5	3	10	8	10	4	65
INFRA FAILURE/2NDARY TECH HAZARD	7	9	8	9	6	4	9	3	6	8	69
WILDFIRES	3	9	6	6	9	7	5	8	5	7	65
RIVERINE & URBAN FLOODING	5	6	2	6	9	6	6	8	3	4	55
HIGH WINDS	8	8	3	5	2	3	5	5	3	3	45
PETROLEUM/NATURAL GAS ACCIDENT	6	8	10	8	5	4	10	10	8	8	77
PUBLIC HEALTH EMERGENCY	3	10	8	10	7	7	9	2	5	5	66
HAIL	4	5	10	5	3	1	9	5	8	9	59
HAZMAT: FIXED SITE INCIDENT	1	5	10	5	2	3	10	5	5	5	51
SABOTAGE/TERRORISM	1	5	9	8	4	3	10	5	10	8	63
SNOW STORMS	10	10	4	10	4	4	4	4	3	7	60
CIVIL DISTURBANCE	2	8	7	10	2	5	8	3	9	3	57
SUBSIDENCE	4	9	8	4	7	2	10	5	9	5	63
HAZMAT: TRANSPORTATION INCIDENT	4	7	10	7	7	3	10	6	9	7	70
ICE & SLEET STORMS	2	10	8	10	4	3	6	7	4	8	62
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	5	10	5	2	2	10	4	10	9	59
DROUGHT	4	10	1	6	5	10	1	2	1	10	50
TORNADOES	1	7	8	8	2	1	9	5	9	9	59
LIGHTNING	2	2	10	3	1	1	7	2	8	5	41
SCRAP TIRE FIRES	1	1	10	4	3	3	5	4	8	4	43

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.15	0.10	0.35	0.45	0.75	0.40	0.45	0.10	0.30	0.50	3.55
STRUCTURAL FIRES	1.50	0.20	0.50	0.45	0.75	0.30	0.50	0.80	0.50	0.40	5.90
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.90	0.40	1.35	0.90	0.40	0.45	0.30	0.30	0.80	6.85
WILDFIRES	0.45	0.90	0.30	0.90	1.35	0.70	0.25	0.80	0.25	0.70	6.60
RIVERINE & URBAN FLOODING	0.75	0.60	0.10	0.90	1.35	0.60	0.30	0.80	0.15	0.40	5.95
HIGH WINDS	1.20	0.80	0.15	0.75	0.30	0.30	0.25	0.50	0.15	0.30	4.70
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.80	0.50	1.20	0.75	0.40	0.50	1.00	0.40	0.80	7.25
PUBLIC HEALTH EMERGENCY	0.45	1.00	0.40	1.50	1.05	0.70	0.45	0.20	0.25	0.50	6.50
HAIL	0.60	0.50	0.50	0.75	0.45	0.10	0.45	0.50	0.40	0.90	5.15
HAZMAT: FIXED SITE INCIDENT	0.15	0.50	0.50	0.75	0.30	0.30	0.50	0.50	0.25	0.50	4.25
SABOTAGE/TERRORISM	0.15	0.50	0.45	1.20	0.60	0.30	0.50	0.50	0.50	0.80	5.50
SNOW STORMS	1.50	1.00	0.20	1.50	0.60	0.40	0.20	0.40	0.15	0.70	6.65
CIVIL DISTURBANCE	0.30	0.80	0.35	1.50	0.30	0.50	0.40	0.30	0.45	0.30	5.20
SUBSIDENCE	0.60	0.90	0.40	0.60	1.05	0.20	0.50	0.50	0.45	0.50	5.70
HAZMAT: TRANSPORTATION INCIDENT	0.60	0.70	0.50	1.05	1.05	0.30	0.50	0.60	0.45	0.70	6.45
ICE & SLEET STORMS	0.30	1.00	0.40	1.50	0.60	0.30	0.30	0.70	0.20	0.80	6.10
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.50	0.50	0.75	0.30	0.20	0.50	0.40	0.50	0.90	4.85
DROUGHT	0.60	1.00	0.05	0.90	0.75	1.00	0.05	0.20	0.05	1.00	5.60
TORNADOES	0.15	0.70	0.40	1.20	0.30	0.10	0.45	0.50	0.45	0.90	5.15
LIGHTNING	0.30	0.20	0.50	0.45	0.15	0.10	0.35	0.20	0.40	0.50	3.15
SCRAP TIRE FIRES	0.15	0.10	0.50	0.60	0.45	0.30	0.25	0.40	0.40	0.40	3.55

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
PETROLEUM/NATURAL GAS ACCIDENT	7.25
INFRA FAILURE/2NDARY TECH HAZARD	6.85
SNOW STORMS	6.65
WILDFIRES	6.60
PUBLIC HEALTH EMERGENCY	6.50
HAZMAT: TRANSPORTATION INCIDENT	6.45
ICE & SLEET STORMS	6.10
RIVERINE & URBAN FLOODING	5.95
STRUCTURAL FIRES	5.90
SUBSIDENCE	5.70
DROUGHT	5.60
SABOTAGE/TERRORISM	5.50
EXTREME TEMPERATURES	5.35
CIVIL DISTURBANCE	5.20
HAIL	5.15
TORNADOES	5.15
PASSENGER ACCIDENT	4.85
HIGH WINDS	4.70
HAZMAT: FIXED SITE INCIDENT	4.25
DAM FAILURE	3.55
SCRAP TIRE FIRES	3.55
LIGHTNING	3.15
TOTAL	119.95

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

City of Ironwood

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	1	1	6	2	4	4	9	1	4	5	37
STRUCTURAL FIRES	10	2	10	3	5	3	10	8	10	4	65
INFRA FAILURE/2NDARY TECH HAZARD	7	9	8	9	6	4	9	3	6	8	69
WILDFIRES	3	9	6	6	9	8	5	8	5	7	66
RIVERINE & URBAN FLOODING	9	8	5	9	9	7	4	9	3	4	67
HIGH WINDS	8	8	3	6	2	3	5	5	3	3	46
PETROLEUM/NATURAL GAS ACCIDENT	6	8	10	9	5	4	10	10	8	8	78
PUBLIC HEALTH EMERGENCY	3	10	8	10	7	8	9	2	5	5	67
HAIL	4	5	10	5	3	1	9	5	8	9	59
HAZMAT: FIXED SITE INCIDENT	1	5	10	5	2	3	10	5	5	5	51
SABOTAGE/TERRORISM	1	5	9	8	4	3	10	5	10	8	63
SNOW STORMS	10	10	4	10	4	4	4	4	3	7	60
CIVIL DISTURBANCE	2	8	7	10	2	5	8	3	9	3	57
SUBSIDENCE	4	8	8	4	7	2	10	5	9	5	62
HAZMAT: TRANSPORTATION INCIDENT	4	7	10	7	6	3	10	6	9	7	69
ICE & SLEET STORMS	2	10	8	10	4	3	6	7	4	8	62
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	5	10	5	2	2	10	3	10	9	58
DROUGHT	4	10	1	6	5	10	1	2	1	10	50
TORNADOES	1	7	8	8	2	1	9	5	9	9	59
LIGHTNING	2	2	10	3	1	1	7	2	8	5	41
SCRAP TIRE FIRES	1	1	10	4	2	3	5	3	8	5	42

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.15	0.10	0.30	0.30	0.60	0.40	0.45	0.10	0.20	0.50	3.10
STRUCTURAL FIRES	1.50	0.20	0.50	0.45	0.75	0.30	0.50	0.80	0.50	0.40	5.90
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.90	0.40	1.35	0.90	0.40	0.45	0.30	0.30	0.80	6.85
WILDFIRES	0.45	0.90	0.30	0.90	1.35	0.80	0.25	0.80	0.25	0.70	6.70
RIVERINE & URBAN FLOODING	1.35	0.80	0.25	1.35	1.35	0.70	0.20	0.90	0.15	0.40	7.45
HIGH WINDS	1.20	0.80	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	4.85
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.80	0.50	1.35	0.75	0.40	0.50	1.00	0.40	0.80	7.40
PUBLIC HEALTH EMERGENCY	0.45	1.00	0.40	1.50	1.05	0.80	0.45	0.20	0.25	0.50	6.60
HAIL	0.60	0.50	0.50	0.75	0.45	0.10	0.45	0.50	0.40	0.90	5.15
HAZMAT: FIXED SITE INCIDENT	0.15	0.50	0.50	0.75	0.30	0.30	0.50	0.50	0.25	0.50	4.25
SABOTAGE/TERRORISM	0.15	0.50	0.45	1.20	0.60	0.30	0.50	0.50	0.50	0.80	5.50
SNOW STORMS	1.50	1.00	0.20	1.50	0.60	0.40	0.20	0.40	0.15	0.70	6.65
CIVIL DISTURBANCE	0.30	0.80	0.35	1.50	0.30	0.50	0.40	0.30	0.45	0.30	5.20
SUBSIDENCE	0.60	0.80	0.40	0.60	1.05	0.20	0.50	0.50	0.45	0.50	5.60
HAZMAT: TRANSPORTATION INCIDENT	0.60	0.70	0.50	1.05	0.90	0.30	0.50	0.60	0.45	0.70	6.30
ICE & SLEET STORMS	0.30	1.00	0.40	1.50	0.60	0.30	0.30	0.70	0.20	0.80	6.10
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.50	0.50	0.75	0.30	0.20	0.50	0.30	0.50	0.90	4.75
DROUGHT	0.60	1.00	0.05	0.90	0.75	1.00	0.05	0.20	0.05	1.00	5.60
TORNADOES	0.15	0.70	0.40	1.20	0.30	0.10	0.45	0.50	0.45	0.90	5.15
LIGHTNING	0.30	0.20	0.50	0.45	0.15	0.10	0.35	0.20	0.40	0.50	3.15
SCRAP TIRE FIRES	0.15	0.10	0.50	0.60	0.30	0.30	0.25	0.30	0.40	0.50	3.40

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
RIVERINE & URBAN FLOODING	7.45
PETROLEUM/NATURAL GAS ACCIDENT	7.40
INFRA FAILURE/2NDARY TECH HAZARD	6.85
WILDFIRES	6.70
SNOW STORMS	6.65
PUBLIC HEALTH EMERGENCY	6.60
HAZMAT: TRANSPORTATION INCIDENT	6.30
ICE & SLEET STORMS	6.10
STRUCTURAL FIRES	5.90
DROUGHT	5.60
SUBSIDENCE	5.60
SABOTAGE/TERRORISM	5.50
EXTREME TEMPERATURES	5.35
CIVIL DISTURBANCE	5.20
HAIL	5.15
TORNADOES	5.15
HIGH WINDS	4.85
PASSENGER ACCIDENT	4.75
HAZMAT: FIXED SITE INCIDENT	4.25
SCRAP TIRE FIRES	3.40
LIGHTNING	3.15
DAM FAILURE	6.55
TOTAL	124.45

GOGEBIC COUNTY HAZARD RANKING

Multi-Hazard Mitigation Plan 2013-2018

City of Wakefield

	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	TOTAL
DAM FAILURE	4	8	10	8	8	6	8	10	7	4	73
STRUCTURAL FIRES	10	2	10	3	5	3	10	8	10	4	65
INFRA FAILURE/2NDARY TECH HAZARD	7	9	8	9	6	4	9	3	6	8	69
WILDFIRES	4	9	6	7	9	7	5	8	5	7	67
RIVERINE & URBAN FLOODING	9	8	5	9	9	6	6	9	3	4	68
HIGH WINDS	8	8	3	6	2	3	5	5	3	3	46
PETROLEUM/NATURAL GAS ACCIDENT	6	8	10	9	5	4	10	10	8	8	78
PUBLIC HEALTH EMERGENCY	3	10	8	10	7	7	9	2	5	5	66
HAIL	4	5	10	5	3	1	9	5	8	9	59
HAZMAT: FIXED SITE INCIDENT	1	5	10	5	2	3	10	5	5	5	51
SABOTAGE/TERRORISM	1	5	9	8	4	3	10	5	10	8	63
SNOW STORMS	10	10	4	10	4	4	4	4	3	7	60
CIVIL DISTURBANCE	2	8	7	10	2	5	8	3	9	3	57
SUBSIDENCE	4	8	8	4	7	2	10	5	9	5	62
HAZMAT: TRANSPORTATION INCIDENT	4	7	10	7	6	3	10	6	9	7	69
ICE & SLEET STORMS	2	10	8	10	4	3	6	7	4	8	62
EXTREME TEMPERATURES	7	10	1	10	1	6	2	1	2	7	47
PASSENGER ACCIDENT	2	5	10	5	2	2	10	4	10	9	59
DROUGHT	4	10	1	6	5	10	1	2	1	10	50
TORNADOES	1	7	8	8	2	1	9	5	9	9	59
LIGHTNING	2	2	10	3	1	1	7	2	8	5	41
SCRAP TIRE FIRES	1	1	10	3	2	3	5	3	8	5	41

Weight	15%	10%	5%	15%	15%	10%	5%	10%	5%	10%	100%
	Probability of Occurrence	Affected Areas	Speed of Onset	Population Impact	Economic Effects	Duration	Predictability	Collateral Damage	Availability of Warnings	Mitigation Potential	WEIGHTED TOTAL
DAM FAILURE	0.60	0.80	0.50	1.20	1.20	0.60	0.40	1.00	0.35	0.40	7.05
STRUCTURAL FIRES	1.50	0.20	0.50	0.45	0.75	0.30	0.50	0.80	0.50	0.40	5.90
INFRA FAILURE/2NDARY TECH HAZARD	1.05	0.90	0.40	1.35	0.90	0.40	0.45	0.30	0.30	0.80	6.85
WILDFIRES	0.60	0.90	0.30	1.05	1.35	0.70	0.25	0.80	0.25	0.70	6.90
RIVERINE & URBAN FLOODING	1.35	0.80	0.25	1.35	1.35	0.60	0.30	0.90	0.15	0.40	7.45
HIGH WINDS	1.20	0.80	0.15	0.90	0.30	0.30	0.25	0.50	0.15	0.30	4.85
PETROLEUM/NATURAL GAS ACCIDENT	0.90	0.80	0.50	1.35	0.75	0.40	0.50	1.00	0.40	0.80	7.40
PUBLIC HEALTH EMERGENCY	0.45	1.00	0.40	1.50	1.05	0.70	0.45	0.20	0.25	0.50	6.50
HAIL	0.60	0.50	0.50	0.75	0.45	0.10	0.45	0.50	0.40	0.90	5.15
HAZMAT: FIXED SITE INCIDENT	0.15	0.50	0.50	0.75	0.30	0.30	0.50	0.50	0.25	0.50	4.25
SABOTAGE/TERRORISM	0.15	0.50	0.45	1.20	0.60	0.30	0.50	0.50	0.50	0.80	5.50
SNOW STORMS	1.50	1.00	0.20	1.50	0.60	0.40	0.20	0.40	0.15	0.70	6.65
CIVIL DISTURBANCE	0.30	0.80	0.35	1.50	0.30	0.50	0.40	0.30	0.45	0.30	5.20
SUBSIDENCE	0.60	0.80	0.40	0.60	1.05	0.20	0.50	0.50	0.45	0.50	5.60
HAZMAT: TRANSPORTATION INCIDENT	0.60	0.70	0.50	1.05	0.90	0.30	0.50	0.60	0.45	0.70	6.30
ICE & SLEET STORMS	0.30	1.00	0.40	1.50	0.60	0.30	0.30	0.70	0.20	0.80	6.10
EXTREME TEMPERATURES	1.05	1.00	0.05	1.50	0.15	0.60	0.10	0.10	0.10	0.70	5.35
PASSENGER ACCIDENT	0.30	0.50	0.50	0.75	0.30	0.20	0.50	0.40	0.50	0.90	4.85
DROUGHT	0.60	1.00	0.05	0.90	0.75	1.00	0.05	0.20	0.05	1.00	5.60
TORNADOES	0.15	0.70	0.40	1.20	0.30	0.10	0.45	0.50	0.45	0.90	5.15
LIGHTNING	0.30	0.20	0.50	0.45	0.15	0.10	0.35	0.20	0.40	0.50	3.15
SCRAP TIRE FIRES	0.15	0.10	0.50	0.45	0.30	0.30	0.25	0.30	0.40	0.50	3.25

FINAL HAZARD RANKING	
	WEIGHTED TOTAL
RIVERINE & URBAN FLOODING	7.45
PETROLEUM/NATURAL GAS ACCIDENT	7.40
DAM FAILURE	7.05
WILDFIRES	6.90
INFRA FAILURE/2NDARY TECH HAZARD	6.85
SNOW STORMS	6.65
PUBLIC HEALTH EMERGENCY	6.50
HAZMAT: TRANSPORTATION INCIDENT	6.30
ICE & SLEET STORMS	6.10
STRUCTURAL FIRES	5.90
DROUGHT	5.60
SUBSIDENCE	4.95
SABOTAGE/TERRORISM	5.50
EXTREME TEMPERATURES	5.35
CIVIL DISTURBANCE	5.20
HAIL	5.15
TORNADOES	5.15
HIGH WINDS	4.85
PASSENGER ACCIDENT	4.85
HAZMAT: FIXED SITE INCIDENT	4.25
SCRAP TIRE FIRES	3.25
LIGHTNING	3.15
TOTAL	124.35

CITY OF IRONWOOD

FLOOD MITIGATION ANNEX 2013

A COMPONENT OF THE GOGEBIC COUNTY

2013-2018 HAZARD MITIGATION PLAN

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SECTION 1: INTRODUCTION

PROJECT DESCRIPTION

The City of Ironwood prepared this Flood Mitigation Plan (FMP) as an annex to the Gogebic County Multi-Hazard Mitigation Plan. The FMP was developed by Western Upper Peninsula Planning and Development Region (WUPPDR), under the guidance of the Ironwood Flood Mitigation Committee. The FMP was created in an effort to provide Ironwood residents an enhanced understanding of potential flood dangers. An expected result of this increased awareness is improved flood protection, which will minimize losses from flood events. For the purposes of this plan, improved flood protection includes the broad base of community elements including:

- Life safety;
- Personal and public property;
- Economic stability with regard to commercial and industrial losses; and
- Economic stability with regard to public services, including schools and local governments.

The FMP was developed through an open planning process that included public involvement.

1. The public was involved primarily through an online survey, which was twice publicized a through press release.
2. The City of Ironwood formed a task committee to oversee the development of the plan. Invitations to join this committee were sent to Gogebic County, City of Wakefield, Gogebic Community College, Ironwood municipal employees, the volunteer fire department, and private businesses.
3. Several plans and documents were reviewed in preparation of this FMP including the 2005 Gogebic County Multi-Hazard Mitigation Plan, the City of Wakefield Flood Mitigation Plan, and FEMA's Local Multi-Hazard Mitigation Planning Guidance and other documents, all of which are referenced in the Works Cited, along with several other Flood Mitigation Plans. Local and external research was thus combined with solicited input from local officials and

other individuals to form a complete picture of flood preparation, risk, response, and recovery in the City.

PURPOSE AND OVERVIEW

Ironwood, Michigan, is located in Gogebic County on the far western end of the Michigan's Upper Peninsula (U.P.). The city is separated from Wisconsin and its border city of Hurley by the Montreal River, a waterway that runs northwest to discharge at Lake Superior. The primary purpose of this plan is to set out a strategy for mitigating flooding associated with that river. Funding acquired through the support of this plan will help to permanently reduce vulnerability to flooding in accordance with state, federal, and local objectives.

This plan is to be incorporated as an annex to the concurrent 2013 Gogebic County Hazard Mitigation Plan update. That plan's 2005 incarnation was the impetus for development of a separate flood mitigation plan for the city of Wakefield in 2007. Ironwood, a larger city and the county seat, has never had a flood mitigation plan even though it has historically been affected by many of the same weather events that have led to flooding in Wakefield.

The Michigan Hazard Mitigation Plan identifies flooding to be one of the state's highest-risk hazards with regard to property damage. Within Gogebic County, riverine and urban flooding is classified as high risk because of the proximity of significant and volatile streams to major population areas. Flooding from the Montreal River is considered an annual occurrence. Dam failure is also high risk, but Ironwood itself is not subject to such occurrences. As the city is not located on the Lake Superior coast, shoreline flooding and erosion is not a threat.

AUTHORITY

The Flood Mitigation Assistance (FMA) grant program, administered by the Federal Emergency Management Agency (FEMA), is a result of the National Flood Insurance Reform Act of 1968, as amended. The Act requires that a FEMA-approved flood mitigation plan be in place as a prerequisite for award of a project grant under the program. Funding for this plan was derived indirectly from an

FMA planning grant. The Flood Mitigation Plan is a component of the Gogebic County Multi-Hazard Mitigation Plan, which fulfills a similar requirement for pre-disaster federal mitigation funds under Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165). Since November 1, 2004, a plan has been required to obtain post-disaster mitigation funds under the Hazard Mitigation Grant Program. To meet ongoing eligibility requirements for FEMA funds, the County plan and all components must be updated every five years.

PLANNING PROCESS

The preparation of this Flood Mitigation Plan (FMP) was funded by the Federal Emergency Management Agency through the Michigan State Police Emergency Management and Homeland Security Division. The FMP was developed by Western Upper Peninsula Planning and Development Region under the guidance of the Ironwood Flood Mitigation Advisory Committee ("committee"). The committee was formed for the sole purpose of overseeing the FMP development and was composed of the following people:

- Scott Erickson, City Manager
- Dennis Hewitt, City Planning & Zoning
- Rick Semo, Mayor Pro Tem
- Bob Richards, City Public Works
- Jim Loeper, Gogebic County Emergency Manager

The planning process started by identifying committee members and establishing a project timeline. Members of the committee were the primary source of information for initial risk assessment and flood hazard analysis. The members assisted with identifying past flood events so that they could be related to the current planning effort. The members also provided local information not otherwise available on the location of critical facilities, bridges, shelters, and other community features that could uniquely affect or be affected by flood events. City staff were consulted as necessary.

Committee members helped to guide the public engagement process, advising how best to reach community members and what inquiries should be made of them. The committee remained

involved throughout the process in order to review and correct documents and methodologies as they proceeded and became more complex. The committee will remain engaged after the plan's adoption in order to ensure it is implemented and evaluated, as well as updated every five years.

PUBLIC ENGAGEMENT

Initial public involvement in the creation of this plan was by way of an online survey accessible through WUPPDR's website, http://www.wuppdr.org. A press release was done to publicize the survey. Further responses were solicited several months later through an additional press release and targeted mailings of print surveys to floodplain property owners.

Throughout the planning process, the Flood Mitigation Advisory Committee was actively involved in development of plan components and review of the plan document. Besides representing agency expertise, each member of the committee brought a unique set of public concerns to the table. The Mayor Pro Tempore, in particular, was in tune with public opinion regarding flood mitigation solutions and played a significant role in selecting and prioritizing these.

Although much of the public input was expressed indirectly by committee members, the combination of expert views and public opinion formed a well-rounded document with accurate but suitably diverse underpinnings.

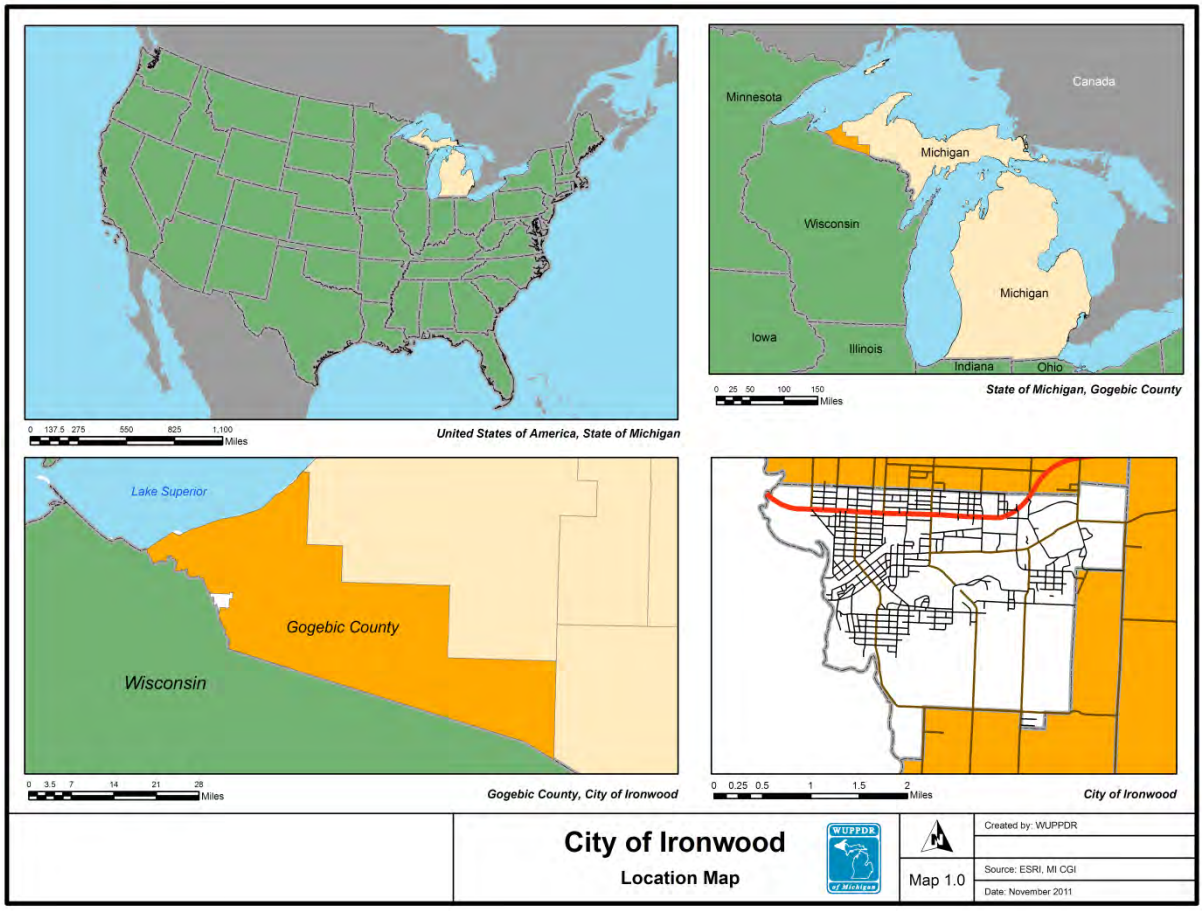
SECTION 2: COMMUNITY PROFILE

GENERAL INFORMATION

The city of Ironwood, Michigan's westernmost city, lies on Highway US-2 in Gogebic County and is the Western Gateway to the state's Upper Peninsula (see **Map 1**: Location Map). Home to 5,387 residents, Ironwood encompasses 5.8 square miles of gently rolling terrain in the north and very steep terrain in the south ranging in elevation from 1,420 to 1,750 feet above sea level. The Montreal River, which separates Ironwood from Hurley, Wisconsin, serves as the city's western boundary. The river, typically a source of area flooding, flows from the south through the city and falls over 800 feet in the approximately 14 miles to its mouth on Lake Superior. Ironwood's land use is predominantly residential. Commercial use is concentrated downtown and along the Highway US-2 corridor. Industrial development is primarily located in an industrial park in the northeast section of Ironwood.

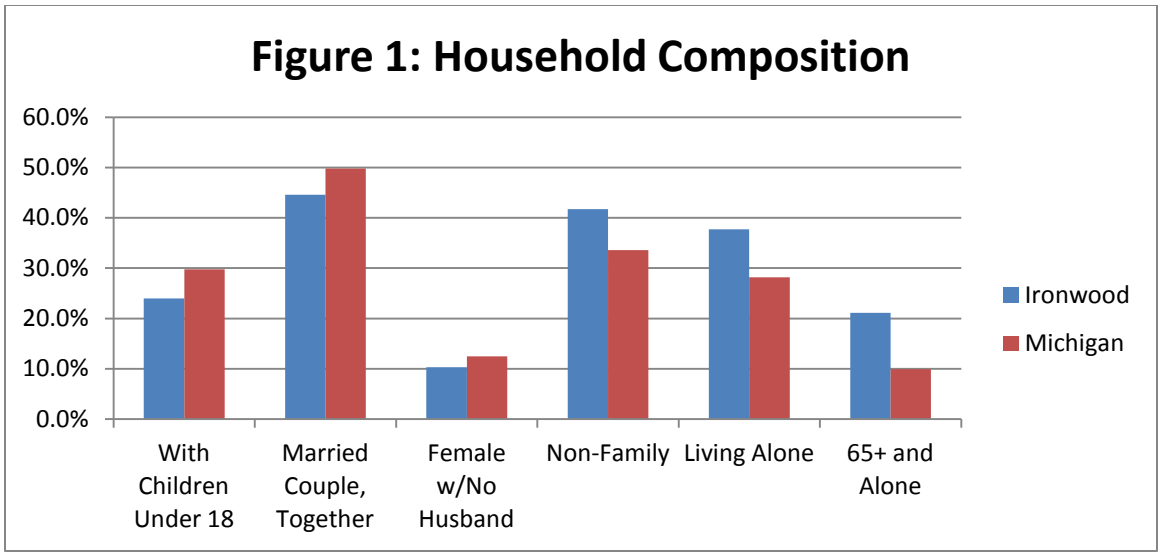
Ironwood was originally a mining town founded in 1885 but today is a tourist destination. The surrounding area boasts the Black River National Forest Scenic Byway, including numerous waterfalls and the Copper Peak Ski Flying Complex. In the summer and fall, Copper Peak offers chairlift and elevator rides to the top of the world's largest ski jump, and a network of recreational trails is now being developed there. The 954,000-acre Ottawa National Forest offers 27 campgrounds, access to 35 scenic waterfalls, and many miles of hiking trails. Additionally, the area's downhill ski resorts and extensive network of snowmobile trails appeal to winter enthusiasts.

Map 1: Location Map



DEMOGRAPHICS, HOUSING, AND ECONOMY

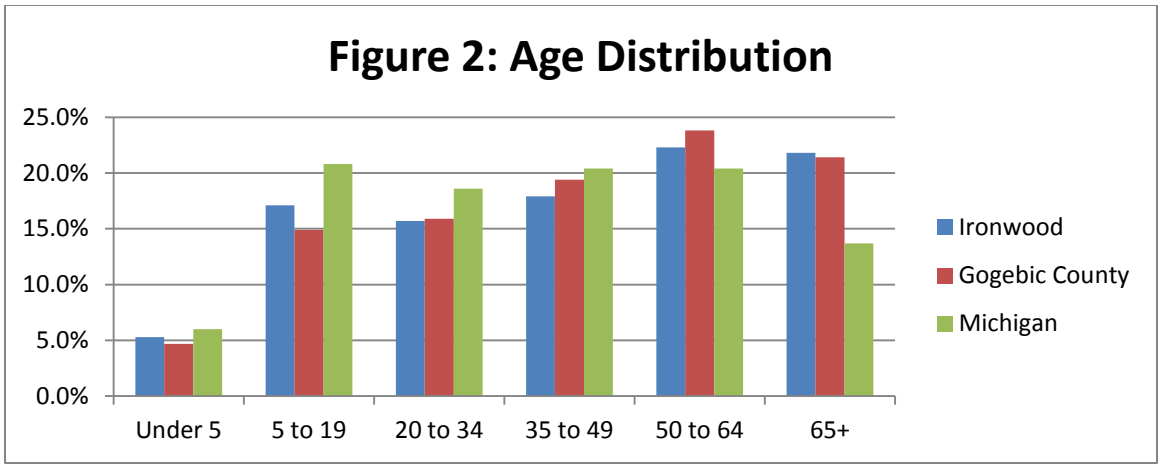
According to the 2010 Census, Ironwood's population is 5,387. 96.0% of the population is White. The second largest racial group is American Indian or Alaska Native, with 1.1% of the population. The city has seen a 14.4% decline in population since the 2000 Census, when the population was 6,293. There are now 2,520 households with an average size of 2.1, while the average family size is 2.7. Composition of these households is presented in **Figure 1**.



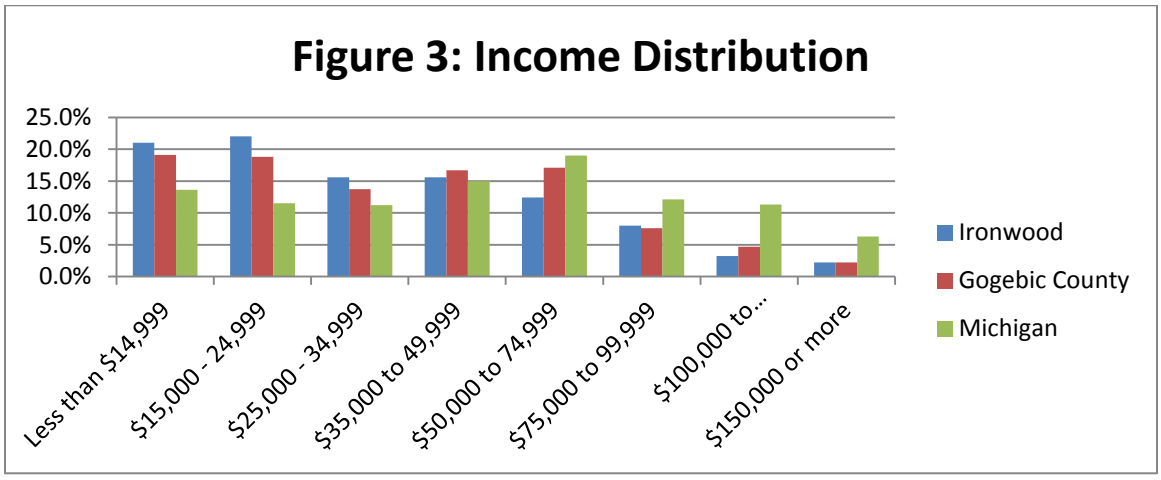
Source: U.S. Census 2005-2010 American Community Survey 5-Year Estimates

Ironwood has an aging population, with a median age of 45.5 as opposed to the state's 38.9. This obviates careful consideration of the needs of older persons, and areas where they are concentrated, in an emergency. The age distributions of Ironwood, Gogebic County, and Michigan are depicted in **Figure 2**.

Figure 3 shows the distribution of income for Ironwood, Gogebic County, and Michigan residents. Ironwood residents have much lower average incomes than the state average. The mean household income in Ironwood is $40,274, as compared with Michigan's $63,692. Ironwood's individual poverty level is 21.0% compared with 14.8% for Michigan. Nearly half of the county's households with no vehicles are located in Ironwood. Ironwood has the most concentrated housing distribution in Gogebic County. The city contains 207, or 62.7 percent, of the county's 330 housing units in structures with 20 or more dwellings. Ironwood's economic base is supported by lumber and forest products, healthcare, education, manufacturing, small business, and tourism.



Source: U.S. Census 2010



Source: U.S. Census 2005-2010 American Community Survey 5-Year Estimates

CLIMATE

According to 30-year data ranging from 1981 to 2010 from National Weather Service Station 204104 in Ironwood, the city's long-term average annual temperature is approximately 40.0 degrees Fahrenheit. As depicted in the table below, July is the warmest month with an average of 65.9 degrees, while January is by far the coldest with an average temperature of 11.6 degrees. See **Table 1**.

Table 1. Mean Temperatures, Monthly, and Overall (Annual), 1981-2010, Ironwood

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Max °F	20.6	25.5	35.9	50.1	63.4	72.3	76.5	74.9	66.1	52.7	37.3	24.5	50.0
Min °F	2.5	4.6	14.3	28.5	40.5	50.3	55.2	53.4	45.4	34.3	22.6	8.9	30.0
Mean °F	11.6	15.0	25.1	39.3	51.9	61.3	65.9	64.1	55.7	43.5	30.0	16.7	40.0

Source: NOAA U.S. National Climatic Data Center U.S. Climate Normals

The mean annual precipitation over the same period was 35.03 inches. July is the month that receives the most precipitation, at 4.17 inches, while February receives the least, at 1.27. Mean annual snowfall over the same time period was a more impressive number, at 189.2 inches. December and January receive the most snowfall—46.4 and 46.1 inches, respectively—while the summer of months of June, July, and August were snow-free. See **Table 2**.

Table 2. Monthly and Annual Mean Precipitation & Snow, 1981-2010, Ironwood

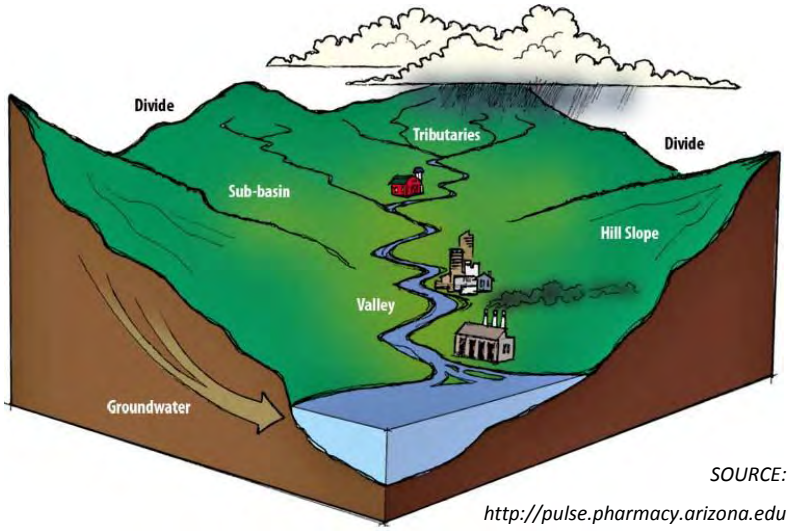
Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Precip(in.)	1.96	1.27	1.97	2.60	3.14	3.65	4.17	3.37	4.06	3.96	2.74	2.15	35.03
Snow(in.)	46.10	27.20	24.40	11.10	1.90	0.00	0.00	0.00	0.30	6.50	25.40	46.40	189.20

Source: NOAA U.S. National Climatic Data Center U.S. Climate Normals

WATERSHEDS

A watershed is an area of land from which all surface and groundwater drains to the same place. Water ultimately drains to a lake or stream channel, but watersheds are generally named for the final stream outlet. Watersheds come in all shapes and sizes, which is important to understand since the effects of both natural and man-made activities in one area can have a direct impact on other areas. For example, runoff from a heavy rainfall or snow melt upstream in a watershed will eventually reach the downstream part of the watershed as shown in the watershed model in **Figure 4**.

Figure 4: Watershed Model



SOURCE: http://pulse.pharmacy.arizona.edu /images/watrshed.jpg

Watersheds are, of course, natural bodies that do not recognize political boundaries. Watersheds located within the city of Ironwood can be viewed in **Map 2**: City of Ironwood Watersheds. These watersheds include the Montreal River Watershed, the Black River (west) Watershed, and the Lake Superior Watershed. The watershed of main concern is the Montreal. The Montreal River Watershed has an area of 200,891.6 acres. The watershed borders the city limits on the north and south and extends some distance east of the northern border. The river is characterized by a precipitous course at its end stretches to Lake Superior, though this section does not directly affect the city.

Watersheds are determined largely by elevation. The city's elevation variation is shown in **Map 3**.

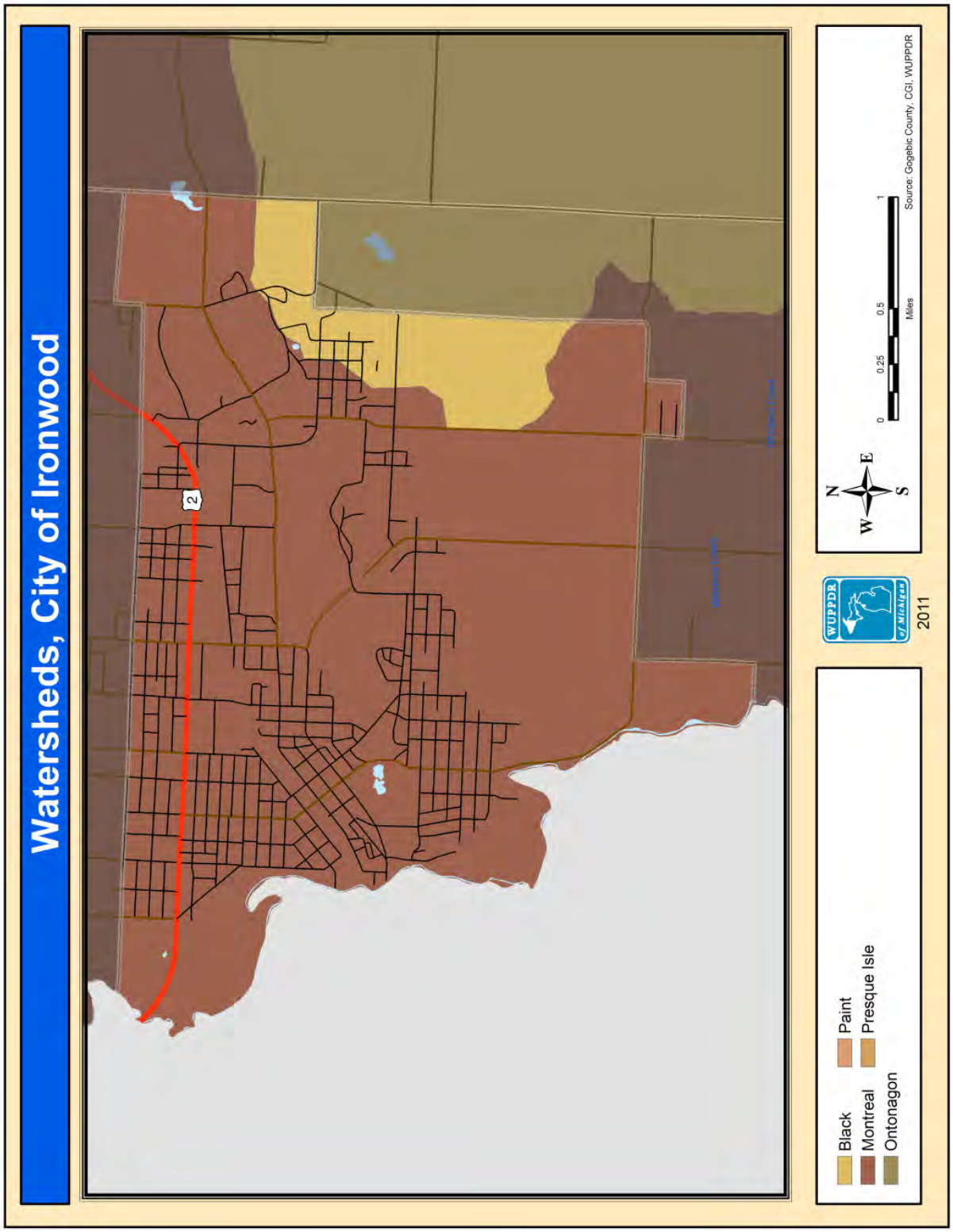
LAKES AND STREAMS

Besides the Montreal River, the only water bodies within the city are several small ponds, first- and second-order tributaries to the Montreal, and wetlands (delineated based on the tributaries). In short, all moving water is directly related to the Montreal River.

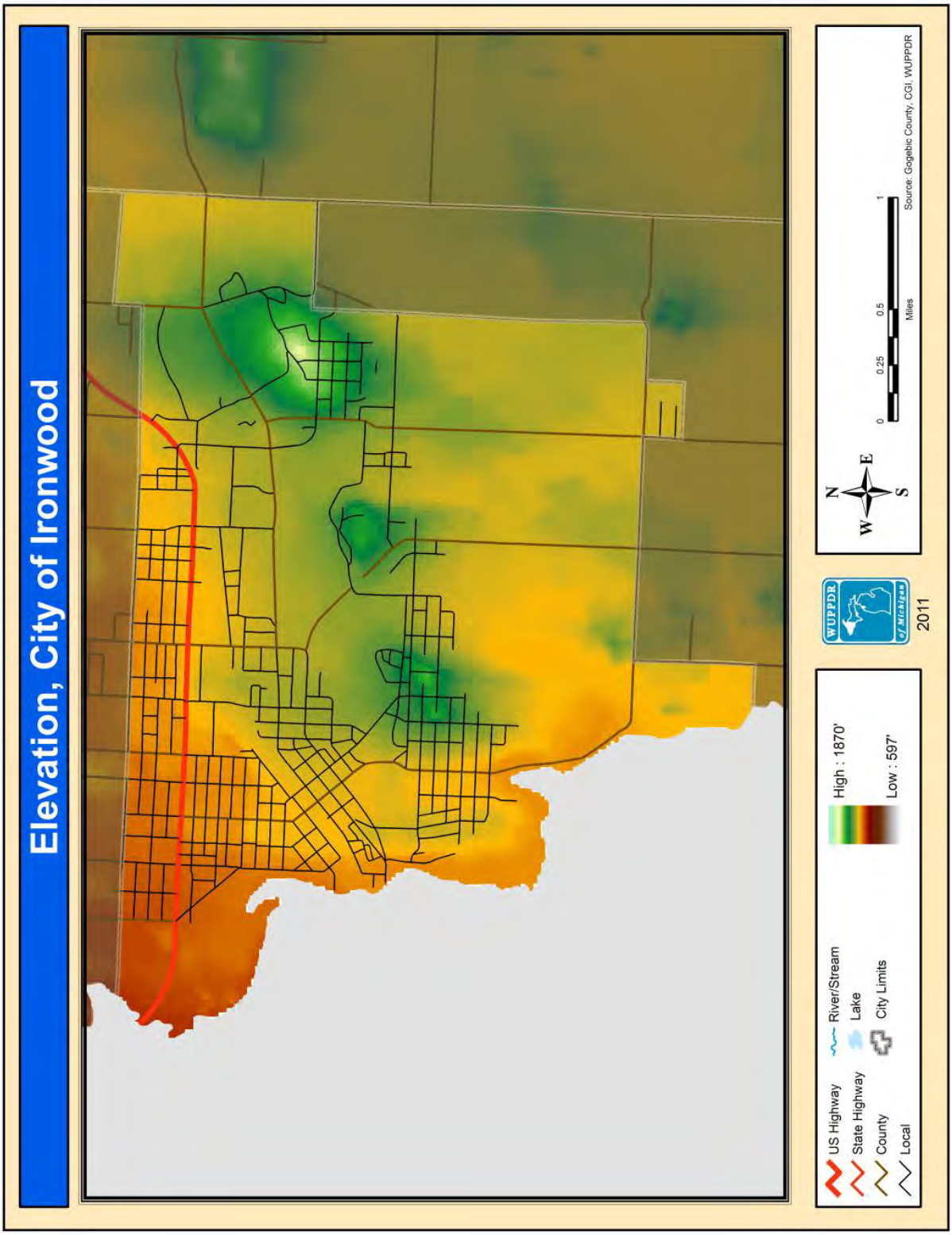
The Montreal River is best known for the large waterfalls close to its mouth, but it is just as notable for its flood risk. Major flooding occurred in 2002 due to sudden snowmelt and extensive rains. After first overcoming the Montreal and flooding at least 35 structures in Ironwood, even more severe flooding overcame the waterways of nearby Wakefield. The Montreal flooding led to designation of Ironwood as a disaster area by the Michigan governor.

Significant flooding of a slightly lesser magnitude also occurred in Gogebic County in 1960, establishing a pattern, however weak, of such events. Therefore, with riverine and urban flooding being the area's major disaster concern, lakes and streams are important natural features to consider.

Map 2: Watersheds



Map 3: Elevation



WETLANDS

There are a number of wetland areas within the watersheds that can affect water levels of rivers and creeks flowing through Ironwood. Michigan's wetland statute, Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, defines a wetland as "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh." The definition applies to public and private lands regardless of zoning or ownership.

Wetlands are valuable to the city in many ways. They regulate the levels of rivers, lakes and streams by storing and slowly releasing excess rainwater and snow melt. When wetlands are altered or destroyed, flooding is greatly increased because water is no longer held back. These special areas also serve as filters for water, removing pollutants and reducing sediment which otherwise flows into rivers and streams. Wetlands act to reduce soil erosion too. The quality of water is much better when wetlands are left in place to do their work. Wetlands in the city are depicted in **Map 4**.

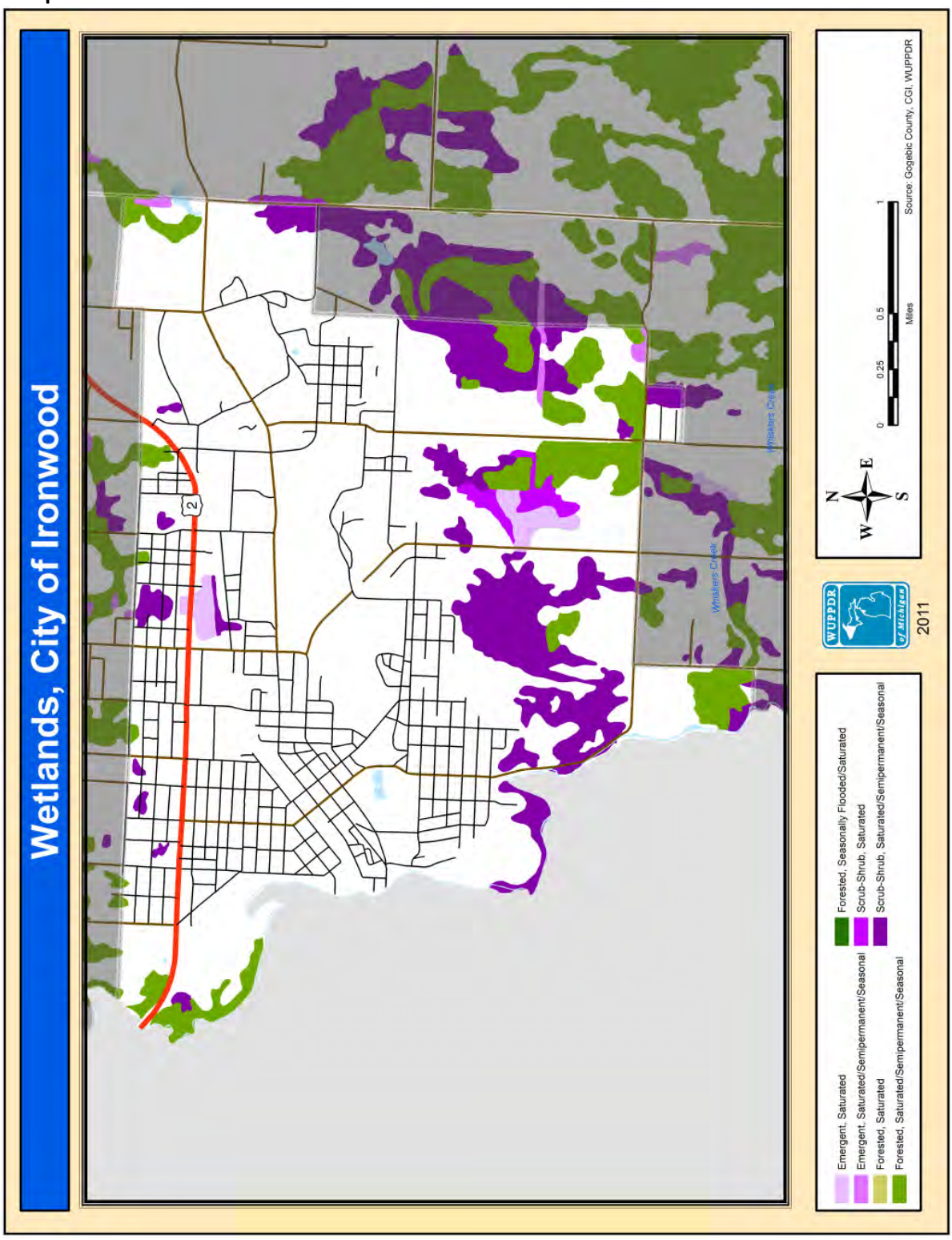
Despite their environmental value, wetlands may create flooding situations of their own under certain conditions. The only wetlands that could potentially threaten property in Ironwood are those located along US-2 in the north-central part of the city, and even then only in rare instances.

SECTION 3: RISK/VULNERABILITY ASSESSMENT

RIVERINE AND URBAN FLOODING

Riverine flooding is defined as periodic occurrence of overbank flows of streams and rivers resulting in the inundation of the adjacent floodplain. Riverine floods are caused by prolonged, intense rainfall, snowmelt, ice jams, man-made or beaver dam failures, or any combination of these factors. Such overbank flows are natural and may occur on a regular basis and occur on river systems that drain large geographic areas and many river basins. Floods on large river systems may extend several days. Many areas of Michigan are subject to riverine flooding, and this type of flooding, along with urban flooding, has been identified as Gogebic County's foremost hazard risk.

Map 4: Wetlands



Flash floods, a type of riverine flooding, are brief, heavy flows on small streams or normally dry creeks. The cause of flash floods is normally locally intense thunderstorms with significant rainfall resulting in high velocity water often carrying large amounts of debris. These conditions can be exacerbated by secondary or cascading events such as beaver dam failure. Spring is highest risk as a result of quickly changing temperatures, intense precipitation, rapid snowmelt, and saturated or frozen ground with little infiltration capacity.

Urban flooding—the overflow of municipal storm sewer systems—is usually caused by inadequate drainage following heavy rainfall or rapid snowmelt. This type of flooding, though it may be diminished through proper infrastructure planning and investment, often occurs as a result of the other two types.

In Ironwood, the risk of this type of flooding was reduced by a project completed in 2011 which upgraded storm sewers and mainly separated them from the sanitary sewer system. County staff also take seasonal steps as necessary to remove buildup of leaves from storm sewer grates and to clear and free debris from catch basins prior to thaws to allow free flow of drainage. If for some reason these steps could not be taken, urban flooding could become a major problem in some areas. One area of past concern has been a low section of the US-2 corridor near the crossings of Douglas Boulevard and North Lowell Street.

Given that flood events in the Ironwood area occur with limited frequency but sometimes high severity, the best way to estimate future risk is by analyzing past hazards . Still, probability estimates are unreliable based on the small number of samples. Based on the following limited history, the probability of a significantly damaging recurring flood in the city proper in any given year since 1960, based on the three severe floods that have occurred (in 1960, 2002, and 2013, as described below), is 3/53 or 5.7 percent. More recently, based on floods in 2002, 2003, 2010, and 2013, the probability of any recordable abnormal flooding has been 4/11 or 36.4 percent. Minor seasonal flooding, however, is a normal annual occurrence.

DAM FAILURE

There are no dams whose failure would directly affect the city of Ironwood. However, this is ranked as the number three hazard risk for Gogebic County, primarily because of a dam in the city of Wakefield that is subject to overtopping due in part to a malfunctioning floodgate.

SHORELINE FLOODING AND EROSION

This type of flooding is not a direct concern for the city of Ironwood due to its non-coastal location.

SECTION 4: FLOOD HISTORY AND IMPACT

The city of Ironwood has experienced three relatively severe riverine and urban floods in the recorded past, in 1960, 2002, and 2013; and two less severe floods, in 2003 and 2010.

1960

The 1960 flood was a result of extended rainfall in the Upper Peninsula (U.P.). During April 24 through 26, three to five inches of rain were received. From May 6 through 12, four to six more inches were received. This rain had a more severe effect in the Western U.P. than in other regions because of a particularly large snowpack remaining in forested areas. The rain, then, was only one direct factor, contributed to in large degree by snowmelt.

One of the best documented ways to measure the direct effect of runoff and floodwater magnitude associated with flood events is with United States Geological Survey (USGS) stream discharge data. USGS operates a number of automatic stream level and discharge monitoring stations throughout the United States, including in the Western U.P. A summary of the data's applicability to the 1960 flood is provided in USGS (1988-89).

During the 1960 flood, large areas of the U.P. experienced peak stream discharge recurrence intervals of 25 to 50 years. Somewhat more limited areas experienced intervals of over 50 years. The

Montreal, Black, and Presque Isle Rivers in the Western U.P. saw intervals of 100 years. These intervals may be considered in the same way as flood intervals. While the discharges do not necessarily translate to a 100-year flood, these historical data indicate just how severe the 1960 flood event was.

Luckily damage was minimal thanks to the region's mostly rural nature, and damage, primarily commercial and residential, was estimated at $575,000. Transportation was also hindered by washed-out roads. According to an April 28, 1960 Wakefield News article, area rains delayed iron ore shipments due to road and rail closures. As a result, ore was stockpiled for several days at mines throughout the Gogebic Range, of which Ironwood is a part (though no mines remain in operation).

2002

As severe as the 1960 flood event was, 2002's flooding was of an even greater magnitude. This flood event was primarily a result of snowmelt. Extreme snowfall had taken place in February and March 2002 over the Western U.P. Over 100 inches were received, holding over 11 inches of water. Much of this water was released from April 11 through 17, sending it into lakes and streams. Prior to this, over two inches of rain had fallen on April 6 and 7. Temperatures during the melting period were unseasonably high, with record highs around 80 degrees Fahrenheit on April 13 and 15. One and one half additional inches of rain were received toward the end of the melting period on April 16. In response to this chain of events, stream levels rose and began to overflow; the initial response was to close a number of county and local roads throughout the U.P.

Major flooding took place in eight Upper Peninsula counties, with Gogebic bearing the worst. In Ironwood, the Montreal River rose above flood stage, along with other major streams in the county. Within the county, the cities of Ironwood and Wakefield suffered the greatest damage. The Governor responded by declaring a state of emergency in the county, which was later declared a disaster area. All major area highways were closed due to high water, including U.S. 2 through Ironwood, along with 25 local and county roads. One partial failure of a minor dam occurred in an outlying area on the Presque Isle River. Floodwaters were receding by April 19, at which time County Board Chair Leroy Kangas estimated at least 30 homes and five businesses to have been damaged in the city, according to an Associated Press article with that date.

Several residents were temporarily displaced by the 2002 flood, and the Red Cross and Salvation Army assisted them with lodging. The flood seriously impacted nonresidents as well, whether they were travelers intending to pass through the area or workers from outside of the area: One mail carrier from Ontonagon, in the next county over, was forced to add 100 miles to his evening commute just to run his regular route. There were no fatalities as a direct result of the flooding, but there was one indirect fatality due to cardiac arrest when ambulance response was delayed by detours. Overall, however, adequate response resources were available to assist both residents and nonresidents with adjusting as necessary to the changing situation.

2003

Substantial flooding occurred again just outside the city, on the Black River (among other places), just over one year after the 2002 flood event. The 2003 event was not of the same magnitude but did result in $2 million worth of damage in the Western U.P. overall. The 2002 event, in comparison, caused well over $10 million in damage across the Western U.P. and ultimately had a regional economic impact of $18.5 million.

2010

During a period of severe thunderstorms throughout the southern Upper Peninsula on July 27, nearly 3 inches of rainfall flooded Highway U.S. 2 from Douglas Street to Lowell Street in Ironwood. In the western part of the city, several homes near Hemlock Street were flooded. Property damages of $10,000 resulted.

2013

In the last days of April, a very heavy snowpack combined with moderately high temperatures resulted in flooding of the Montreal River, Sunday Lake in Wakefield, and numerous streams, both large and small, in the region. Flooding was the most severe since 2002, but lessons learned from that event resulted in quicker reaction and better preparedness for 2013. Large number of sandbags were on hand and were used to minimize overflows in Ironwood and Wakefield. Pumps were close at hand to impede overflow of Sunday Lake onto Highway M-28; the highway was closed for three days to accommodate efforts. In Ironwood itself and throughout the county, several roads were inundated and many others nearly so. Heavy snowfall during May 2 and 3 hampered flood control, but ultimately the waters receded and left little damage in the City of Ironwood in their wake.

Near the end of the flooding period in mid-May, a disaster declaration was issued by the state and federal governments, opening up the area to use of non-local funds. Early damage estimates were approximately $2 million in Gogebic County as a whole.

SECTION 5: CURRENT CONCERNS

CONTINUING RISK

Despite improved response to flooding in 2013, much of the hazard associated with the catastrophic 2002 flood and other minor ones remains in the city. The Montreal River sees mild flooding annually. Property owners living in floodplains along the river have resigned themselves to this flooding, sustaining losses that may or may not be recouped through flood insurance. Neither

property owners nor the city have undertaken structural or other long-term mitigation measures to reduce the threat of either annual flooding or a potential extreme event.

REPETITIVE LOSS PROPERTIES

Properties that have faced two repetitive losses of at least $10,000 within ten years are of special concern, possibly demonstrating incompatibility of current land use with location. These properties are prioritized for mitigation. Properties for which both such losses have exceeded the market value of the building are eligible for special FEMA mitigation funding. According to the Michigan state National Flood Insurance Program Coordinator, there are no repetitive loss structures in the city.

Occurrence of severe flooding in Ironwood is highly irregular and unpredictable. As previously mentioned, the Montreal River typically floods seasonally. This affects several homes located in the floodplain, but financial losses do not reach the threshold for these to be considered repetitive losses.

CRITICAL FACILITIES

As the county seat and largest community in Gogebic County, Ironwood has a number of critical facilities (those essential to city operations and/or flood response) to consider for protection in the event of a flood. One of these, the water treatment plant, is located within the 100-year floodplain. Inundation of this facility with water could lead to contamination of the municipal water supply. This would be extremely disruptive to operations of the city and its residents and businesses in flood response and recovery, making protection measures an important goal. No other critical structures within the city are subject to flooding. However, one city-owned pump station located in a low-lying area of Ironwood Township is at risk from potential flooding of Spring Creek.

Critical facilities within and adjacent to the city are shown in **Map 5**.

SPECIAL FLOOD HAZARD AREAS

One of the easiest ways to delineate areas sensitive to flooding is to examine what is present in the 100-year flood boundary. A 100-year flood is one that has a one percent chance of being equaled or

exceeded in any given year. The areas or "zones" within this boundary are termed "**Special Flood Hazard Areas (SFHAs)**." The boundary is a determinant for flood planning and for the FEMA National Flood Insurance Program described below. All such areas of concern in Ironwood and bordering Hurley, Wisconsin, are along the Montreal River. The most recent boundaries are shown in **Map 6**.

Based on analysis of high-resolution satellite photos and the 100-year flood boundary as expressed in Map 6, as well as committee input, approximately 50 structures within and adjacent to the floodplain could be affected by a 100-year flood. Besides the critical facilities noted above, another city property relatively sensitive to flooding is Norrie Park along the banks of the Montreal River. However, even the park is removed from flooding to the extent that the Flood Mitigation Advisory Committee has indicated that if the park were to be inundated, the city as a whole would essentially be at the point of shutdown.

SECTION 6: FLOOD PREPARATION, OCCURRENCE, AND OUTCOME

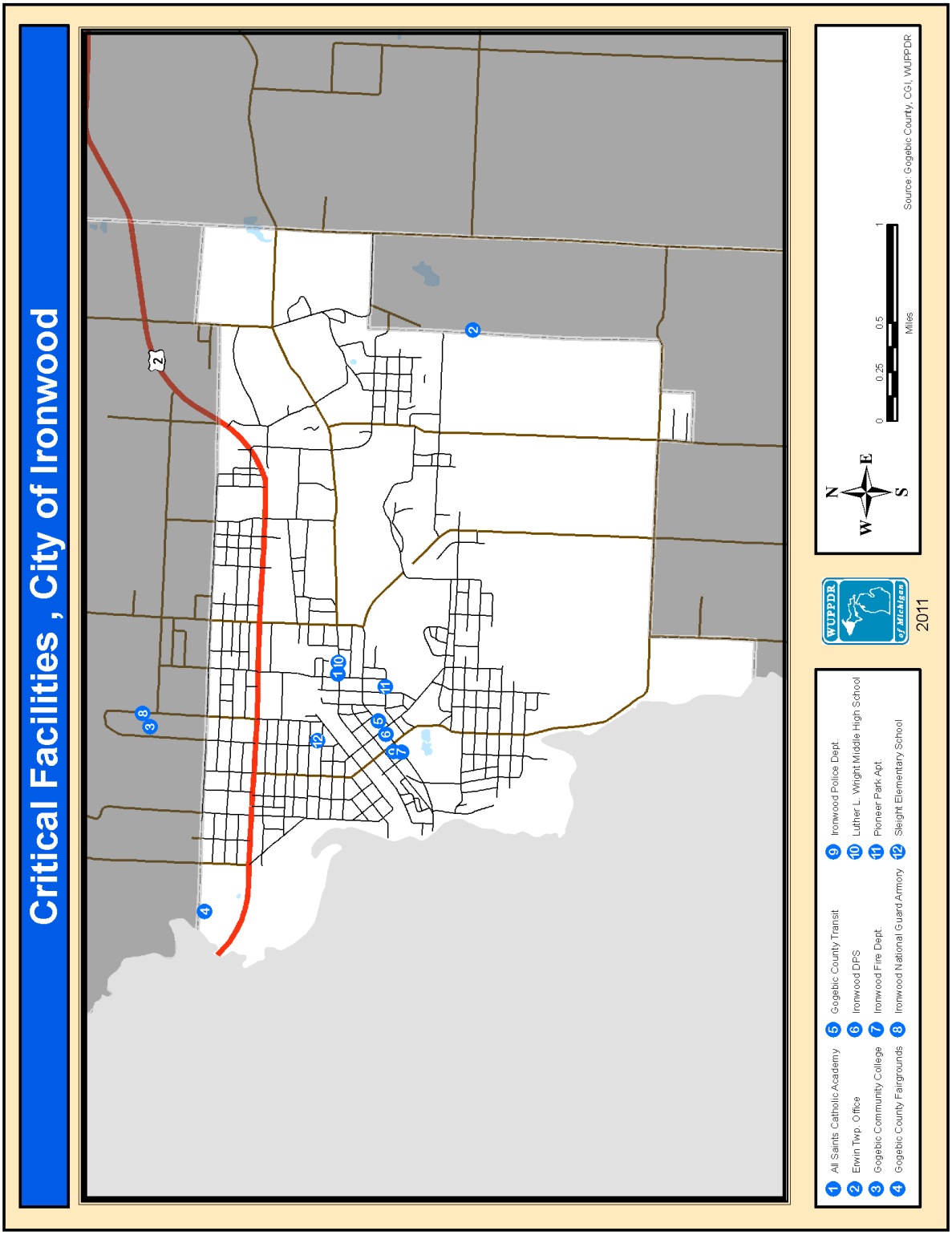
The major intention of conducting a risk assessment is to determine how to prepare and respond to a flood. Municipalities institute a variety of warning systems as advance preparation, the value and logic of which depend on the likelihood of a disaster occurring. Evacuation routes, procedures, and shelters constitute late stage preparation and must be arranged in detail long before they are needed, thus aiding in immediate, effective response to an event. The subsequent long-term response ideally should inform preparation for potential future disasters.

FLOOD INSURANCE

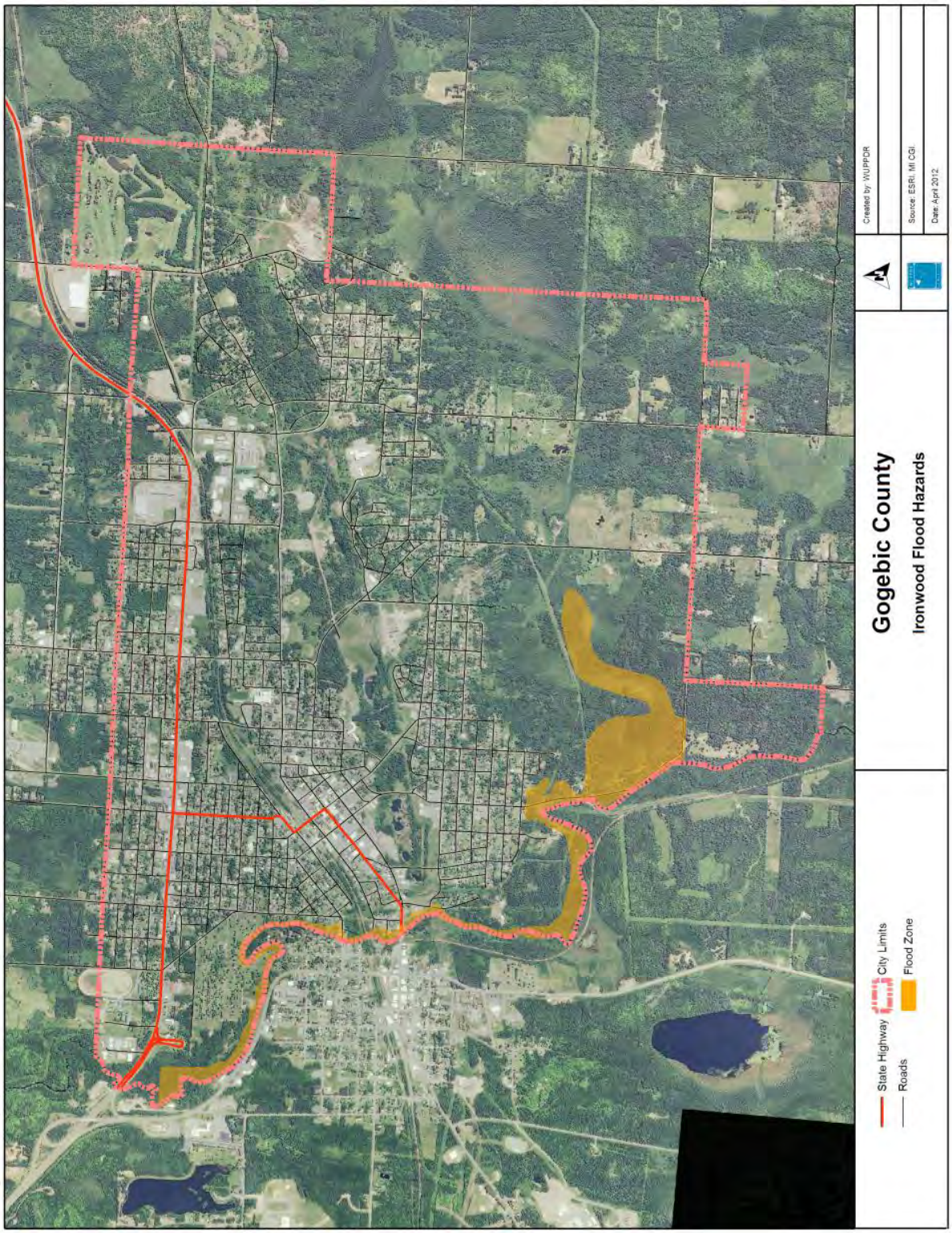
The Federal Emergency Management Agency offers flood insurance through the **National Flood Insurance Program (NFIP)**. Participating cities and other municipalities must have active floodplain management ordinances to be eligible for the federally guaranteed and subsidized insurance, which is available to renters, homeowners, and business owners.

During a flood hazard assessment, FEMA develops a **flood insurance study** and **flood insurance rate map (FIRM)**. Insurance agents use the map to determine flood insurance premium rates for specific properties. The most recent FIRM for the city of Ironwood (**Appendix A**) was developed in 1975. It is

Map 5: Critical Facilities



Map 6: Special Flood Hazard Boundary



a good general guideline but not necessarily representative of current conditions. The map has some correspondence to the SFHAs within the 100-year flood boundary shown in Map 6 above. The city is compliant with NFIP, a status maintained through a Flood Hazard Reduction Standards ordinance and through planning activities such as this. Additionally, building codes prevent issuance of city permits for any structure to be built in the 100-year floodplain.

In order for flood insurance to be effective, of course, eligible residents in floodplains must enroll in the policies. During the 2002 flood, only 12 properties were insured in the city of Ironwood, and some of those were undamaged. Only one percent of eligible structures were covered in Gogebic County, and none in the city of Wakefield. Losses on uninsured properties could not be recouped, as flood insurance coverage is not retroactive when purchased following a flood. As with any insurance, this is why it is important for property owners to be covered even when they do not expect to need the coverage.

The **NFIP Community Rating System (CRS)** provides discounts up to 50 percent on flood insurance to policyholders based on flood mitigation activities undertaken by the community where the policyholders live. Ironwood does not participate in the CRS at this time, but it is a future option.

WARNING, RECOGNITION, AND MONITORING

The one universally beneficial safeguard to disaster is an early warning system since, as the Michigan State Hazard Mitigation Plan states, “it is typically the last line of defense against serious disaster related injury or loss of life.” In the event of a flood or other disaster, Gogebic County relies on an Incident Command System (ICS) for on-scene disaster response. Under this arrangement, described in the Emergency Action Guidelines of 2003 (EAG), the Gogebic County Sheriff’s Department is primarily responsible for initial warnings. The Emergency Management Coordinator also plays a role. Subsequently, out of five teams composing ICS, the Planning and Intelligence team performs ongoing monitoring of a situation.

Ironwood does not have an advanced early warning system specifically for floods. Weather forecasts and human observation of stream conditions have so far sufficed to predict and monitor flooding. Officers from the Ironwood Department of Public Safety report in writing, during conditions of high

flood potential, on the status of the city's two primary visual gauges. These are located at Norrie Street and at the railroad trestle to the south. In addition, many property owners residing near the Montreal River take it upon themselves to notify public officials if conditions become critical. If this occurs, community warnings are broadcast as appropriate, followed by response and monitoring as detailed in the EAG. An advanced early flood warning system is unnecessary and not feasible for the city given the low severity and frequency of floods as well as clear visible and meteorological warning signs.

IMMEDIATE RESPONSE

Under the EAG, the five teams of ICS serve different aspects of response:

- The **Command** team, headed by an Incident Commander, assumes overall control of all aspects of response and gauges the need for higher level involvement and external funding.
- The **Operations** team handles immediate issues and directs different actors in ICS to meet their specific duties.
- Along with the monitoring described above, the **Planning and Intelligence** team is responsible for providing and analyzing information and anticipating future needs.
- The **Logistics** team makes arrangements to obtain personnel and other resources necessary for the response effort.
- The **Finance and Administration** team works in the background but is responsible for tracking expenses, monitoring agency financial capabilities, and addressing contract issues.

ICS was developed in the 1970s to resolve communication and coordination issues and continues to serve this purpose, being adaptable to all types of disasters, both human-related and natural.

EVACUATION

Evacuation for flooding of the Montreal River in the city is simple: Move uphill. The city's street grid makes immediate removal from flood waters a straightforward process. However, evacuation in the event of widespread inundation would be more problematic. As previously mentioned, some low-lying sections of Highway US-2 can potentially flood. As this is the primary evacuation route, options

for movement from and through the city can become limited. During the 2002 flood, road closures due to flooding of the Bad River and other streams to the west required diversion of Wisconsin-to-Michigan travelers as far south as Park Falls, Wisconsin—a detour of up to 35 miles in one direction.

Normally Highway US-2 is the east-west evacuation route from the city, but this would most likely be blocked during a flood event at the bridges across the Montreal River. US-51 in Wisconsin is the primary route to the south but would suffer the same problem, as would Business Route US-2, which becomes WI-77 and then intersects US-51. Farther to the east, secondary north and south evacuation routes less likely to be affected by flooding are Lake Street/County Road 505 and Van Buskirk Road, respectively. See **Map 7**. Although likely evacuation routes can be identified in advance, routes should of course be reviewed by the Sheriff and fire departments in coordination with the Gogebic County Emergency Manager at the onset of imminent disaster threats.

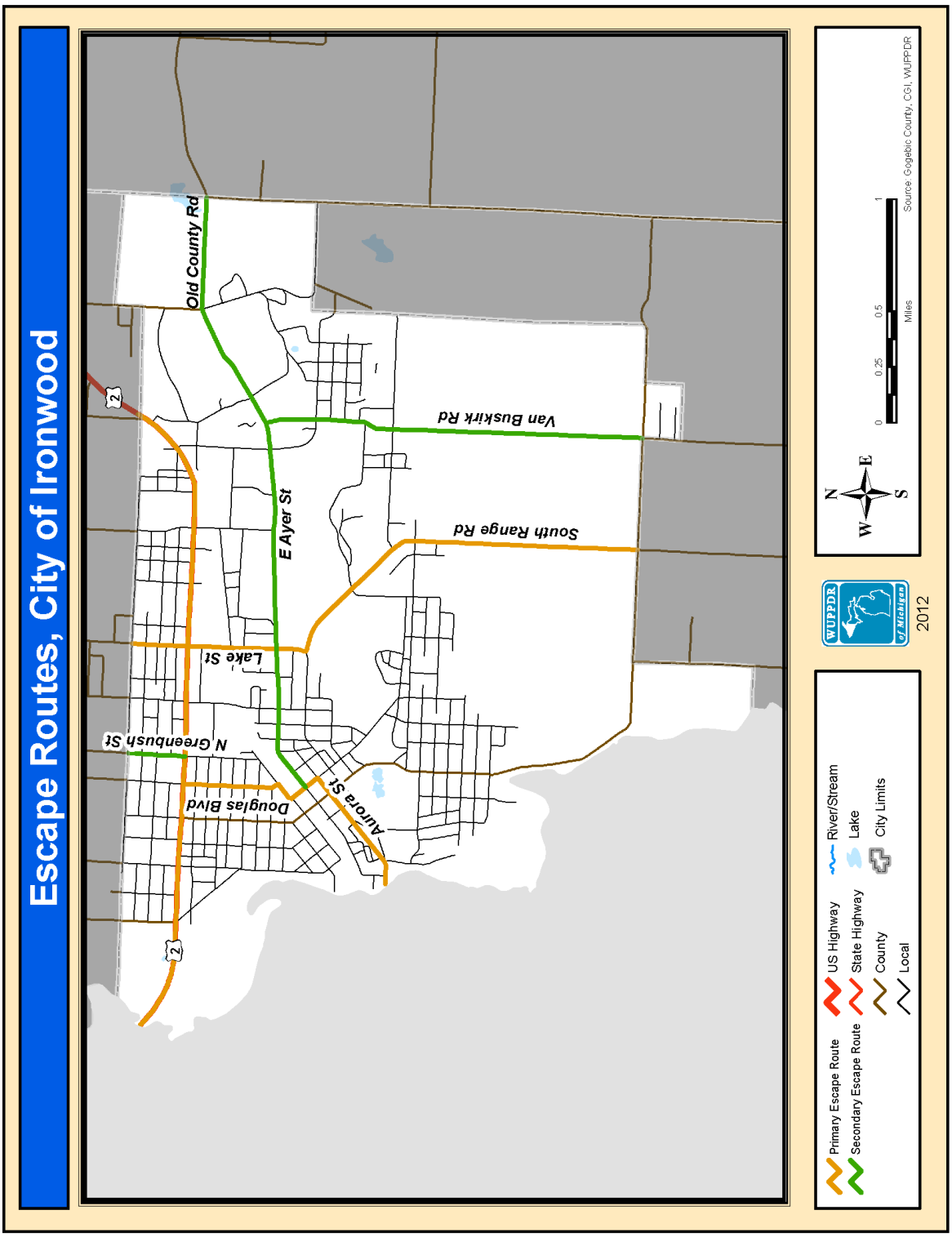
One part of the evacuation process is the ability of the Gogebic County Transit Authority and its buses to be quickly mobilized to evacuate group homes, subsidized housing, and similar institutions. This is especially important for elderly and disabled individuals who cannot board regular cars or vans. The Transit Authority maintains continual contact with emergency management officials in such a scenario using the Public Safety Communications System, as it did in recent years when a front end loader broke a natural gas line, requiring evacuation upwind of the gas within eight minutes. The evacuation was successful.

SHELTERS

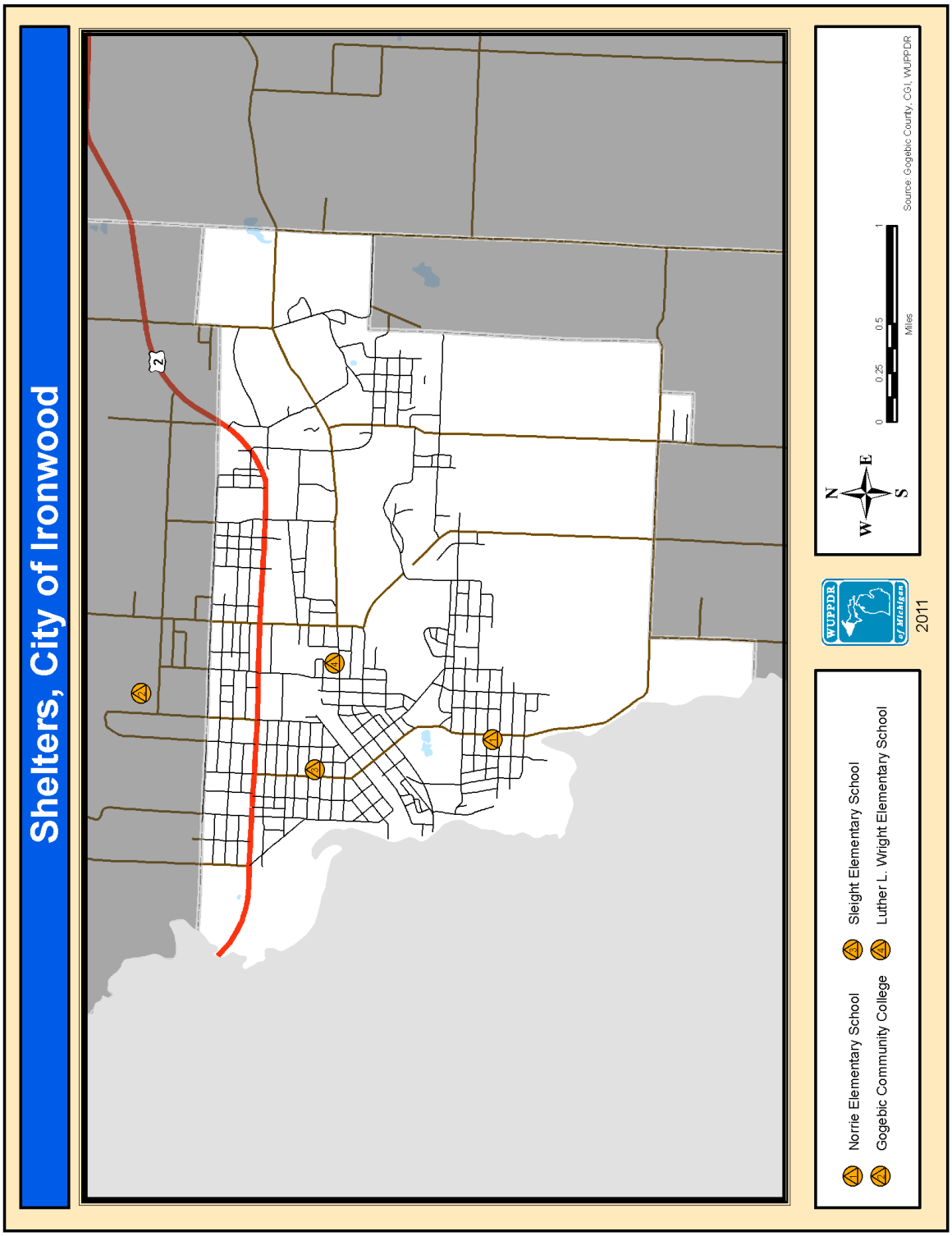
Three of Gogebic County's eight Red Cross emergency shelters are located in the Ironwood city limits, with one other adjacent. All of the county shelters are reasonably close to the city. The shelters are staffed by the American Red Cross service office in Hancock, and, if necessary, supported by the Chapter office in Marquette. The three shelters located in the City of Ironwood Sleight Elementary School, Luther L. Wright Elementary School, and Norrie Elementary School. Gogebic Community College is another shelter located in Ironwood Township near the city.

None of the shelters are located in a floodplain, and they are all expected to remain accessible during a 100-year flood event. Shelters in and near the city are shown in **Map 8**.

Map 7: Evacuation Routes



Map 8: Emergency Shelters



The American Red Cross service office in Hancock responded to the 2002 Western Upper Peninsula flooding. In such an event, the Disaster Director (team leader) in Hancock deploys the approximate number of trained personnel needed to provide service and requests additional support if necessary.

If shelters are required, the American Red Cross office in Hancock, Michigan will establish a shelter in coordination with the Gogebic County emergency manager in the vicinity of the event. In the case of the 2002 flood, the American Red Cross set up a shelter at the Indianhead Ski Resort, which was about 3 miles from the disaster area and took in 30 to 40 families for three days. For a rescue effort, a temporary assembly area for people coming out of the danger area would be established, and then they would be transported to a shelter. In an evacuation effort, the locations of shelters are established before they are announced through the information dissemination process.

The Red Cross is responsible for operating, staffing, and managing the shelters, and their efforts would be coordinated with the Salvation Army if necessary. In the case of a flood disaster, the Red Cross tracks all evacuees so that families and relatives are able to ascertain their locations.

PROPERTY PROTECTION

In 2002, Ironwood's main form of response to the floodwaters themselves – that is, immediate measures taken to limit or stop flooding and prevent inundation – was sandbags. This strategy was used throughout the city and was quite successful in preventing destruction of many structures. The purpose of sandbags is not to form an impermeable barrier that will hold back all floodwaters but to prevent inundation by most

water and slow accumulation behind the barrier to prevent severe property damage, prevent road closures, and allow water to be pumped out from the "dry" side of the barrier at the rate of accumulation if necessary.

The city of Ironwood Public Works Department maintains a stockpile of sandbags in sufficient numbers to address an event comparable to the 2002 flood. Eight pallets of 50 to 60 bags each are stored, and city staff are aware of the steps that would need to be taken to distribute them – a process tested successfully during the 2013 flood. At the very least, this number of sandbags provides a good starting point for flood response. Given the gradual buildup of floodwaters in the past, the stored bags can allow sufficient time to order additional materials from other locations as necessary.

For water that does accumulate on the dry side of sandbag lines, pumps may be necessary in some cases, especially to protect sensitive facilities. Some private property owners may also be interested in using these devices to protect their own property. Due to the expense and limited use of pumps, the city does not maintain any regularly.

LONG-TERM RESPONSE AND MITIGATION

Post-disaster reconstruction, regulation, and mitigation planning procedures should be coordinated as part of post-flood response planning. Preliminary damage assessments should be conducted immediately following a flood to evaluate conditions and to identify appropriate mitigation measures. Some level of reconstruction is almost always necessary. The federal, state, and

local mitigation efforts should evaluate the warning and response activities that were implemented during the disaster.

Proactive measures that could be coordinated and delegated by the Gogebic County emergency manager to prepare for floods and assist in the repair and recovery process include:

1. Regulating reconstruction to ensure that it meets all code requirements
2. Disseminating public information to advise residents about mitigation measures they could incorporate into their reconstruction work (for example, elevating structures and utilities above flood level)
3. Constructing flood-retaining structures alongside watercourses as necessary and feasible
4. Evaluating damaged public facilities to identify mitigation measures that could be included during repairs
5. Acquiring substantially or repeatedly damaged properties from willing sellers in order to transition to land uses less likely to be affected by future flooding
6. Continuing to disallow construction in the 100-year floodplain as a permit condition of public agencies in accordance with FEMA compliance requirements
7. Planning for long-term mitigation activities
8. Applying for post-disaster mitigation funds

ECONOMIC LOSSES

The assessed value of structures in the floodplain is $2,038,420. A large proportion of these structures was affected by the 2002 flood, totaling 170 in Gogebic County.

SECTION 7: COMPREHENSIVE MITIGATION PLANNING

The end product of mitigation planning is a set of strategies comprised of goals, objectives, and actions to reduce future flooding potential and improve preparedness, response, and recovery. Each goal is implemented through objectives and actions. These actions are laid out and prioritized in a

capital improvements plan. This is a prerequisite for the projects to be eligible for federal disaster mitigation funds.

OTHER RELEVANT PLANNING DOCUMENTS

The Michigan Hazard Mitigation Plan addresses a wide variety of hazards on a statewide scale. Since that plan covers a much larger geographic area than this one, with a range of population densities, terrains, and climate types, many of the hazards identified in that plan do not necessarily apply to Ironwood or its surrounding area. However, the state plan provides valuable guidance in what potential disasters are worth exploring. There is no sub-state regional plan covering the city of Ironwood.

Development of a master plan for the City is underway. When a master plan is completed, it should incorporate the suggested mitigation measures set out in this plan. In the meantime, all proposed development projects within the city limits must be approved by a planning commission through zoning. Current land use is shown in **Appendix C**.

At its most basic level, a zoning ordinance narrowly regulates present land uses. These regulations are one instrument for preventing construction of permanent structures such as residences in environmentally volatile areas such as floodplains. Ironwood employs a Community Development Director who administers zoning; a Code Inspector; and an Assessor/Building Inspector; all who can provide staff support to implement items in specialized plans such as this.

TYPES OF HAZARD MITIGATION

The Michigan Hazard Mitigation Plan identifies five basic types of hazard mitigation. These are influential but not directly connected to the strategies outlined in the next section.

1. Modifying the hazard: Removing, eliminating, reducing, or controlling the hazard itself rather than its effects, as by retaining floodplain vegetation
2. Segregating the hazard: Keeping the *hazard* away from *people*, as with floodwalls (or, in more urgent situations, sandbags)

3. Preventing or limiting development: Keeping the *people* away from the *hazard*, as with zoning
4. Altering design or construction: For example, raising buildings above flood levels
5. Early warning and public education: Raising awareness so people know how to react to a flood

SECTION 8: GOALS AND OBJECTIVES

Based on past occurrences and current status of flood risk in the City of Ironwood, number of goals, objectives, and potential actions to address future flooding have been identified. High-priority actions that have been included as specific items in the subsequent Action Plan are in bold text.

PREVENTION

Goal: Reduce rapid surface runoff or point-source influxes to the Montreal River and its tributaries within the city.

- Objective: Reduce direct runoff from paved surfaces to storm sewers.
    - *Action*: Promote construction "best practices" (such as erosion control and avoidance of soil compression) to reduce the severity and overall impact of runoff from construction sites.
    - ***Action*: Through the city newsletter and website, provide information on low runoff-impact site development features, such as rain gardens and permeable pavers.**
    - *Action*: Enact regulations prohibiting any increase in the overall impervious surface area of each developed lot being modified.
- Objective: Restore natural ground cover along the shore of the Montreal River and its tributaries in order to reduce runoff rate and volume.
    - *Action*: Maintain current undeveloped city property in the 100-year floodplain in its present state or as parks, forested land, or agricultural plots.

- *Action*: Acquire land within the 100-year floodplain as city property and reserve it for the limited uses above.
- *Action*: Develop and implement a program to educate residents through mailings, public forums, or other information resources as to the environmental benefits of maintaining ground surfaces as natural vegetation that slows and absorbs runoff.

Goal: Eliminate blockages to water flow before they cause broader problems.

- Objective: Provide surface watercourses with adequate capacity to support natural flows and prevent inundation of transportation routes.
  - ***Action*: Replace culverts periodically as indicated in Capital Improvements Plan.**
  - ***Action*: Keep the Montreal River adjacent to the city free of debris and miscellaneous materials to eliminate backup points, which could result in upstream flooding and potential downstream flash flooding due to sudden blowouts.**
- Objective: Provide urban drainage systems with adequate capacity.
  - *Action*: Keep storm sewer inlets and outlets and retention pond inlets free of debris, which can cause flooding related to precipitation and runoff in surrounding areas.
  - *Action*: Ensure that storm sewer system upgrades are made in areas that still require them, preventing routine backups.

Goal: Prevent inundation of vulnerable areas in the city overall by flood-stage waters that cannot be avoided.

- Objective: Explore the feasibility of a permanent floodwall or other flood-retaining structure to protect low-lying developed areas of the city from at least a 100-year flood.
  - ***Action*: Commission a scientific/engineering study of the feasibility and impacts of such a structure skirting the Montreal River from, at minimum, Silver Street south to Spruce Street.**
  - *Action*: Provide opportunities for public input.

- *Action*: Discuss the potential external impacts of a floodwall with officials from neighboring municipalities, including the city of Hurley, Wisconsin.

PREPAREDNESS

Goal: Reduce the immediate threat potential from an impending flood.

- Objective: Improve flood prediction capability.
  - ***Action*: Acquire and install wireless transducers at two points (those traditionally measured visually) in the Montreal River to remotely transmit water level data to the Department of Public Safety.**
- Objective**:** Plan for an orderly immediate response to a flood event.
  - ***Action*: Develop a flood response plan compatible with and incorporated into the city's general emergency plan and Gogebic County Emergency Action Guidelines.**
  - *Action*: Ensure primary and contingency evacuation measures are in place and compatible with those of surrounding communities.
  - *Action*: Maintain a supply of temporary water containment materials at the Department of Public Works, and keep new staff apprised of the location and distribution process.
  - ***Action*: Publicize information on evacuation routes and other flood response resources through the city newsletter, and make it easily available to residents at all times on the city website.**

Goal: Reduce the potential for structural damage within and near the floodplain.

- Objective: Acquire properties as they become available to prevent perpetuation of structural uses within the floodplain.
  - ***Action*: Create a floodplain overlay zoning district to permit only undeveloped land, agricultural use, and parks without structures susceptible to flood damage within the 100-year floodplain.**

    - *Action*: Acquire flood-susceptible properties from landowners, on a voluntary basis, to become city properties maintained as above.
    - ***Action*: Develop a city Comprehensive or Master Plan to formalize and legally support all acquisition and land use controls suggested by this plan.**
- Objective: Safeguard properties with structures in the 100-year floodplain that are not likely to be acquired and/or converted to an alternate use.
    - *Action*: Respond to information requests from property owners regarding the level of risk to their properties and recommend single property-based mitigation steps (e.g. water barriers and pumps) to limit damage from a flood hazard.
    - *Action*: Apprise property owners of the same during code inspections and other visits by city staff.
    - *Action*: Publicize to floodplain property owners the benefits of acquiring and maintaining flood insurance.
    - ***Action*: Participate in the Community Rating System to make flood insurance as accessible as possible to at-risk property owners.**

RECOVERY

Goal: Examine the process of recovery from past flood events and determine what steps can be taken to ease it.

- Objective: Ensure that all organizations playing different parts in recovery, such as fundraising, housing dislocated persons, and dealing with psychological effects are in place and aware of the potential contingencies and outcomes of flood scenarios.
- Objective: Following a flood event, ensure that involved organizations are kept apprised of the initial and continuing impacts of the flood and the needs of victims.
- Objective: Encourage grassroots efforts to develop new non-governmental organizations to fill gaps in recovery pertaining to disasters, including floods.

SECTION 9: IMPLEMENTATION

Mitigation projects of primary importance will be submitted to DEQ/FEMA for a Pre-Disaster Mitigation Program grant program. Many projects suggested by the objectives and actions outlined above can be done at little or no marginal cost, whereas others are too costly to undertake based on current risk. Those identified by the Flood Mitigation Advisory Committee as current important concerns are listed here.

ACTION PLAN

1. **Develop a Master Plan for the city of Ironwood**
    - *Responsible Entity*: City Manager (through consultant)
    - *Goal Deadline*: 2014
    - *Potential Funding Sources*: City
    - *Benefits*: A master plan is legally required for any municipality implementing zoning. Such a plan legitimizes and legally supports the zoning ordinance, which includes floodplain regulations. A master plan can also be used to redirect unsuitable land uses away from the floodplain and to regulate impervious surfaces and other runoff components.
2. **Inspect and keep the Montreal River free of excessive debris.**
    - *Responsible Entity*: DPW
    - *Goal Deadline*: Ongoing
    - *Cost*: City for routine observation; $10,000 for full debris removal
    - *Potential Funding Sources*: City; other sources
    - *Benefits*: Debris removal can prevent stream backups, reducing or eliminating flooding. Debris can be removed upstream from the city to prevent remote releases of distant backups into the city limits (one of the few controls the city has outside of its jurisdiction.
3. **Create and maintain a Flood Response and Responsibility Plan as a component of the city Emergency Plan.**

- *Responsible Entities*: IDPS; County Emergency Management
- *Deadline*: 2014
- *Cost*: City
- *Potential Funding Sources*: City
- *Benefits*: A flood-specific plan can coordinate city departments and between the city and county.

4. **Replace culverts as indicated in Capital Improvements Plan.**
    - *Responsible Entity*: DPW
    - *Deadline*: Ongoing, as indicated
    - *Cost*: Variable
    - *Potential Funding Sources*: City
    - *Benefits*: Updated culverts reduce water backups and open potential evacuation routes by preventing road closures.
5. **Develop and conduct an information campaign, through the city newsletter and website, regarding low-impact development and flood response.**
    - *Responsible Entities*: Community Development & City Clerk
    - *Deadline*: 2015
    - *Cost*: City
    - *Potential Funding Sources*: City
    - *Benefits*: Public education on urban environmental and water systems helps prevent flooding issues from arising in the first place. Public awareness of flood response capabilities and procedures reduces disarray in the event of an actual flood.
6. **Create and adopt a Floodplain Overlay Zoning District.**
    - *Responsible Entity*: Community Development
    - *Deadline*: 2015
    - *Cost*: City
    - *Potential Funding Sources*: City; FEMA

- *Benefits*: An overlay district can address flood-specific issues in localized areas without affecting general zoning districts throughout the city. This provides added flexibility.

7. **Acquire and install Montreal River water level transducers/transmitters.**
    - *Responsible Entities*: IDPS; City Manager (for grant)
    - *Deadline*: 2016
    - *Cost*: ?
    - *Potential Funding Sources*: from Jim Loeper
    - *Benefits*: A remote flood observation system allows for real-time reporting and automatic recording, eliminates the need for trips to check visual gauges, and allows for observation when visual gauges are not accessible.
8. **Commission a feasibility study for a floodwall along a segment(s) of the Montreal River.**
    - *Responsible Entities*: IDPS & County Emergency Management
    - *Deadline*: 2017
    - *Cost*: ?
    - *Potential Funding Sources*: FEMA
    - *Benefits*: A floodwall can protect property by reducing flooding of the lowest-lying residences and business areas.
9. **Explore properties in the 100-year floodplain for potential acquisition on voluntary basis.**
    - *Responsible Entities*: Community Development
    - *Deadline*: 2017/ongoing
    - *Cost*: City
    - *Potential Funding Sources*: City; FEMA
    - *Benefits*: The hazard to private property and structures can be permanently eliminated by converting residences and businesses to low-activity public uses.
10. **Pursue participation in the FEMA Community Rating System (CRS).**
    - *Responsible Entities*: Community Development
    - *Deadline*: 2018, then ongoing
    - *Cost*: City

- *Potential Funding Sources*: City
- *Benefits*: CRS grants discounted flood insurance to residents of a municipality that takes steps to reduce current and future flood hazards. Property owners benefit from a lower cost of coverage, and the city itself benefits from a lower risk of flooding.

EXTERNAL FUNDING SOURCES

At one time federal disaster funding required presidential or gubernatorial declarations of emergency. Such is no longer the case. The following funding sources are available to communities for disaster planning and mitigation, including flood mitigation:

1. Pre-Disaster Mitigation Program: This was established by the federal Disaster Mitigation Act of 2000 to provide a funding source for obtaining planning and project funding outside the context of a disaster. The FEMA program is proactive, unlike most others, and ultimately lessens the cost of disaster by reducing damage through lower cost mitigation measures. The Gogebic County Multi-Hazard Mitigation Plan, including this Ironwood Flood Mitigation Annex, is funded under a planning grant through this program.
2. Emergency Management Performance Grant: Another FEMA program, this provides additional state funding, which can be redirected to local governments, for planning, mitigation, response, and recovery.
3. Flood Mitigation Assistance Program: The intent of this FEMA program is to reduce the burden on the National Flood Insurance Program through mitigation and implementation of mitigation measures. Repetitive losses, in particular, are to be avoided through this program. Funding is only available to participants in NFIP. This plan annex is developed using a planning grant through this program. **State-administered; 75% federal/25% local**
4. Hazard Mitigation Grant Program
5. Project Impact Program
6. Repetitive Flood Claims Program: This narrowly focused FEMA program is geared toward reducing damage to individual properties for which one or more NFIP claims have been

made in communities that cannot afford a local share under the Flood Mitigation Assistance Program. This program is annually appropriated and nationally competitive. **100% federal**

Numerous other grants are available to communities for which a presidential disaster declaration has been made, but those are outside the focus of this preventive plan.

REVIEW

This plan will be reviewed and updated on an ongoing basis as a component of and in the same manner as the Gogebic County Hazard Mitigation Plan, with special participation of City of Ironwood officials having duties and input related to flood mitigation.

Appendix

A. Flood Insurance Rate Map (1975) of Ironwood

B. Current Land Use Map of Ironwood

Appendix A. Flood Insurance Rate Map (1975) of Ironwood

Appendix B. Current Land Use Map of Ironwood