Antrim County Michigan

Natural Hazards Mitigation Plan

2016

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I. ACKNOWLEDGEMENTS

The Plan is the culmination of the interdisciplinary and interagency planning effort that required the assistance and expertise of numerous agencies, organizations, and individuals. Without the technical assistance and contributions of time and ideas of these agencies, organizations, and individuals, this plan could not have been completed.

Each jurisdiction within Antrim County is a continuing participant in the update of the Plan. The following is a list of key contributors who were instrumental in the development of the Antrim County Natural Hazards Mitigation Plan:

Antrim County Emergency Management Coordinator
Leslie Meyers

Antrim County Administrator
Peter Garwood

Antrim County Planning Department
Janet Koch

Antrim County Equalization
Karleen Heimreich, Director
Julie Weston, GIS Analyst

Antrim Conservation District
Heidi Shaffer

Antrim County Road Commission
Burt Thompson

Organizations
American Red Cross

Others

- Michigan Department of Natural Resources
- Antrim County Sheriff and 911 office
- Meadow Brook Health Care Facility
- Anchor Lamina (Industrial Facility)
- Commission on Aging
- Alba Fire Dept.
- Antrim County School District
- Bellaire Fire Dept.
- Elk Rapids Fire Dept.
- Star Township Fire Dept.
- Mancelona Fire Dept.
- Central Lake Fire Dept.

II. FEMA Letter of Approval

U.S. Department of Homeland Security
Region V
536 S. Clark St., 6th Floor
Chicago, IL 60605-1509

FEMA

NOV 1 8 2015

Mr. Matt Schnepp
State Hazard Mitigation Officer
Michigan State Police
Emergency Management and Homeland Security Division
4000 Collins Rd
Lansing, MI 48910

Dear Mr. Schnepp:

Thank you for submitting the adoption documentation for the Antrim County Hazard Mitigation Plan update. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. Antrim County met the required criteria for a multi-jurisdiction hazard mitigation plan and the plan is now approved for the county. Please submit the adoption resolutions for any remaining jurisdictions who participated in the planning process.

The approval of this plan ensures continued availability of the full complement of Hazard Mitigation Assistance (HMA) Grants. All requests for funding, however, will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted.

We encourage Antrim County to follow the plan's schedule for monitoring and updating the plan, and continue their efforts to implement the mitigation measures. The expiration date of the Antrim County Plan is five years from the date of this letter. In order to continue project grant eligibility, the plan must be reviewed, revised as appropriate, resubmitted, and approved no later than the plan expiration date.

Please pass on our congratulations to Antrim County for this significant action. If you or the communities have any questions, please contact Tom Smith at (312) 408-5220 or Thomas.Smith6@fema.dhs.gov

Sincerely,

E. N. E for

Christine Stack, Director
Mitigation Division

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III. PREFACE

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

The mission of the Antrim County Natural Hazard Mitigation Plan is to permanently eliminate or reduce long-term risks to people and property from natural hazards so that county assets such as transportation, infrastructure, commerce, and tourism can be sustained and strengthened. This can be accomplished through collaborative efforts/activities amongst agencies within Antrim County.

Mitigation allows repairs and reconstruction to be completed after an incident occurs in such a way that does not just restore the damaged property as quickly as possible to pre-disaster conditions. This process is needed to ensure that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage.

Recognizing the importance of reducing community vulnerability to natural hazards, Antrim County is actively addressing the issue through the development and implementation of this plan. The many benefits to be realized from this effort are:

Community Benefits of a Natural Hazard Mitigation Plan
Protection of the public health and safety
Preservation of essential services
Prevention of property damage
Preservation of the local economic base

This process will help ensure that Antrim County remains a vibrant, safe, enjoyable place in which to live, raise a family, maintain a tourist base, and continue to conduct business.

IV. EXECUTIVE SUMMARY

In 2000, the Disaster Mitigation Act shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is called hazard mitigation planning. FEMA now requires government entities to have natural hazards mitigation plans in place as a condition for receiving grant money, such as hazard mitigation grant program funds, in the future.

To meet this requirement, the Michigan State Police provided funding to encourage regional cooperation in the development of individual county Natural Hazards Mitigation Plans. The ***Northwest Michigan Hazard Mitigation Planning Project*** **update** was coordinated by the Northwest Michigan Council of Governments (NWMCOG) with Leelanau County being the Fiduciary. The update included Antrim, Kalkaska, Missaukee, Wexford, Grand Traverse, Leelanau, Benzie, and Manistee counties. NWMCOG worked with the Task Forces to update plans for these counties, which includes a general community profile, a comprehensive inventory of existing hazards, a hazard analysis, goals and objectives, and feasible mitigation strategies to address the prioritized hazards.

The Antrim County Natural Hazards Mitigation Plan focuses on natural hazards such as drought, wildfires, flooding, shoreline erosion, thunderstorms and high winds, and extreme winter weather, earthquakes and subsidence and was created to protect the health, safety, and economic interests of the residents and businesses by reducing the impacts of natural hazards through planning, awareness, and implementation. Through this Plan, a broad perspective was taken in examining multiple natural hazards mitigation activities and opportunities in Antrim County. Each natural hazard was analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigative action.

The Plan serves as the foundation for natural hazard mitigation activities and actions within Antrim County, and will be a resource for building coordination and cooperation within the community for local control of future mitigation and community preparedness around the following:

Table 1: Planning Goals for Antrim County

Natural Hazards Mitigation Planning Goals for Antrim County
Goal 1: Increase local participation in natural hazards mitigation
Goal 2: Integrate natural hazards mitigation considerations into the County's comprehensive planning process
Goal 3: Utilize available resources and apply for others for natural hazards mitigation projects
Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

Table 2: Priority Areas for Antrim County

Natural Hazards Mitigation Priority Areas
Priority Area 1: The Village of Bellaire (County Seat) area has a high damage potential from high winds and tornados; and flooding of residential areas. Mitigation Strategies: ***High Winds, Flooding***
Priority Area 2: Highway U.S. 31 through the Village of Elk Rapids and Torch Lake shoreline (Milton, Torch Lake, Central Lake, Forest Home, and Helena Townships). A high damage impact potential from severe thunderstorms and high winds affecting a high seasonal population rate and festivals in the summer. There are erosion concerns along Lake Michigan and Torch Lake coastal areas. Mitigation Strategies: ***Erosion, Severe Thunderstorm and High Winds***
Priority Area 3: Torch Lake shoreline (Central Lake, Helena, Milton, Torch Lake townships and Village of Central Lake) and Village of Mancelona - A high damage impact potential from extreme winter weather including snow and ice hazards. Mitigation Strategies: ***Extreme Winter Weather***
Priority Area 4: The Central Lake area (Village of Central Lake, Central Lake Township) has a high damage impact potential from severe thunderstorms and high winds, specifically affecting seasonal population increases at summer camps such as Camp Hayo-Went-Ha. Mitigation Strategies: ***Severe Thunderstorms***
Priority Area 5: The Cedar River area (Kearney and Custer Townships, Shanty Creek resort), has a high damage impact potential from severe thunderstorms and high winds; snow and ice hazards. Mitigation Strategies: ***Severe Thunderstorms, Extreme Winter Weather***

Table 3: Mitigation Strategies for Antrim County

Frequent Natural Hazard	Mitigation Strategies
Thunderstorms and High Winds	
	• Business and Homeowner education
	• Update and confirm shelter areas for campgrounds
	• Building code enforcement on new construction; following state and county codes; utilizing anchoring, bracing, tie downs, and window shuttering of buildings where necessary
	• Tree management on power line easements
Snow and Ice	
	• Data collection – develop a study of snowfall patterns and occurrence of damage
	• Snow load design standards
	• Adoption/Enforcement of building codes
	• Promote structural maintenance/improvements
	• Public education and awareness
Erosion	
	• Collaborate with county agencies and non-profits to identify erosion sites needing immediate corrective action
	• Open space designations: acquisition or conservation easements by land conservancies, county, townships
	• Soil erosion permits: erosion areas, drainage control, grading, debris flow measures, placement of vegetation (native species)
	• Zoning administration and enforcement of ordinances: development setbacks, lot sizes, driveways, relocation of structures, Lake Michigan coastal zoning ordinances – U.S. Army Corps of Engineers and Michigan Department of Environmental Quality
	• Building code enforcement through permits
Flood	
	• Identify potential flood areas and wetlands
	• Protection of wetlands for flood control: acquisition, conservation easements, stormwater control ordinance enforcement
	• Enforce Soil Erosion and Sedimentation Control Act
	• Building code enforcement for new construction
	• Public education and awareness

V. PURPOSE OF THE PLAN

In 2000, the Disaster Mitigation Act shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is called hazard mitigation planning. FEMA requires government entities to have natural hazards mitigation plans in place and updated on a 5-year cycle as a condition for receiving grant money related to natural hazard remediation.

The **purpose of the Antrim County Natural Hazards Mitigation Plan** is to find solutions to existing problems, anticipate future problems, prevent wasteful public and private expenditures, protect property values, and allocate land resources. The implementation of the Plan is to prevent injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, diminished tourist activity, liability issues, and damage to a community's reputation. For Antrim County in the northwest region of the lower peninsula of Michigan, the **planning process** utilized the following steps in the development of the Plan. Emphasis was placed on natural hazards that have had significant impact on the community in the past.

Steps in the Planning Process
Identification of natural hazards and risks
Preparation of draft plan
Identification of natural hazards mitigation goals and objectives for emergency management programs
Selection of evaluation criteria
Selection of mitigation strategies using locally chosen criteria
Public Comment
Completion of the final plan

What is a Hazard?

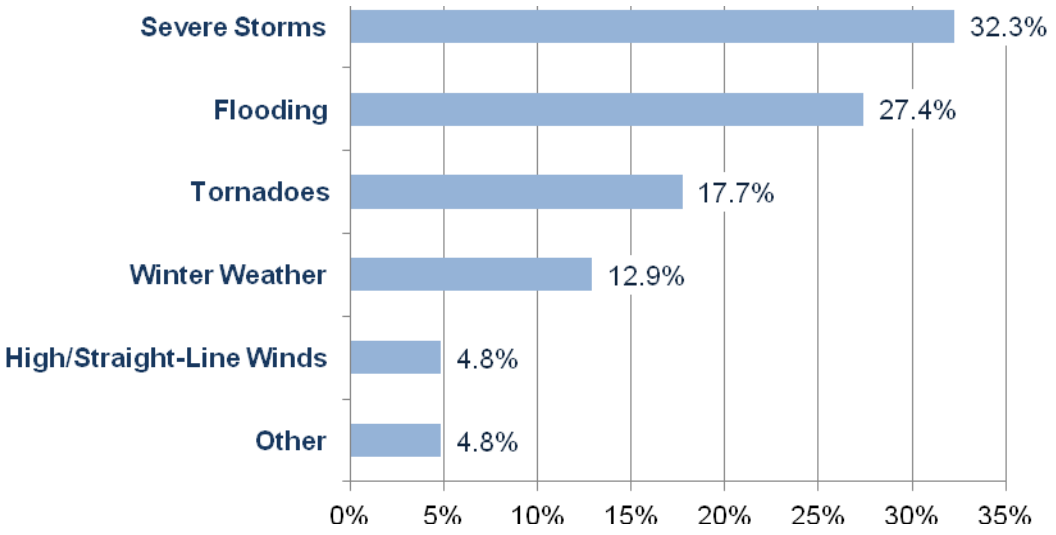
A **hazard** is an event or physical condition that has potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. This plan focuses on principle natural hazards that occur in the northern lower region (see Page 12). This Plan is intended to be a resource for building coordination and cooperation within a community for local control of future mitigation and community preparedness.

Principle Natural Hazards in Northern Lower Michigan
Severe Storms (Thunderstorms, Winter storms)
High Winds
Tornadoes
Extreme Temperatures
Flooding
Shoreline Hazards
Dam Failures
Drought
Wildfires
Invasive Species
Subsidence

Source: FEMA

Percent of natural hazard events for all formal disaster declarations in the State of Michigan (1953 – 2014)

Figure 1: Disaster Declarations for the State of Michigan



Source: FEMA

What is Mitigation?

Mitigation is the sustained action taken to lessen the impact from natural hazards and to work to reduce the long-term risk to human life and property from natural hazards and their effects. This long-term planning distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery. This Plan can be used to lessen the impact, to support and be compatible with community goals, to lay out considerations in choosing and evaluating methods, and to look at the feasibility of mitigation strategies.

VI. COMMUNITY PROFILE

Antrim County is located in Northwest Lower Michigan and is bordered on the west by Lake Michigan and Grand Traverse Bay and on the east by the Mackinaw State Forest, also referred to as the Jordan River Valley. The county is covered with a rolling terrain, with many lakes and rivers throughout the area. Most notable of the lakes is Torch Lake, considered to be one of the most beautiful lakes in the world. This lake is on a chain of lakes that runs from Bellaire, the county seat, to Elk Rapids. Another chain of lakes in the county goes from Bellaire north through Central Lake and Ellsworth, with the largest of these being Intermediate Lake. The largest concentration of people and businesses is in Mancelona located in the southeast corner of the county on US-131.

There has not been any major infrastructure development, nor major hazard mitigation efforts, in the county since the last adoption of the Plan in 2007.

The following community data is provided to describe Antrim County for planning and implementing mitigation strategies.

Table 4: Geographic features for Antrim County

Feature	Measure
Area in Water	31,161 acres
Forest Lands	180,821 acres
Wetlands	6,513 acres
Farmland (2012)	64,167 acres
Operating Farms (2012)	415
Miles of Great Lakes shoreline	27 miles

Source: US Agricultural Census, 2012; County Data

The total County population is **23,580**. The projected growth for 2020 is 25,780 and for 2030 it is 26,502. The population numbers from the 2010 Census for the **15 Townships and 5 Villages** covered by this plan include:

Table 5: Antrim County Population

Township/City/Village	Population	Township/City/Village	Population
Banks Township	1,260	Mancelona Township	3,010
Central Lake Township	1,246	Milton Township	2,204
Chestonia Township	511	Star Township	926
Custer Township	1,136	Torch Lake Township	1,194
Echo Township	877	Warner Township	416
Elk Rapids Township	989	Village of Ellsworth	349
Forest Home Township	1,239	Village of Central Lake	952
Helena Township	1,001	Village of Elk Rapids	1,642
Jordan Township	992	Village of Bellaire	1,086
Kearney Township	1,160	Village of Mancelona	1,390

Source: U.S. Census Bureau, 2008-2012 American Community Survey

- There are 17,749 *Housing Units* in Antrim County with an average household size of 2.4 people per household.
- The number of residents 65 years and over is 22.4% of the population.
- The number of residents 19 years and under is 22.6% of the population.
- The number of residents over 65 with a disability was 32.4% of the population.
- The total Number of residents with disability was 14.7% of the population.
- The percentage of residents that speak English less than 'very well' is 0.5% of the population.
- February 2014 Poverty level:
    - $19,790 Family of 3
    - $11,670 Family of 1

Table 6: Poverty Statistics for Antrim County

Poverty	Statistics
Families in poverty	10.7%
Income less than $15,000	12.2%
Population in poverty	16.0%

Source: U.S. Census Bureau, 2008-2012 American Community Survey

Table 7: Economic Census for Antrim County

Industry Description	Number of Establishments	Number of Employees
Manufacturing	40	732
Wholesale Trade	12	41
Retail Trade	89	479
Information	12	46
Real Estate, Rental, Leasing	21	65
Professional, Scientific, Technical Services	36	NA
Administrative, Support, Waste Management, Remediation Services	22	25
Educational Services	3	NA
Health Care, Social Assistance	55	349
Arts, Entertainment, Recreation	9	NA
Accommodation and Food Services	59	1007
Other Services (except administration)	62	253

Source: US Census Bureau: County Business Patters 2008-2012

VII. THE DEVELOPMENT OF THE PLAN

Data Methodology and Map Development

Antrim County staff identified the critical facilities and infrastructure on the base map and provided updated GIS .shp files for mapping purposes.

Table 8: Critical Facilities and Infrastructure in Antrim County

5	Airports
11	Banks
7	Bridges
9	Communications Facilities
33	Community Shelters
3	Dams
9	Emergency Management Systems Facilities
1	Emergency Operations Center
14	Fire Stations
19	Government Buildings
15	Hazardous Materials Sites or Facilities
3	Industrial Sites
5	Medical Buildings (urgent care and clinics)
3	Nursing Homes and/or Assisted Living Facilities
6	Police Stations/Jail
25	Places of Worship
6	Resort/Recreational
15	School buildings
4	Senior Centers
3	Water and Sewage Treatment Facilities • Water: 18.6% public system or private company; 71.1% individual wells; • Sewer: 18.6% public sewer; 79.2% individual septic/cesspool; 2.2% other
1	U.S. Fish and Wildlife Service Fish Hatchery

Source: Antrim County Data

Flood Data

Flood hazard information may be obtained from the Flood Insurance Rate Maps (FIRM) available for jurisdictions. In order to delineate potential flood plain areas (seasonal floodplains) for each county, NWMCOG overlaid wetland, soils, and elevation data to determine the most likely flood prone areas. Once overlaid; isolated polygons (areas) were removed in order to show a more accurate representation of potential flood prone areas along lakes, rivers, and streams. Sources: Temporary/Seasonally Flooded Areas data are from the National Wetland Inventory of the US Fish and Wildlife Service; hydric soils data are from the county digital soil surveys (where available); and Digital Elevation Model data are from the Center for Geographic Information, Michigan Department of Information Technology.

Natural Flood Insurance Program (NFIP) participants:

In addition to the current participants, the County is working to establish a baseline elevation figure to determine if property owners in other municipalities qualify for coverage under the NFIP.

Table 9: NFIP Participation

Municipality	NFIP status	Flood Maps	Year Joined
Banks Township	P	Y	1988
Elk Rapids Township	P	N	1988
Milton Township	P	Y	1983
Torch Lake Township	P	Y	1992
Village of Elk Rapids	P	Y	1988

According to an official database associated with the National Flood Insurance Program, Antrim County has no properties currently designated as suffering from repetitive losses in insured flood events.

Fire Data
Modern forest fire data were obtained from the USDA forest service and the Departments of Natural Resources in Minnesota, Wisconsin, and Michigan. Fire regimes data (fire prone areas) were provided by the USDA Forest Service, North Central Research Station located in Wisconsin. Land type associations, and historical and modern fire rotations were used to identify the fire prone areas.

Tornadoes - National Weather Service

Damaging Winds - National Weather Service

Large Hail - National Weather Service

Winter Weather - National Weather Service

Landslide/Erosion
Shoreline erosion and landslide incident zones were delineated by the US Geological Service. Digital Elevation Model data from the Center for Geographic Information are from the Michigan Department of Information Technology.

Other hazards such as earthquakes and subsidence were considered but are not substantial risks in Antrim County.

Natural Hazards Recorded Events
Data for weather events was compiled from the National Oceanic and Atmospheric Administration's (NOAA) website utilizing the following sections:

- Weather/Climate Events, Information, Assessments
- Climatology and Extreme Events
- NOAA Storm Event Database; 1950 to present, local storm reports, damage reports, events checked for Antrim County included: Flood (Flash Flood, Flood, Lakeshore Flood), Hail (Hail), Snow and Ice (Blizzard, Extreme Cold/Wind Chill, Freezing Fog, Frost/Freeze, Heavy Snow, Ice Storm, Lake-effect Snow, Sleet, Winter Storm, Winter Weather), Tornado (Tornado, Funnel Cloud), Thunderstorm and High Wind (Heavy Rain, High Wind, Lightning, Strong Wind, Thunderstorm Wind), Wildfire (Wildfire)

The following list includes the frequency, dates, and descriptions of the most severe natural hazard events that have occurred within Antrim County, according to the NOAA Storm Event Database; January 1950 – August 2014. *Extreme Winter Weather* includes events with ice covering, property damage, and/or up to/over 12 in. of snow. *Severe Thunderstorm* include 50 knot winds + and property damage figures.

Flood/Flash Flood: 1 Event

Table 9: Flood Events for Antrim County

Month	Year	Location	Effect	Damage	Other Event
July	1999	Elk Rapids	4-6 in. watered covered secondary roads	NA	Flash Flood

Hail: 18 Events

Table 10: Hail Events for Antrim County

Month	Year	Location	Effect	Damage
July	1979	County	1.00 in.	$0
October	1989	County	0.75 in.	$0
July	1996	Eastport	1.50 in.	$0
June	2000	Mancelona	0.75 in.	$0
May	2001	Kewadin, Eastport	0.75 in.	$0
August	2004	Central Lake	0.88 in.	$0
June	2005	Mancelona	0.88 in.	$0
July	2006	Kewadin	1.0 in.	$30,000 (property/crop)
July	2006	Mancelona	1.25 in.	$0
March	2007	Ellsworth	0.75 in.	$0
October	2007	Mancelona	0.75 in.	$0
October	2007	Alba	1.50 in.	$0
June	2008	Mancelona	0.88 in.	$0
July	2008	Chestonia	0.75 in.	$0
August	2008	County	0.75 in. – 1.50 in.	$0
May	2012	Central Lake	1.0 in.	$0
May	2013	Clam River, Bellaire, Chestonia	0.75 in. – 1.00 in.	$0
May	2013	County	1.0 in.	$0

Extreme Winter Weather: 133 Events

Table 11: Extreme Winter Weather Events for Antrim County

Month	Year	Location	Effect	Damage	Other Event
March	1993	Region	6-12 in. snow	$500,000(statewide)	
April	1993	Region	Snow depth not given	$50,000	
January	1994	County	Snow depth not given	$5,000,000(statewide)	
November	1996	County	21-35 in. snow	NA	
December	1996	County	12-18 in.	NA	

Extreme Winter Weather (continued)

Month	Year	Location	Effect	Damage	Other Event
December	1998	Region	6-18 in. snow	NA	
January	1999	Region	6-12 in. snow	NA	
December	1999	Region	12-14 in. snow	NA	
February	2001	Region	1/4 in. ice	NA	Ice Storm
December	2001	Region	20 in. snow	NA	
February	2002	Region	10-16 in.	$5,000	
January	2003	Region	6-12 in. snow	NA	
November	2003	Region	High Winds	NA	
December	2003	Region	10-15 in. snow	NA	
January	2004	County	6-12 in. snow/ drifting	NA	
January	2005	Region	1/4 - 1/3 in. ice	NA	Ice Storm
February	2007	County	20-30 degrees below zero	NA	Extreme Cold/Wind Chill
December	2008	Alba	10-15 in. snow	NA	
January	2009	Mancelona	6-12 in. snow	NA	
January	2009	Bellaire	8-12 in. snow	NA	
December	2009	Central Lake	12 in. snow	NA	
January	2012	Mancelona	8-12 in. Snow	NA	
March	2012	County	6-14 in. snow/power outages	NA	
April	2012	County	Killing frost	$10,000,000 (crop)	Frost/Freeze
December	2012	County	6-10 in. snow/downed trees/power outages	$12,000	
November	2013	Central Lake	12 in. snow	NA	
December	2013	County	18 in. snow	NA	
January	2014	Bellaire, Ellsworth	12+ in. snow	NA	
February	2014	County	45 mph winds/wind chill 15-25 degrees below zero	NA	

Severe Thunderstorms/High Winds: 54 Events

Table 12: Storm Events for Antrim County

Month	Year	Location	Effect	Damage	Other Event
May	1965	County	52 knots	NA	
July	1995	Bellaire	52 knots	$10,000	
May	1996	Mancelona	50-60 knots/ building damage	NA	
September	1998	Alba	70 knots	NA	
November	1998	County	50 knots/trees uprooted/ power outages	NA	
July	1999	Bellaire	50 knots/trees down/ straight line wind damage	NA	
June	2001	Kewadin	50 knots/ trees downed	NA	
August	2001	Kewadin, Elk Rapids	50 knots/ large limbs down	NA	
October	2001	Region	50 knots/ trees and power lines down	NA	
April	2002	Kewadin, Mancelona	50-55 knots/ trees and power line down	NA	
July	2002	Elk Rapids, Eastport, Kewadin, Alba, Mancelona	50 knots/ trees and power lines down	NA	
August	2002	Bellaire, Torch Lake	50-52 knots/ trees down	NA	
November	2003	Region	52 knots/ trees and power lines down/ power outages	$20,000	
August	2004	Central lake	Trees down	NA	
August	2004	Alden	52 knots/ trees down	$6,000	
June	2005	Alba	50 knots/ hiker injured by falling tree	NA	
June	2005	Mancelona	57 knots/ trees down/ building damage	$40,000	
September	2005*	County	55 knots/ trees and power lines down	$15,000	
November	2005	County	52 knots/ trees down	$3,000	
November	2005	County	52 knots/ trees down	$10,000	
November	2005	County	52 knots/ trees down	$10,000	
May	2006	Alba	52 knots/ trees down	$4,000	
July	2006	Elk Rapids	53 knots/ trees down/crops destroyed	$4,000	
July	2006	Bellaire	55 knots/ trees down/ crops destroyed	$25,000	
August	2006	Bellaire	52 knots/ trees and power lines down	$6,000	
August	2006	Mancelona	52 knots/ trees and power lines down	$7,000	
May	2007	Kewadin	52 knots/ trees down/ property damage	$1,500	

Severe Thunderstorms/High Winds (continued)

Month	Year	Location	Effect	Damage	Other Event
July	2007	Mancelona	52 knots/ trees down/ waterspout on Torch Lake	$3,000	
October	2007	Kewadin	56 knots/ gusts up to 65 mph	NA	
April	2008	Elk Rapids	50 knots/ trees down	$2,000	
April	2008	Bellaire	50 knots/ trees down	$1,500	
April	2008	Mancelona	52 knots/ trees and power lines down	$5,000	
June	2008	Mancelona	52 knots/ gusts 60 mph	NA	
July	2008	Chestonia	50 knots/ tree limbs down	$1,000	
July	2008	Alba	50 knots/ metal flag pole down	$1,500	
October	2009	County	55 knots/ trees down/ building and vehicle damage	$3,000	
May	2011	Alden	55 knots/ trees down	$10,000	
May	2011	Mancelona	52 knots/ trees and power lines down	$18,000	
May	2011	Kewadin	56 knots/ tree limbs down	$500,000	
June	2011	County	50 knots/ trees down	$2,000	
June	2012	County	Lightning destroyed home	$80,000	Lightning
May	2013	Kewadin	55 knots/ trees down	$8,000	
May	2013	Mancelona	50 knots/ trees down	$3,000	
September	2013	County	52 knots/ trees down/ vehicle damage	$21,000	

Tornados: 8 events

Table 13: Tornado Events for Antrim County

Month	Year	Location	Effect	Damage
July	1958	County	F1	$3,000
July	1974	County	F3/ 12 miles long, 67 yards wide/ 2 injuries	$20,000
July	1977	County	F2	NA
September	1985	County	F1	NA
July	1990	County	F1	NA
August	1995	Elk Rapids	F0	NA
May	1998	Torch Lake	F0	NA
July	2007	Alden	F0/ water spouts/ trees down/ dock damage	$4,000

** Governor and Presidential Hazard Declaration*

Other Possible Natural Hazard Events

Drought

In Northern Michigan's forested regions, drought can adversely impact timber production and some tourism and recreational enterprises. This can also cause a drop in income, which impacts other economic sectors. The biggest problem drought presents, however, is the increased threat of wildfire. Many Northern Michigan counties are heavily forested and are therefore highly vulnerable to drought-related wildfire threats. The most extreme drought was in January 1931, when the Palmer index hit a record low of -8.07. Lengthy drought incidents took place in 1895-1896 (17 months), 1898-1899 (8 months), 1899-1901 (21 months), 1901-1902 (15 months), 1908-1911 (37 months), 1913-1914 (11 months), 1914-1915 (10 months), 1919-1920 (8 months), 1920-1922 (17months), 1925-1926 (17 months), 1929-1931 (28 months), 1935-1936 (20 months), 1955-1956 (13 months), and 1976-1977 (13 months).

Wildfires

194 wildfires occurred in Antrim County from 1981 to 2010, affecting nearly 194 acres countywide

Pandemics or other Public Health Emergencies

Naturally occurring pandemics may cause widespread precautions around the world. The Northwest Michigan Health Department created a pandemic plan that serves Antrim County is used as a template for responding to a large-scale outbreak of influenza and other highly infectious respiratory diseases.

Probability of Natural Hazards

Natural hazards such as hail, thunderstorm and high wind, tornadoes, snow and ice, flooding, and shoreline erosion that will affect Northwest Michigan is a perennial concern. The magnitude and severity depends on the season, which determines temperature, moisture in the air, ice cover on the lakes, etc. Additionally, the severity of an event is directly proportional with tourist activity throughout the year, the pace of residential development, and an increasing base population that affects overall land use in the region. The events recorded indicate that natural hazard events may be happening more frequently, but the geographic impact of the natural hazards' impact has remained the same in Antrim County.

The areas where natural hazards overlap in Antrim County may include heavy snow that causes trees and power lines down, and then melting, rain and flooding. Rising water levels with high winds can cause coastal landslides/debris flow/erosion.

Antrim County Natural Hazards Task Force and Public Input

The Natural Hazards Task Force comprised of the County's Local Planning Team (LPT) which is a collection of first responders and local, regional, and state public entities that ensure the readiness of County entities by recommending equipment purchases, training and exercises, and public education on preparedness issues. The Task Force meetings were scheduled monthly in 2014, held in various locations throughout the county, and open to the public. Participants analyzed and updated the hazard priority maps, goals & objectives, hazard priority areas, mitigation measures, and the action agenda items.

- According to the Michigan Hazard Analysis report, 3 Dams are listed as a "Extreme Hazards" should failure occur.
- Bellaire area where high winds and tornadoes have occurred in the past; also flooding near the seasonal marina and houses
- Mancelona area for snow and ice hazards; the Road Commission's main maintenance garage is located here, where the most industry and population levels are the largest in the county
- Central Lake area concerns thunderstorms and high winds where a large seasonal Camp Hayo–Went-Ha is located
- Cedar River area has the large Shanty Creek Resort with three different villages with its own sewer, water tower, communications and potential for high winds
- Seasonal population fluctuations, especially festivals:

    - Elk Rapids: Harbor Days, Paddle Antrim
    - Bellaire: Rubber Ducky Days
    - Mancelona: Bass Festival
    - Central Lake: Antrim Outdoors
    - Eastport: Petoskey Stone Festival
    - 4th of July events: Central Lake, South Torch Lake Sand Bar
- Over 1,700 oil and gas wells and gathering plants – gas explosion incident in Mancelona
- Lakes of the North area – historic fire with no re-growth

Natural Hazards Priority Areas were narrowed to the top 5 significant according to the Task Force and the priority areas have not changed since the adoption of the original plan.

Top Five Natural Hazards Priority Areas

1. **The Village of Bellaire (County Seat) area has a high damage potential from high winds and tornados; and flooding of residential areas.**

   There is a historical record of high wind events around the village and a few tornadoes in the county. Severe winds or straight line winds that sometimes occur during severe thunderstorms can be very damaging to a community. Severe winds have the potential to cause loss of life from property damage and flying debris. Damage from straight line winds is more widespread than tornadoes and usually affects multiple counties. There is also risk of infrastructure damage from downed power lines from falling trees and limbs.

   In addition to "regular" flooding in a riverine floodplain, other flooding may involve low lying areas that collect runoff waters; flaws or shortcomings in existing sewer infrastructure; undersized or poorly designed storm water control practices; collective effects of land use and development trends; illegal diversion of water, or actions that interfere with system function.

2. **Highway U.S. 31 through the Village of Elk Rapids and Torch Lake shoreline (Milton, Torch Lake, Central Lake, Forest Home, and Helena Townships). A high damage impact potential from severe thunderstorms and high winds affecting a high seasonal population rate and festivals in the summer. There are erosion concerns along Lake Michigan and Torch Lake coastal areas.**
   There is a historical record of severe thunderstorms and high wind events affecting the Village of Elk Lake and vicinity. These weather events may produce lightning strikes, flash flooding, hail, strong winds, and tornadoes.

   Erosion hazards involve the loss of property as sand or soil is removed by water over time, which may cause built structures to stand perilously close to waters or bluffs. The foundation of a built structure and/or underground utility pipes may become fully exposed and vulnerable to weather, extreme temperatures, water damage, etc.

   Roadways along shorelines are susceptible to banks eroding which causes the road to become more vulnerable to various types of surface and/or structural degradation.

Top Five Natural Hazards Priority Areas (continued)

3. **Torch Lake shoreline (Central Lake, Helena, Milton, Torch Lake townships and Village of Central Lake) and Village of Mancelona - The potential for extreme winter weather with snow and ice hazards, the County experiences a large seasonal population flux and is home to the County Road Commission's main offices and maintenance garage**

   Antrim County experiences frequent heavy snow events due to its location in a "snow-belt" area. Heavy snow events have the potential of shutting down towns and businesses for a significant period of time. Blowing and drifting snow with blizzard conditions cause driving hazards.

4. **The Central Lake area (Village of Central Lake, Central Lake Township) has the potential of severe thunderstorms and high winds with the concerns of the seasonal population increases at summer camps such as Camp Hayo-Went-Ha.**

   There is a historical record of severe thunderstorms and high wind events affecting the Village of Elk Lake and vicinity. These weather events may produce lightning strikes, flash flooding, hail, strong winds, and tornadoes. Severe or straight line winds that sometimes occur during severe thunderstorms can be very damaging to a community. Severe winds have the potential to cause loss of life from property damage and flying debris. Damage from straight line winds is more widespread than tornadoes and usually affects multiple counties. There is also risk of infrastructure damage from downed power lines from falling trees and limbs.

5. **The Cedar River area (Kearney and Custer Townships, Shanty Creek resort), has the potential for severe thunderstorms and high winds, snow and ice hazards.**

   There is a historical record of severe thunderstorms and high wind events in this section of the county with concerns regarding the increase of seasonal population levels. These weather events may produce lightning strikes, flash flooding, hail, strong winds, and/or tornadoes.

   Severe or straight line winds that sometimes occur during severe thunderstorms can be very damaging to a community. Severe winds have the potential to cause loss of life from property damage and flying debris. Damage from straight line winds is more widespread than tornadoes and usually affects multiple counties. There is also risk of infrastructure damage from downed power lines from falling trees and limbs.

   Antrim County experiences frequent heavy snow events due to its location in a "snow-belt" area. Heavy snow events have the potential of shutting down towns and businesses for a significant period of time. Blowing and drifting snow with blizzard conditions cause driving hazards.

   The Shanty Creek Resort includes three (3) resort villages, a water tower and a communications tower.

Emergency Warning System Coverage

Mancelona and Bellaire sirens are not working because there is no funding available for maintenance. Elk Rapids has a working siren with approximately 1,700 people covered plus seasonal influx in the summer.

Economic Impact Analysis

The total Damaging Events' Costs recorded since 1950 with the National Oceanic and Atmospheric Administration for Antrim County, the region, and the state are as follows:

Table 14: Damage Cost by Natural Hazard for Antrim County

Antrim County	Property Damage Cost	Crop Damage Cost
Drought	NA	NA
Flood	$160,000	NA
Hail	NA	$500,000
Snow and Ice	$35,000	NA
Tornado	$262,750	NA
Thunderstorm and High Wind	$324,000	NA
Wildfire	NA	NA

The Antrim County Equalization Department calculated each Priority Area's economic value through the State Equalized Values (SEV) for real and personal property (residential and commercial). The following includes 2010 Census data and 2014 SEV dollar amount times two (estimated fair market values) for each priority area. According to the 2014 Northwest Michigan Season Population Analysis, assume a 22% increase to account for the average seasonal population within the county.

Table 15: Economic Value by Geography for Antrim County

Priority Area(s)	Geography	Population	State Equalized Value
	Antrim County	23,370	$1,986,800,439
1	Village of Bellaire area	3,485	$384,528,160
2	US 31 communities	9,515	$1,582,636,122
3	Torch Lake shoreline area and Village of Mancelona	7,987	$976,449,191
4	Central Lake area	3,156	$174,177,930
5	Cedar River area (including Shanty Creek Resort)	6,376	$356,513,913

VIII. NATURAL HAZARDS MITIGATION GOALS AND OBJECTIVES

The mission of the Antrim County Natural Hazards Mitigation Plan is to protect the health and safety of the public and property in the County which includes prevention of injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, maintain tourist base, and liability issues. This is done by taking action to permanently eliminate or reduce the long-term risks from natural hazards.

Specific goals and objectives have been established based upon the community's natural hazards analysis, as well as input from the Task Force participants and the public through meetings, request for comments on the draft plan, and the presentation of the plan to the Antrim County Planning Commission.

Goal 1: Increase local awareness and participation in natural hazards mitigation strategies

- Encourage cooperation and communication between planning and emergency management officials
- Encourage additional local governmental agencies to participate in the natural hazards mitigation process
- Encourage public and private organizations to participate, including organizations who advocate for individuals with functional or access needs

Goal 2: Integrate natural hazards mitigation considerations into the community's comprehensive planning process

- Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- Incorporate natural hazards mitigation into basic land use regulation mechanisms
- Update of zoning ordinances to reflect new building codes, shoreline protection rules, etc.
- Incorporate natural hazards area classifications into standard zoning classifications
- Develop community education and warning systems
- Strengthen the role of the Local Emergency Planning Committee in the land development process
- Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
- Encourage county agencies to review local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

Goal 3: Utilize available resources and apply for additional funding for natural hazards Mitigation

- Provide a list of desired community mitigation measures to the State for possible future funding
- Encourage the application for project funding from diverse entities

Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

- Encourage public and business involvement in natural hazards mitigation projects

IX. IDENTIFICATION AND SELECTION OF MITIGATION STRATEGIES

A set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems in Antrim County.

- The measure must be technically feasible.
- The measure must be financially feasible.
- The measure must be environmentally sound and not cause any permanent, significant environmental concerns.
- The measure must be acceptable to those participating in the strategy and/or primarily impacted by the strategy.

By anticipating future problems, the County can reduce potential injury, structure losses, loss of power such as electric and gas, and prevent wasteful public and private expenditures.

Priority Area 1: Severe Thunderstorms/High Winds and Flooding - The Village of Bellaire area

Wind Mitigation Strategies

- Business and homeowner education; creation of shelters and safe rooms where necessary
- Building code enforcement on new construction; follow state and county codes: utilize techniques such as anchoring, bracing, tie downs, and/or window shuttering of buildings
- Tree management on power line easements; incorporate urban forestry practices

Flood Mitigation Strategies: (including NFIP participants)

- Identify potential flood areas and wetlands
- Protection of wetlands for flood control: acquisition, conservation easements
- Stormwater Control ordinance enforcement
- Building code enforcement for new construction
- Public education and awareness

Priority Area 2: Severe Thunderstorms/High Winds and Erosion - Highway U.S. 31 through the Village of Elk Rapids and Torch Lake shoreline (Milton, Torch Lake, Central Lake, Forest Home, and Helena Townships).

Erosion Mitigation Alternatives

- Collaborate with county agencies and non-profits to identify erosion sites needing immediate corrective action
- Open space designations: acquisition or conservation easements by land conservancies, county, townships
- Soil erosion permits: erosion areas, drainage control, grading, debris flow measures, placement of vegetation (native species)
- Zoning administration and enforcement of ordinances: development setbacks, lot sizes, driveways, relocation of structures, Lake Michigan coastal zoning ordinances – U.S. Army Corps of Engineers and Michigan Department of Environmental Quality
- Building code enforcement through permits

Priority Area 2 (continued):

Thunderstorm and High Wind Mitigation Strategies

- Business and Homeowner education
- Update and confirm shelter areas for campgrounds
- Building code enforcement on new construction; follow state and county codes: utilize techniques such as anchoring, bracing, tie downs, and/or window shuttering of buildings
- Tree management on power line easements

Priority Area 3: Extreme Winter Weather - Torch Lake shoreline (Central Lake, Helena, Milton, Torch Lake townships and Village of Central Lake) and Village of Mancelona

Snow and Ice Strategies

- Data collection – develop a study of snowfall patterns and occurrence of damage
- Snow load design standards – develop planning grant for a study of the county areas
- Adoption/Enforcement of building codes – state code is 60 lbs. per sq. ft.; consider increase in minimal lbs. per sq. ft.
- Promote structural maintenance/improvements – history of pole barns, and heavy industrial warehouse roof cave-ins
- Public education and awareness

Priority Area 4: Central Lake area (Village of Central Lake, Central Lake Township) – Severe Thunderstorms/High Winds

Thunderstorm and Wind Mitigation Strategies

- Business and homeowner education
- Designated shelter areas for camps, campgrounds
- Building code enforcement on new construction; follow state and county codes: utilize techniques such as anchoring, bracing, tie downs, and/or window shuttering of buildings
- Tree management on power line easements

Snow and Ice Strategies

- Data collection – develop a study of snowfall patterns and occurrence of damage
- Snow load design standards – develop planning grant for a study of the county areas
- Adoption/Enforcement of building codes – state code is 60 lbs. per sq. ft.; consider increase in minimal lbs. per sq. ft.
- Promote structural maintenance/improvements – history of pole barns, and heavy industrial warehouse roof cave-ins
- Public education and awareness

X. PARTICIPATION IN THE DEVELOPMENT OF THE ANTRIM COUNTY NATURAL HAZARDS MITIGATION PLAN

The opportunities for review by other governmental entities and the public included the following:

- The Natural Hazards Mitigation Plan was presented to the Antrim County Planning Commission where the meetings are posted in the newspaper and are open to the public.

- The Natural Hazards Mitigation Plan was presented to the Antrim County Board of Commissioners where the meetings are posted in the newspaper and are open to the public.

- During development of the plan, all townships and villages were provided the opportunity to formally comment on plan drafts and other related materials. They were given the opportunity via mailings of both meeting notices and draft copies of the plan for comment. Notification was also provided to them that the plans were posted on the NWMCOG website and could be reviewed there. While no jurisdictions (other than the county) provided formal written comments, they did provide county staff (particularly the county emergency manager) with feedback via other informal means. This feedback took the form of phone calls, emails and conversations that occurred at various non-mitigation related meetings throughout the county. This information was provided back to NWMCOG staff by the county staff and used in development of the plan, including the risk assessment and community profile sections.

In addition, the townships and villages (whether or not they have their own zoning) have indicated to NWMCOG and the county emergency manager that they will follow the county's lead in identifying mitigation projects and developing grant applications to fund those projects. Land use issues associated with those projects (where applicable) will be handled by each jurisdiction that controls zoning in the project area.

Community planning services are provided by the professional staff of the Antrim County Administration & Planning Department. The Department assists communities in developing plans and zoning ordinances, provides resource information and technical assistance, and convenes communities to address land use issues of common interest. The Antrim County Planning Commission coordinates and reviews local zoning and master plans to ensure consistency across jurisdictional boundaries. Building permits are issued by the Antrim County Construction Code Department

The Townships/Villages in the priority areas include:

Village of Bellaire - Zoning
Village of Elk Rapids - Zoning
Milton Township - Zoning
Torch Lake Township - Zoning
Central Lake Township
Village of Central Lake
Forest Home Township - Zoning
Kearney Township - Zoning
Custer Township
Village of Mancelona – Zoning

Table 16: Plan Participation

County/Township/Others	Zoning	Participation
Antrim County	No	Task Force meetings, review of draft plans: County Commissioners Emergency Management Coordinator Equalization Department Housing Commission Planning Commissioners Planning Department Road Commission
Banks	Yes	See last bullet point paragraph, above
Village of Ellsworth	Yes	See last bullet point paragraph, above
Central Lake	No	See last bullet point paragraph, above
Village of Central Lake	No	See last bullet point paragraph, above
Chestonia	No	See last bullet point paragraph, above
Custer	No	See last bullet point paragraph, above
Echo	No	See last bullet point paragraph, above
Elk Rapids	Yes	See last bullet point paragraph, above
Village of Elk Rapids	Yes	See last bullet point paragraph, above
Forest Home	Yes	See last bullet point paragraph, above
Village of Bellaire	Yes	See last bullet point paragraph, above
Helena	Yes	See last bullet point paragraph, above
Jordan	No	See last bullet point paragraph, above
Kearney	Yes	See last bullet point paragraph, above
Mancelona	Yes	See last bullet point paragraph, above
Village of Mancelona	Yes	See last bullet point paragraph, above
Milton	Yes	See last bullet point paragraph, above
Star	No	See last bullet point paragraph, above
Torch Lake	Yes	See last bullet point paragraph, above
Warner	No	See last bullet point paragraph, above
American Red Cross	N/A	Task Force meetings, review of draft plans

****The Grand Traverse Band of Indians may adopt the approved County plan as their own.***

N/A = Not applicable; these are non-governmental authority entities

XI. IMPLEMENTATION OF THE ANTRIM COUNTY NATURAL HAZARDS MITIGATION PLAN

Natural Hazards Mitigation Plan Managers and Technical Assistance

The Antrim County Board of Commissioners will lead the implementation of the Natural Hazards Mitigation Plan, with support from the Emergency Management Coordinator and the Planning Department. Working partnerships can be established with the following agencies to provide technical assistance to accomplish the goals and objectives of the Plan.

- Antrim County Government Staff
- Townships, cities, and villages
- Antrim County Conservation District
- Antrim County Road Commission
- Grand Traverse Band of Ottawa and Chippewa Indians
- Grand Traverse Regional Land Conservancy
- The Watershed Center Grand Traverse Bay
- New Designs for Growth
- Tip of the Mitt Watershed Council
- Michigan State University Extension
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- Insurance Companies
- Real Estate Companies

All natural hazards mitigation planning could be pursued with the new tool available to the local governments which is the Michigan Public Act 134 of 2010, the Enrolled House Bill Number 6152; and Michigan Public Act 226 of 2003, the Joint Municipal Planning Act. These Acts provides for joint land use planning by cities, villages, and townships and allows two or more municipalities' legislative bodies to create a single joint planning commission to address planning issues. This tool helps with planning for the "big picture" issues such as natural hazards that cross jurisdictional boundaries.

The intent of this legislation is for local governments to consider the following:

- Individual units of government modifying their ordinances simultaneously to include language that would incorporate aspects of protection
- Developing an overlay zoning district that would cross jurisdictional boundaries that would be incorporated into existing independent units of government's zoning ordinances
- Forming a new joint (multi-jurisdictional) planning commission or zoning board
- Sharing zoning administration
- Sharing enforcement activities

Funding the Implementation of the Plan

To assist with the funding of the proposed natural hazards mitigation strategies, here is a list of potential financial assistance entities to help fund the implementation projects of the Plan.

- Federal Emergency Management Administration – Hazard Mitigation Grant Program
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture Natural Resources Conservation Service

Funding the Implementation of the Plan (continued)

- U.S. Department of Agriculture Rural Development: Rural broadband opportunity – high speed telecommunication funding from the Public Telecommunications Facilities
- Planning and Construction grants
- U.S. Army Corps of Engineers: Apply to research and complete projects preventing erosion of critical Lake Michigan shoreline areas
- U.S. Department of Housing and Urban Development
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- National Oceanic and Atmospheric Administration
- Community, Regional Foundations
- Businesses: Home Depot (local store and Foundation: Educational initiatives that help families prepare their homes for natural disasters. The Home Depot Foundation assists organizations that provide developers and the general public with the information they need to make homes more disaster resistant.

Action Agenda

The following is a summary for accomplishing the **recommended natural hazards mitigation actions** for Antrim County.

Table 17: Action Strategies for Antrim County

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 1: Flood Mitigation Strategies		
a. Identify potential flood areas and wetlands	Emergency Management Coordinator Drain Commissioner County Conservation District County Planning County Building Inspector GIS Department	1-3 years from adoption of the plan
b. Protection of wetlands for flood control; acquisition, conservation easements	County Conservation District MI Department of Environmental Quality Non-profit conservation organizations Drain Commissioner County Planning	Ongoing
c. Soil erosion and sedimentation control	County Conservation District Drain Commissioner County Planning	Ongoing
d. Building code enforcement for new construction	County Building Inspector	Ongoing
e. Public education and awareness	County Planning Emergency Management Coordinator County Conservation District Townships, Villages Drain Commissioner	Ongoing

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 2: Erosion Mitigation Strategies		
a. Inventory shoreline erosion sites	County Planning Emergency Management Coordinator County Conservation District Townships, Village	1-3 years from adoption of the plan
b. Open space designations: acquisition or conservation easements by land conservancies, county, townships	County Planning County Conservation District MI Department of Environmental Quality Non-profit conservation organizations	Ongoing
c. Soil erosion permits include erosion areas, drainage control, grading, debris flow measures, placement of vegetation (native species)	County Conservation District County Planning	Ongoing
d. Zoning administration and enforcement of ordinances	County Planning Townships, Village	Ongoing
e. Building code enforcement through permits	County Building Inspector	Ongoing
Priority Areas 3, 5: Snow and Ice Mitigation Strategies		
a. Data collection – study of snowfall patterns and occurrence of damage	County Planning Emergency Management Coordinator County Building Inspector Village, Township	Ongoing
b. Develop a planning grant for a study of the county areas for snow load design standards	County Planning Emergency Management Coordinator County Building Inspector Village, Township	2-5 years from adoption of the plan
c. Adoption/Enforcement of building codes	County Planning Emergency Management Coordinator County Building Inspector Village, Township	Ongoing
d. Promote structural maintenance/improvements	County Building Inspector Emergency Management Coordinator Village, Township	Ongoing
e. Public education and awareness	County Planning Emergency Management Coordinator County Building Inspector Village, Township	Ongoing

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Areas 1, 2, 4, 5: Thunderstorm and High Wind Mitigation Strategies		
a. Business and homeowner education; shelters and safe rooms	Emergency Management Coordinator County Building Inspector Village, Township	Ongoing
b. Designate shelter areas for camps, campgrounds	Emergency Management Coordinator State/county campground managers Village, Township	1-3 years after adoption of the plan
c. Building code enforcement (new construction) of state and county codes	County Building Inspector	Ongoing
d. Tree management by power companies; urban forestry practices promoted	County Planning Emergency Management Coordinator County Conservation District Power Companies	1-3 years from adoption of the plan

Additional Mitigation Strategies

- Work on a multi-hazard warning plan
- Increase collaboration with other governmental entities, organizations, businesses, and the public
- Incorporate natural hazards mitigation concepts, strategies, and policies into existing elements of Antrim County's Master Plan

Antrim County can also utilize watershed management plans that have been developed within the county boundaries. Proposed mitigation strategies that have been laid out in the Elk River Chain of Lakes Watershed Management Plan and the Grand Traverse Bay Watershed Management Plans include:

- Inventory shoreline erosion sites
- Reduce the magnitude of overland stormwater runoff to streams
- Minimize the change of terrestrial vegetation types from forest/shrub
- species to turf species
- Utilize maps for potential flood areas and wetlands
- Work to stop wetland and other types of lowland filling
- Protect critical riparian areas
- Limit habitat fragmentation by maintaining compact communities
- Adequate setbacks for buildings
- Minimize development clearings by landowners
- Establish riparian buffers along waterways
- Establish and support stormwater best management practices
- Reduce the amount of impervious surfaces in the watershed, especially in areas
- of high groundwater recharge
- Regularly inform public about the watershed, activities, study findings, success/example projects, and opportunities for contribution (organization to public)
- Provide focused information to residents, visitors, local governments, and other
- target groups on priority topics (organization to individual)
- Involve the citizens, public agencies, user groups and landowners in
- implementation of the watershed plan through meetings and workshops with individuals or groups

Monitoring and Evaluation

The Antrim County Natural Hazards Mitigation Plan will be monitored on a regular basis by the Emergency Management Coordinator and the Planning Department. Because Antrim County is a dynamic, changing county with population growth, it is expected that the plan should be reviewed on an annual basis.

To assess the effectiveness of the Plan, some questions to ask include: 1) How many and which mitigation strategies were developed? Implemented? 2) Did any new natural hazards events take place the past year to report? This review will be administered by the Emergency Management Coordinator with the Local Emergency Planning Committee, the County Planning Commission and Department, and the public. If changes are needed, the plan will be presented to the Task Force participants for revisions.

Although review of the plan will occur annually, and a formal revision may not be needed each year, a new edition of the plan will be expected within every five year period. New additions of the plan will be based on annual reviews, monitoring, evaluation, and an accumulation of official feedback and public input. When it is appropriate to publish a revised version of the plan, the Task Force participants shall again be involved in the revision process. Each new edition of the plan will again be officially adopted by the Antrim County Board of Commissioners.

XII. NATURAL HAZARDS MITIGATION PLAN ADOPTION RESOLUTION

ANTRIM COUNTY
BOARD OF COMMISSIONERS
P.O. Box 520
Bellaire, Michigan 49615
Phone (231) 533-6353
Fax (231) 533-6935
Chairman: Michael Crawford

October 13, 2015

At the October 8, 2015 meeting of the Antrim County Board of Commissioners, the following Resolution was offered:

RESOLUTION #22-2015 by Laura Stanek, seconded by Ed Boettcher

ANTRIM COUNTY
HAZARD MITIGATION PLAN

WHEREAS, ANTRIM COUNTY, Michigan has experienced risks that may damage commercial, residential and public properties, displace citizens and businesses, close streets and impair infrastructure, and present general public health and safety concerns; and

WHEREAS, the community of ANTRIM COUNTY has prepared a *Hazard Mitigation Plan* that outlines the community's options to reduce damages and impacts from natural and technological hazards; and

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

NOW, THEREFORE, BE IT RESOLVED BY THIS BOARD OF COMMISSIONERS,
The *Hazard Mitigation Plan* is hereby adopted as the official plan of ANTRIM COUNTY.

Yes – David Heeres, Robert Wilson, Ed Boettcher, Bryan Smith, Michael Crawford, Laura Stanek, Chuck Johnson, Christian Marcus;

No –Karen Bargy;

Absent -None.

RESOLUTION #22-2015 DECLARED ADOPTED.

ANTRIM COUNTY CLERK, BELLAIRE, MI STATE OF MICHIGAN, COUNTY OF ANTRIM, ss I, Sheryl Guy, Clerk of the County of Antrim, do hereby certify the above and foregoing is a true and exact copy of the original record now remaining in this office. IN TESTIMONY WHEREOF, I have hereunto set my hand and official seal this 13th day of October, 2015. Sheryl Guy County Clerk

XIII. APPENDICES

Appendix A

Glossary of Mitigation Planning Terms

Alluvial fan: A gently sloping fan-shaped landform created over time by the deposition of eroded sediment and debris.

Base Flood: A flood having a one percent chance of being equaled or exceeded in any given year.

Coastal high hazard area: An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms.

Disaster: A major detrimental impact of a hazard upon the population and economic, social, and built environment of an affected area.

Exposure: The number, types, qualities, and monetary values of various types of property or infrastructure and life that may be subject to an undesirable or injurious hazard event.

Flood Insurance Rate Map: As defined under the National Flood Insurance Program, an official map of the community on which the administrator of the Flood Insurance Administration has delineated both the special flood hazard areas and the risk premium zones applicable to the community (FIRM).

Floodplain or flood prone area: Any land area susceptible to being inundated by water from any source.

Floodplain management: The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works, and floodplain management regulations.

Fuel: Combustible plant material, both living and dead, that is capable of burning in a wildland situation; any other flammable material in the built environment that feeds a wildfire.

Hazard: An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

Hazard identification: The process of defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations or areas affected.

Lifeline systems: Public works and utilities such as electrical power, gas and liquid fuels, telecommunications, transportation, and water and sewer systems.

Major disaster: As defined in the Stafford Act, “any natural catastrophe or, regardless of cause, any fire, flood, or explosion in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.”

Mitigation: Sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

Multiple-objective management: A holistic approach to floodplain management (or the management of other hazards) that emphasizes the involvement of multiple distinct interests in solving land use problems related to the hazardous area.

Natural hazard: Hurricanes, tornadoes, storms, floods, tidal wave, tsunamis, high or wind-driven waters, volcanic eruptions, earthquakes, snowstorms, wildfires, droughts, landslides, and mudslides.

One hundred year flood: The flooding event that has a one percent chance of occurring in a particular location in any given year. While this is the most common reference point statistically because it is used for regulatory purposes in the National Flood Insurance Program, the same language applies in referring to other actual or hypothetical events in terms of their statistical probabilities.

Risk: The potential losses associated with a hazard, defined in terms of expected probability and frequency, exposure, and consequences.

Risk assessment: A process or method for evaluating risk associated with a specific hazard and defined in terms of probability and frequency of occurrence, magnitude and severity, exposure, and consequences.

Special flood hazard area: Land in the floodplain within a community subject to one percent or greater chance of flooding in any given year.

Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended by P.L. 100-707), which provides the greatest single source of federal disaster assistance.

Structure: A walled and roofed building, including a storage tank for gas or liquid that is principally above ground, as well as a manufactured home (trailer parks).

Urban Wildfire: A fire moving from a wildland environment, consuming vegetation as fuel, to an environment where the fuel consists primarily of buildings and other structures.

Urban/wildland interface: A developed area, also known as the “I-zone,” occupying the boundary between an urban or settled area and a wildland characterized by vegetation that can serve as fuel for a forest fire.

Vulnerability: The level of exposure of human life and property to damage from natural hazards.

Watershed management: The implementation of a plan or plans for managing the quality of flow of water within a watershed, the naturally defined area within which water flows into a particular lake or river or its tributary. The aims of watershed management are holistic and concern the maintenance of water quality, the minimization of stormwater runoff, the preservation of natural flood controls such as wetlands and pervious surface, and the preservation of natural drainage patterns. Watershed management is, in many ways, an enlargement of most of the concerns that underlie floodplain management.

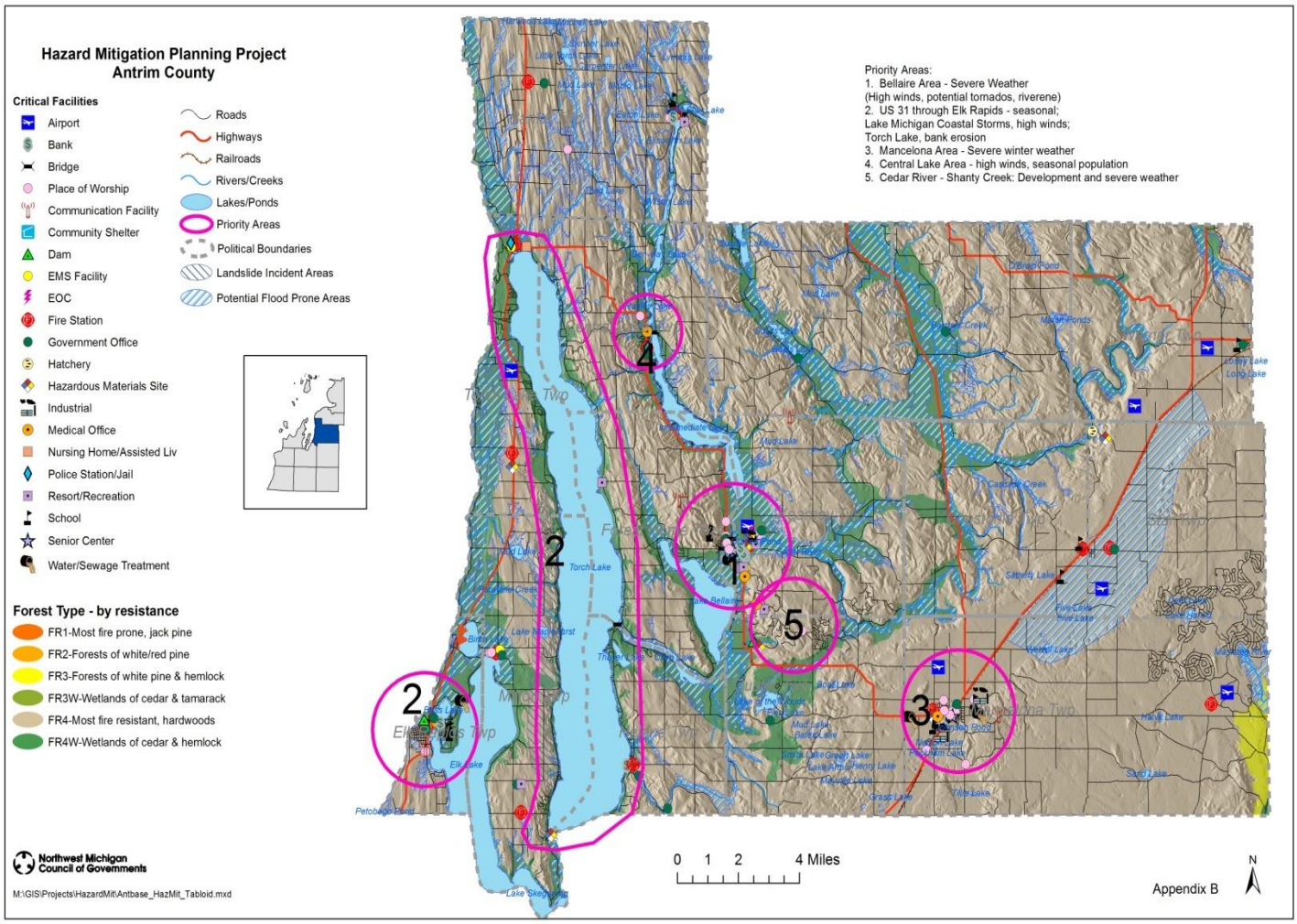
Wildland: An area in which development has not occurred with the exception of some minimal transportation infrastructure such as highways and railroads, and any structures that are widely spaced and serve largely recreational purposes.

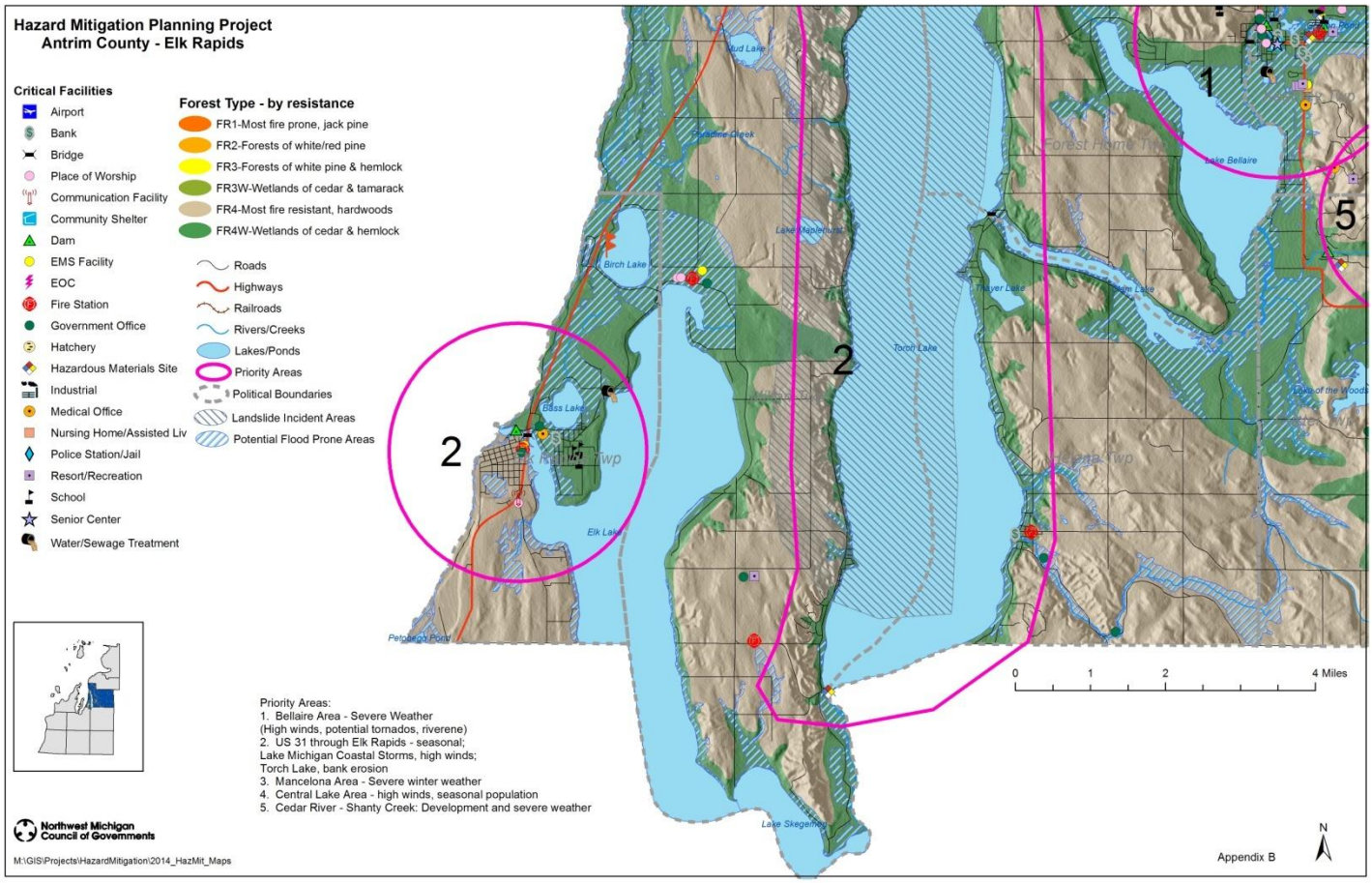
Tornado Classifications:

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys, breaks branches off trees, pushes over shallow-rooted trees, damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed, peels surface off roofs; mobile homes pushed off foundations or overturned, moving autos pushed off the roads, attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses, mobile homes demolished, boxcars pushed over; large trees snapped or uprooted, light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses, trains overturned, most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled, structures with weak foundations blown off some distance, cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate, automobile sized missiles fly through the air in excess of 100 meters, trees debarked, steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies

Appendix B

Detailed Maps




Hazard Mitigation Planning Project
Antrim County - Elk Rapids
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Community Shelter
Dam
EMS Facility
EOC
Fire Station
Government Office
Hatchery
Hazardous Materials Site
Industrial
Medical Office
Nursing Home/Assisted Liv
Police Station/Jail
Resort/Recreation
School
Senior Center
Water/Sewage Treatment
Forest Type - by resistance
FR1-Most fire prone, jack pine
FR2-Forests of white/red pine
FR3-Forests of white pine & hemlock
FR3W-Wetlands of cedar & tamarack
FR4-Most fire resistant, hardwoods
FR4W-Wetlands of cedar & hemlock
Roads
Highways
Railroads
Rivers/Creeks
Lakes/Ponds
Priority Areas
Political Boundaries
Landslide Incident Areas
Potential Flood Prone Areas
Mud Lake
Paradise Creek
Lake Bellaire
Birch Lake
Lake Nagelhout
Bayer Lake
Torch Lake
Bass Lake
Elk Lake
Petobego Pond
Lake Skegemog
Forest Home Twp
Elk Rapids Twp
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Priority Areas:
1. Bellaire Area - Severe Weather
(High winds, potential tornados, riverene)
2. US 31 through Elk Rapids - seasonal;
Lake Michigan Coastal Storms, high winds;
Torch Lake, bank erosion
3. Mancelona Area - Severe winter weather
4. Central Lake Area - high winds, seasonal population
5. Cedar River - Shanty Creek: Development and severe weather
Northwest Michigan
Council of Governments
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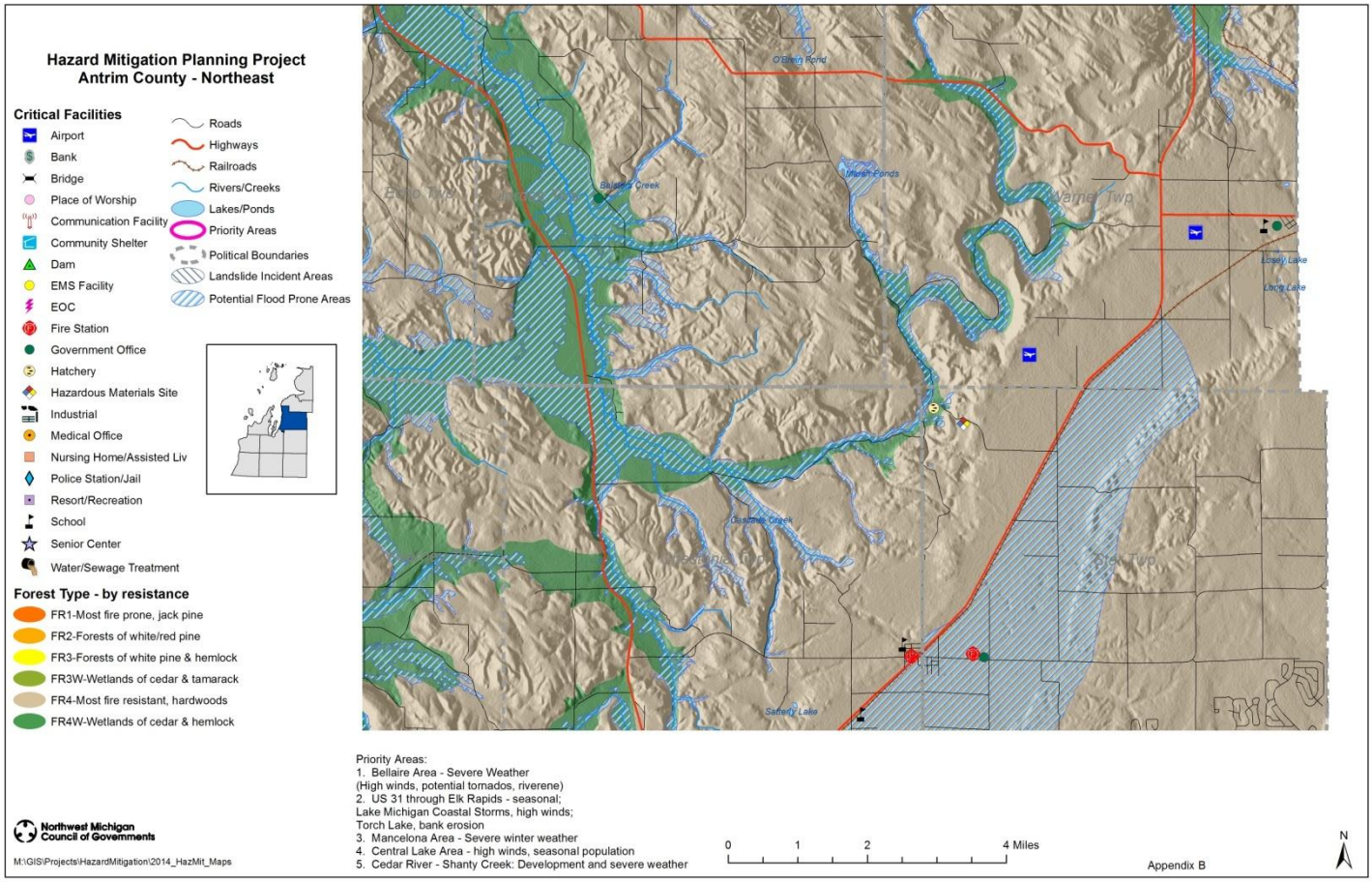
Appendix B


Hazard Mitigation Planning Project
Antrim County - Northeast
Critical Facilities
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Bank
Bridge
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Community Shelter
Dam
EMS Facility
EOC
Fire Station
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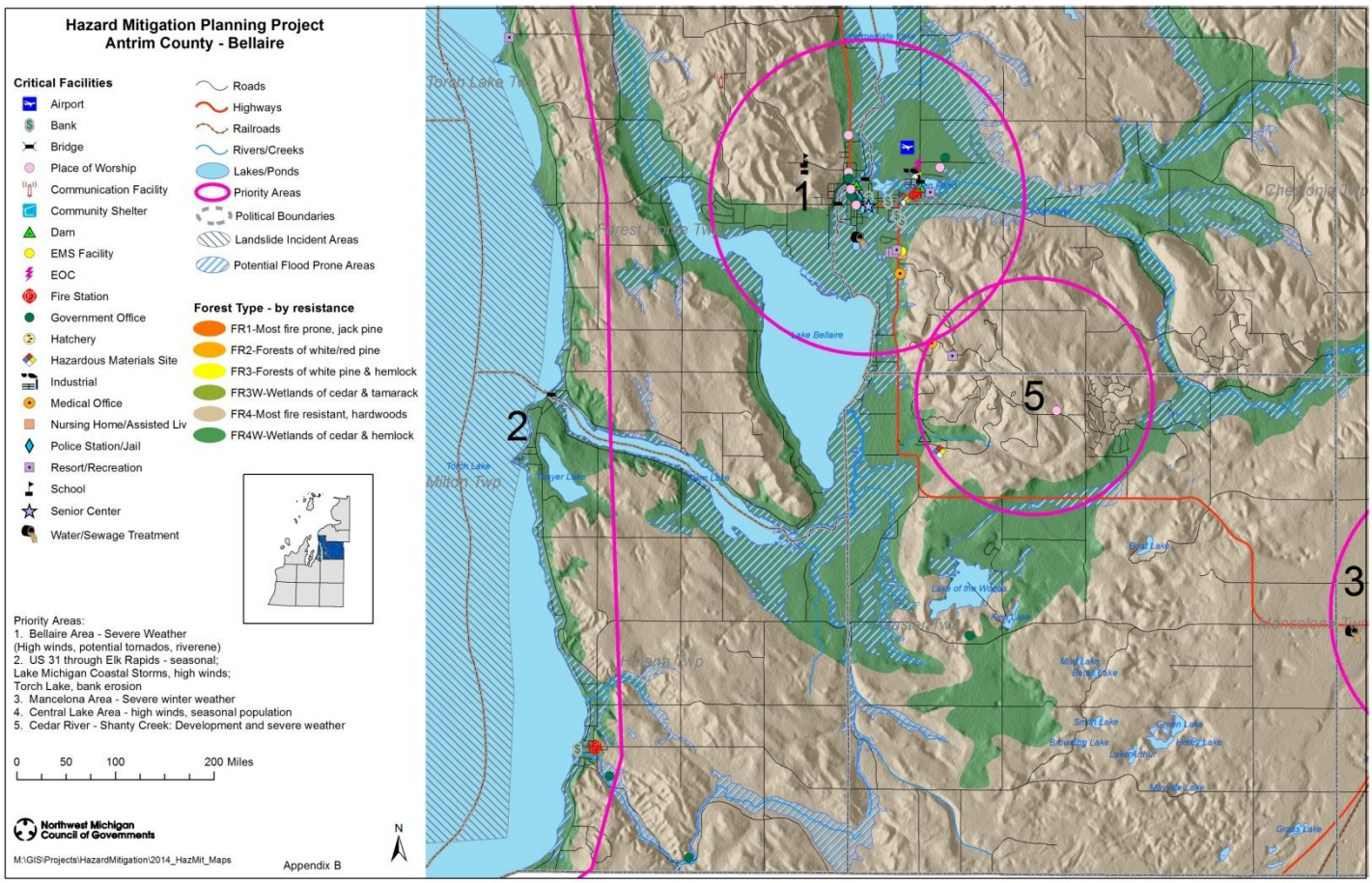
Hazard Mitigation Planning Project
Antrim County - Bellaire
Critical Facilities
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Place of Worship
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Community Shelter
Dam
EMS Facility
EOC
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Northwest Michigan Council of Governments
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Appendix B
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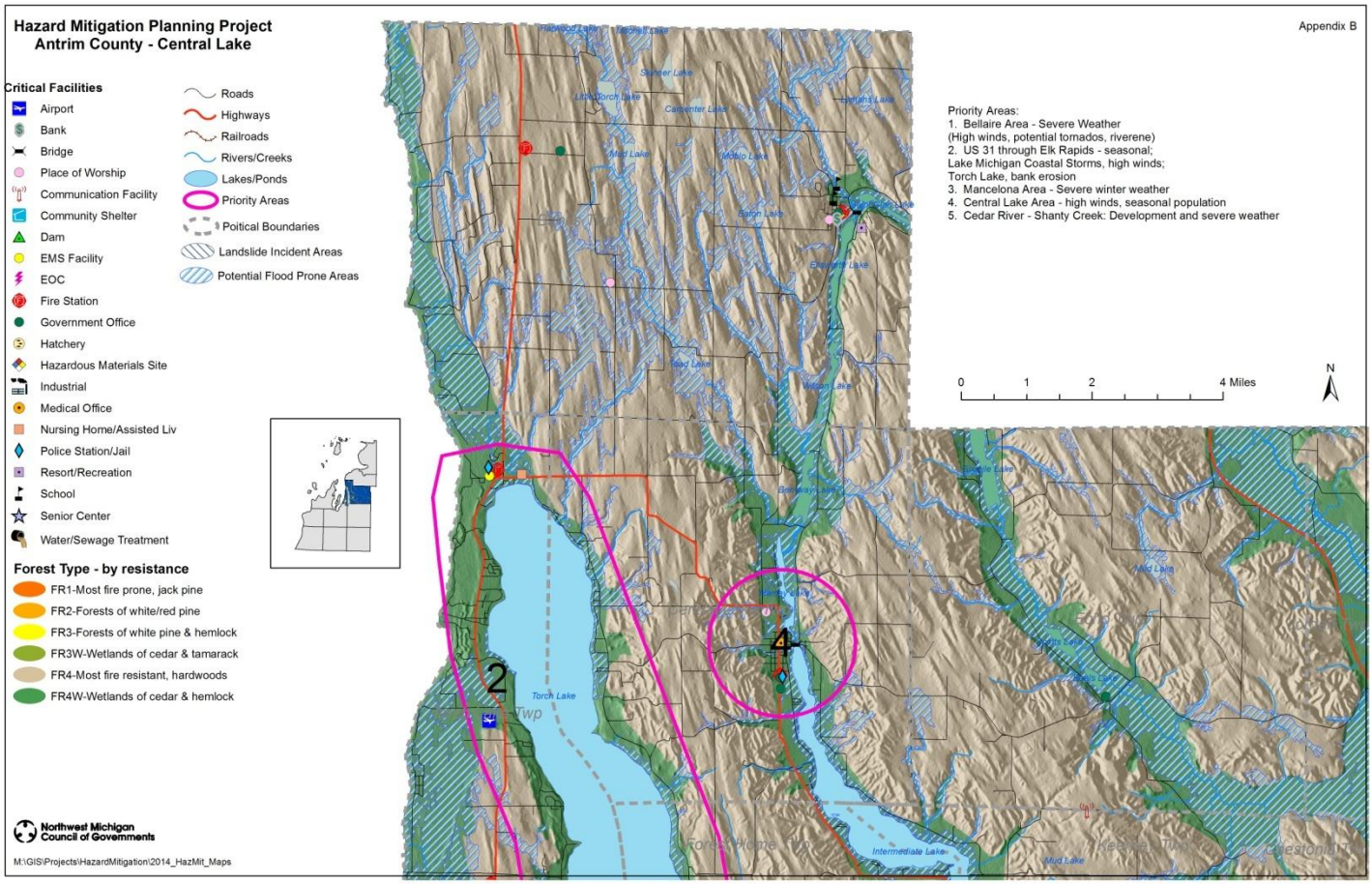
Hazard Mitigation Planning Project
Antrim County - Central Lake
Appendix B
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Community Shelter
Dam
EMS Facility
EOC
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Government Office
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Hazardous Materials Site
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5. Cedar River - Shanty Creek: Development and severe weather
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Torch Lake
Twp
Intermediate Lake
Mud Lake
Northwest Michigan
Council of Governments
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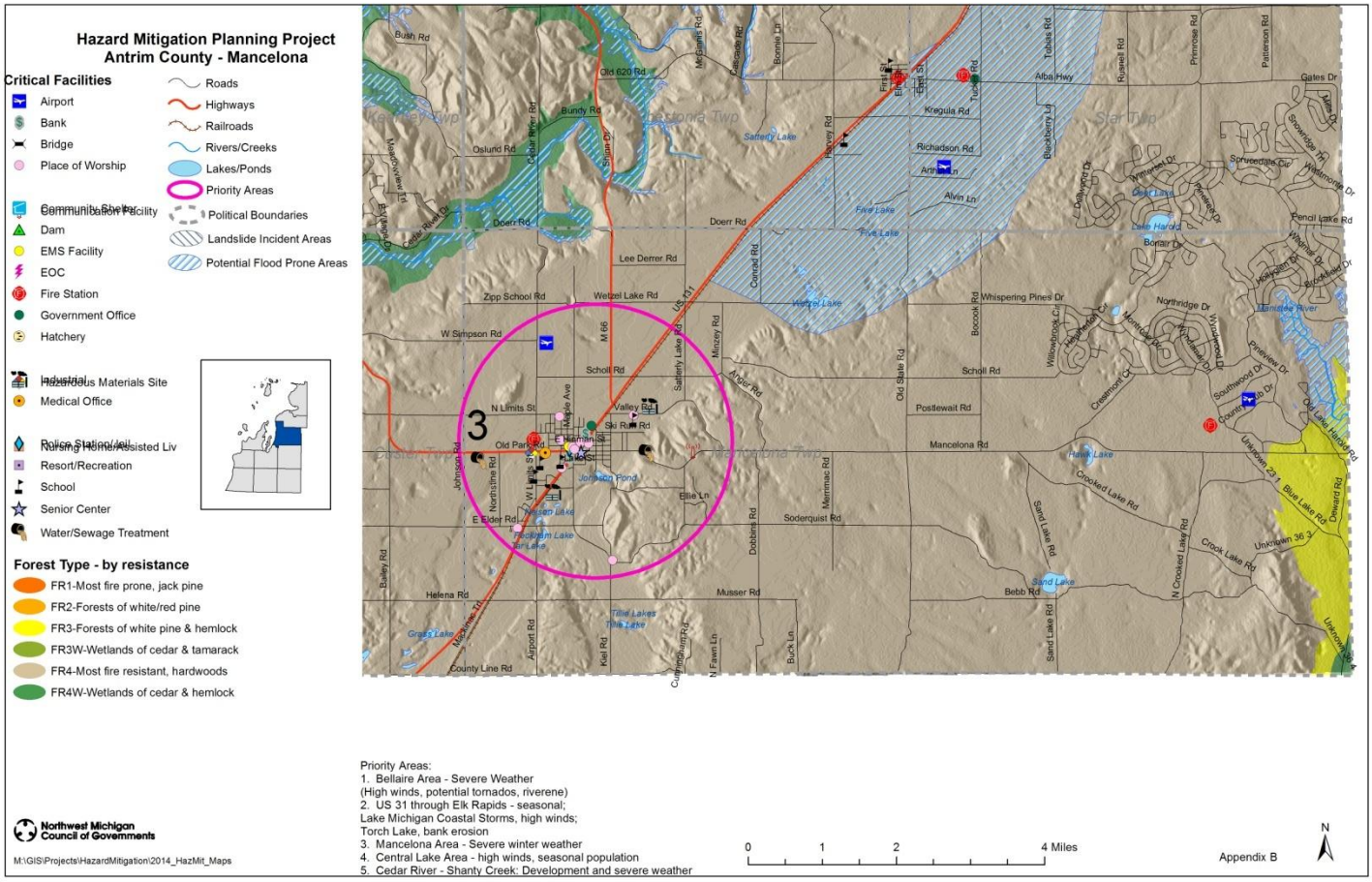
Hazard Mitigation Planning Project
Antrim County - Mancelona
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Bank
Bridge
Place of Worship
Communication Facility
Dam
EMS Facility
EOC
Fire Station
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Hatchery
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3
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Northwest Michigan Council of Governments
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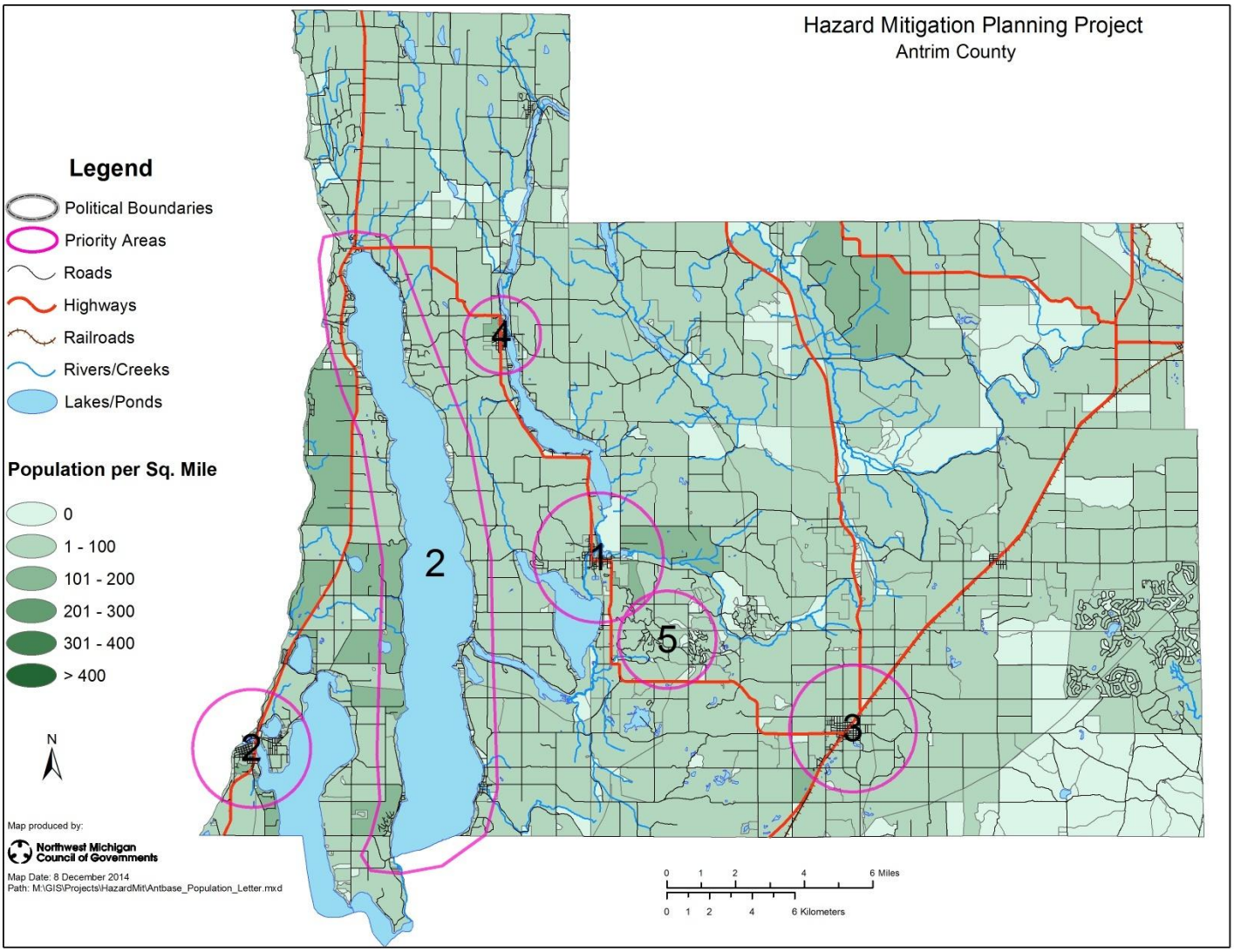
Appendix B

Appendix C

Population Density Map



Appendix D

Risk Assessment Summary Table: ANTRIM COUNTY

HAZARD (Years of Record)	Number of Events	Probability**	Geographic Size Affected	Population Impacted	Specific Priority Area	Known Damage and Estimated Costs
Flash Flooding (1999)	1	Rare	Village of Bellaire area	3,485	1	NA
Hail (1979 – 2014)	18	Occasional	County			$30,000 crop/property
Erosion	NA	Rare	US 31 communities	9,515	2	NA
Extreme Winter Weather (1993 – 2014)	133	Frequent	Torch Lake shoreline area Village of Mancelona Cedar River area	6,597 1,390 6,376	3 5	$5,500,000 (property statewide) $67,000 (property countywide) 10,000,000 (crop statewide)
Thunderstorms and High Winds; Lightning (1965 – 2014)	54	Frequent	Village of Bellaire area US 31 communities Central Lake area Cedar River area	3,485 9,515 3,156 6,376	1 2 4 5	$823,500 property
Tornadoes (1958 – 2014)	8	Occasional	County	23,370		$27,000 property
Wildfire (1981 – 2014)	194	Occasional	County	23,370		NA

***Rare* - Hazard event is likely to occur less than once every 30 years.
Occasional - Hazard event is likely to occur less than once every 5 years, but more often that once every 30 years.
Frequent - Hazard event is likely to occur more than once every 5 years.

Appendix E

Examples of Past Mitigation Projects

Flood Projects	Tornado/Wind Projects	Extreme Cold/Winter/Infrastructure Failure Projects
Replace culvert with bridge	Modify roof ballast system on airport	Insulate municipal water tower
Install stormwater relief drain	Construct storm shelters in public buildings	Insulate city infrastructure
Upgrade road culvert	Construct storm shelters for homes, facilities	Insulate sanitary/storm sewer mains
Elevate floors of homes	Wind bracing for microwave/radio towers	Insulate water mains
Acquire of floodway properties	Construct mobile home park storm shelter	Bury utility lines
Create retention basin	Wind retrofitting for municipal buildings	Relocate sewer mains
Construct new dike	Wind bracing for school facilities	Reroute power lines under a river
Upgrade bridge over a creek (for greater stream flow)	Upgrade warning sirens**	Install plumbing devices to prevent sewer backup
Install sea wall	Install warning sirens**	Elevate and build casing for generator for EOC
Install rip rap to protect roadway	Purchase/Distribute NOAA radios**	Living snow fences for highways and roadways
Re-route various county drains	Severe weather monitoring systems**	
Purchase back-flow prevention valves	Implement long-term community outreach**	
Construct new drains for flood relief		
Flood study for home acquisition		
Flood study of community's flood risk	**Thunderstorm/Lightning Projects**	**Wildfire Projects**
Flood study for stream, roadways		
Elevate electrical equipment in basements	Lightning protection (grounding/phasing)	Vegetation management for roadways
Floodproof wastewater treatment plant	Purchase/Distribute NOAA radios**	Vegetation mgmt. for urban interface areas of city
Warning sensor for creek/river	Install weather alert monitors**	Vegetation mgmt. for homes in fire prone areas
Warning sensor for dam		Urban Interface Education Program**
Raise manholes above 100-Yr floodplain		
Expand storm sewer network for subdivision		
Excavate floodway channel bypass		
Establish permanent flood elevation benchmarks**		
Increase pump capacity for pump stations		
Remove abandoned dam		
Construct emergency floodway		
Install plumbing devices to prevent sewer backup		

***Denotes Hazard Mitigation Grant Program State Discretionary projects (only 5-10% set aside of HMGP funding)*

Appendix F

Resources

Benchmarks 2014, Northwest Michigan Council of Governments

Confronting Climate Change in the Great Lakes Region, Michigan fact sheet, Union of Concerned Scientists and the Ecological Society of America, April 2003.

Integrating Human-Caused Hazards Into Mitigation Planning, State and Local Mitigation Planning how-to guide: Federal Emergency Management Agency, September 2002, FEMA 386-7 CD.

Local Hazard Mitigation Planning Workbook: EMD-PUB 207, February 2003, Emergency Management Division, Michigan Department of State Police.

Michigan Hazard Analysis 2012, EMD-PUB 103, March 2006, Emergency Management and Homeland, Security Division / Michigan Department of State Police

National Oceanic and Atmospheric Administration: Weather/Climate Events, Information, Assessments; Climatology and Extreme Events; U.S. Storm Events Data Base; 1950-present, local storm reports, damage reports, etc. from various sources. www.ncdc.noaa.gov

Northwest Michigan County Profiles 2010, Northwest Michigan Council of Governments, November 2002.

Northwest Michigan Council of Governments Website Data, nwm.org.

Planning for a Disaster-Resistant Community: A One-Day Workshop for City and County Planners, Planning Officials, and Consultants: American Planning Association Research Department, American Planning Association, 2002 in cooperation with the Federal Emergency Management Agency, Planning and Mitigation Branch (materials only).

Platte River Watershed Management Plan, Antrim County Conservation District, April 2002.

State and Local Mitigation Planning how to guide: Understanding Your Risks, identifying hazards and estimating losses: Federal Emergency Management Agency, August 2001, FEMA 386-2.