

Door County Hazard Mitigation Plan

Adopted by the Door County Board of Supervisors on June 28, 2016

Door County Planning Department

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Door County Hazard Mitigation Plan

Chapter 1: Introduction

In 2000, the U.S. Congress passed the Disaster Mitigation Act, intended to reduce public and private expenses associated with disasters and to speed up response time to and reduce recovery time from disasters. The purpose of this act, and the Door County Hazard Mitigation Plan, is “to reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters.” An additional purpose of the Door County Hazard Mitigation Plan is to address similar issues resulting from non-natural disasters.

The Disaster Mitigation Act included a new requirement for local governments to prepare hazard mitigation plans in order to be eligible for funding from the Federal Emergency Management Administration (FEMA) for mitigation activities, both pre- and post-natural disaster, through the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program. Addressing manmade/technological hazards is encouraged, but not required. Without a FEMA-approved and adopted plan, governments cannot utilize funding through the Pre-Disaster Mitigation Grant Program. In order for a local government without a FEMA-approved and adopted plan to be eligible to receive funding through the Hazard Mitigation Grant Program, they would have to agree to prepare a hazard mitigation plan within one year after a disaster occurs.

In 2014, the Door County Planning and Emergency Services Departments partnered to develop the Door County Hazard Mitigation Plan in compliance with FEMA requirements and as a multi-jurisdictional plan. The county’s five incorporated municipalities (City of Sturgeon Bay and Villages of Egg Harbor, Ephraim, Forestville, and Sister Bay) agreed to participate in the development of this plan, as well as other county departments and outside agencies with an interest in disaster management. Representatives from these agencies, departments, and municipalities formed the Planning Team that guided the development of this plan, a list of which is provided later in this chapter.

PLANNING PROCESS

Note: The grant approval letter, press releases, requests for input, meeting agendas and minutes described below can be found in Appendix A.

In June of 2014, FEMA approved a grant application from Door County in the amount of \$33,000 for the development of a county hazard mitigation plan. FEMA provided 75% (\$24,750), Wisconsin Emergency Management provided 12.5% (\$4,125), and Door County provided the remaining 12.5% (\$4,125). The grant timeframe began on June 10, 2014 and ends on June 10, 2017. The draft plan was due to FEMA by January 31, 2016, with the final plan to be completed and approved by FEMA on or before July 31, 2016.

The Door County Hazard Mitigation Plan was developed following guidelines in the “Local Mitigation Planning Handbook” published by FEMA. The handbook covers Title 44 Code of Federal Regulations §201.6 for FEMA approval and eligibility to apply for FEMA hazard mitigation assistance programs. Listed below is a timeline and description of the steps taken to develop the Plan.

- **Grant Application Approved** (June 10, 2014). A letter from FEMA to Wisconsin Emergency Management was sent, approving the application for a Local Multi-Jurisdictional Hazard Mitigation Plan.
- **Pre-Planning Meetings**
 - Meeting with Planning and Emergency Services Department to discuss scope of services to be provided by the Planning Department (June 26, 2014).
 - Meeting with Planning and Emergency Services Departments to plan kick-off meeting (July 10, 2014).
 - Meeting with Planning and Emergency Services Departments to discuss planning process outline (August 13, 2014).

- **Planning Team Press Release and Meetings**
 - **Kick-Off meeting** (September 30, 2014). An invitation to attend a Planning Team kick-off meeting was sent to county departments, incorporated municipalities, and other agencies with an interest in hazard mitigation planning on August 20th, 2014. At the meeting, Planning Team participants reviewed the hazard mitigation plan development process, responsibilities, and timeline. Participants also reviewed the Memorandum of Agreement and the “capabilities” worksheet.
 - **Press Release** (December 12, 2014). A press release was sent to local media contacts announcing the hazard mitigation planning process.
 - **Planning Team Meeting** (January 29, 2014). Planning Department staff members presented research on natural hazards, discussed local capabilities worksheet, and handed out base maps and instructions for asset/infrastructure identification.
 - **Planning Team Meeting** (April 28, 2015). Planning Department staff members presented research on non-natural hazards, discussed DNR redevelopment and remediation information, and discussed asset/infrastructure and hazardous materials/sites maps.
- **Input Requests**
 - **Draft Risk Assessment Chapter** (July 8, 2015). Planning Department staff members emailed the Planning Team notice that the draft risk assessment chapter was posted to the Planning Department’s Web site for their review. Comments requested by July 31st.
 - **Draft Mitigation Strategies Chapter** (July 29, 2015). Planning Department staff members emailed the Planning Team notice that the draft mitigation strategies chapter was posted to the Planning Department’s Web site for their review. Comments requested by August 14th.
 - **Draft Risk Assessment and Mitigation Strategies Chapters** (August 14, 2015). Planning Department staff members sent an email reminding the Planning Team to submit comments regarding the draft risk assessment and mitigation strategies chapters. Comments requested by August 18th.
- **Open House Meetings** (September 21st, 28th, and 29th). Planning Department staff members issued/sent a press release/invitation on August 19th, 2015 regarding open house meetings being hosted by the Planning and Emergency Management Services Departments in late September to review the draft risk assessment and mitigation strategies chapters. Three open house meetings were held in Northern Door, Southern Door, and the City at which the draft risk assessment and mitigation strategies chapters were presented and input was gathered from meeting participants. Note that the meeting minutes in Appendix A list the input received and what the Planning Department did with the input.
- **Input Request** (November 2015). Planning Department staff members issued a press release and emailed the Planning Team, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, and neighboring communities regarding a final opportunity to review and comment on the draft plan prior to submittal to FEMA. The email described where to view the draft chapters on-line and how to offer input in writing by faxing, emailing, or mailing the Planning Department. Comments requested by November 25th, 2015.
- **Plan Submittal to FEMA** (January 2016). Planning Department staff members submitted the final plan draft to FEMA.
- **Municipal Adoption Request** (2016). Planning Department staff members emailed incorporated municipalities the FEMA conditionally approved plan along with a request for official adoption by the municipality.
- **Approval/Adoption by Door County Resource Planning Committee/Board of Supervisors** (2016). The Resource Planning Committee voted to approve recommendation of the plan by the

Door County Board of Supervisors on _____. The Door County Board of Supervisors adopted the plan on _____.

PLANNING TEAM

The following Door County departments, municipalities, and agencies were invited to participate on the Planning Team:

- Door County Departments
 - Administrator – Maureen Murphy, Administrator (since resigned)
 - Airport – Keith Kasbohm, Director
 - Building and Grounds – Wayne Spritka, Director
 - Emergency Management Services – Dan Williams, Director, and Anthony Luchini, Deputy Director (since resigned)
 - Highway – John Kolodziej, Director
 - Human Services – Joe Krebsbach, Director
 - Land Information Office – Tom Haight, Land Information Officer
 - Parks – Erik Aleson, Parks Director
 - Planning – Mariah Goode, Director, and Becky Kerwin, Planner
 - Public Health – Rhonda Kolberg, Director
 - Sanitarian – John Teichtler, Director
 - Sheriff's – Steve Delarwelle, Sheriff
- Municipalities
 - City of Sturgeon Bay, Mayor and Administrator – Thad Birmingham, Mayor, and Steve McNeil, Administrator (since resigned)
 - City of Sturgeon Bay, Community Development – Marty Olejniczak, Director
 - Village of Forestville, President and Administrator – Terry McNulty, President, and Mary Ann Salmon, Clerk
 - Village of Egg Harbor, President and Administrator – Joe Smith, President, and Lynn Ohnesorge, Clerk-Treasurer
 - Village of Ephraim, President and Administrator – Mike McCutcheon, President and Charity Buhr, Clerk (since resigned). Also, Andrea Collak, Clerk, and Brent Bristol, Zoning Administrator
 - Village of Sister Bay, President and Administrator – Dave Lienau, President, and Zeke Jackson, Administrator
- Other agencies
 - U.S. Coast Guard – John Sehn, Senior Chief
 - Wisconsin Public Service – Larry Schlies, General Manager
 - American Red Cross – Travis Waack, Regional Director
 - Ministry Door County Medical Center – Steve Schwenke, Safety Manager (since resigned)

PARTICIPATING JURISDICTIONS

Door County and all incorporated municipalities participated in the development of the hazard mitigation plan. Agreement by the municipalities to participate was formalized with a signed Memoranda of Agreement that outlined specific responsibilities, as listed below. The complete Memorandum of Agreement signed by Door County and the signature page of the municipal Memoranda of Agreement can be found in Appendix B. Also provided below is a description of each municipality's specific participation.

- Develop/approve the Schedule of Tasks with the Planning Team.
- Attend regular meetings of the Planning Team and any applicable sub-county meetings.
- Assist the Planning Team with developing and conducting an outreach strategy to involve other stakeholders and the public in order to appropriately represent the Jurisdiction.
- Provide data and feedback to develop the risk assessment and mitigation strategy, including a specific mitigation action plan for the Jurisdiction.
- Submit drafts of plan to the Jurisdiction for review.
- Work with the Planning Team to incorporate Jurisdiction comments into the draft plan.
- Submit the draft plan to their respective governing body for consideration and adoption.
- After adoption, coordinate a process to monitor, evaluate, and work toward plan implementation.

Municipal Participation

Note that all of the municipalities filled out a capabilities worksheet and provided input in writing and/or at one of the open house meetings. A summary of the capabilities worksheets can be found in Appendix C.

Door County

Memorandum of Agreement: Dan Williams, Emergency Services Director

Meeting Participant(s): Dan Williams, Director; Tony Luchini, Deputy Director (since resigned)

Meeting(s) attended:

- Planning Team Meetings – September 30th, 2014; January 29th, 2015; and April 28th, 2015
- Open house meetings – September 21st, 28th, and 29th, 2015

City of Sturgeon Bay

Memorandum of Agreement: Thad Birmingham, Mayor

Meeting Participants: Marty Olejnik, Administrator

Meetings attended:

- Planning Team Meetings – September 30th, 2014; January 29th, 2015; and April 28th, 2015
- Open house meeting – September 28th, 2015

Village of Egg Harbor

Memorandum of Agreement: Joe Smith, President

Meeting Participants: Josh Van Lieshout, Administrator (since resigned); Michelle Anderson, Deputy Administrator/Deputy Clerk/Deputy Treasurer

Meetings attended:

- Planning Team Meeting – September 30th, 2014
- Open house meeting – September 29th, 2015

Village of Ephraim

Memorandum of Agreement: Mike McCutcheon, President

Meeting Participants: Charity Buhr, Administrator (since resigned); Brent Bristol, Zoning Administrator; Jane Olson, Trustee

Meetings attended:

- Planning Team Meeting – September 30th, 2014
- Open house meeting – September 29th, 2015

Village of Forestville

Memorandum of Agreement: Terry McNulty, President

Meeting Participants: Terry McNulty, President

Meetings attended:

- Planning Team Meeting – September 30th, 2014
- Open house meeting – September 29th, 2015

Village of Sister Bay

Memorandum of Agreement: Zeke Jackson, Administrator

Meeting Participants: Zeke Jackson, Administrator; Patrick Johnson, Operator; Michael Schell, Operations Supervisor

Meeting attended: Open house meeting – September 29th, 2015

STAKEHOLDER AND PUBLIC INVOLVEMENT

Three press releases/invitations were issued over the course of the planning process, as described previously and in more detail below:

- **Press Release** (December 12, 2014). A press release was sent to local media contacts announcing the hazard mitigation planning process and how to get involved.
- **Press Release/Invitation to Open House Meetings** (August 19, 2015).
 - A press release regarding the open house meetings scheduled for late September was emailed to local media contacts and the Planning Team.
 - An invitation to attend the open house meetings was mailed to local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, and neighboring communities.
 - The press release and invitation described the open house meetings as an opportunity to review the draft risk assessment and mitigation strategies chapters and offer input.
 - The press release and invitation described where to view the draft chapters on-line and how to offer input in writing by faxing, emailing, or mailing the Planning Department.
- **Press Release/Input Request** (December 2015). A press release regarding a final draft of the plan was emailed to local media contacts, the Planning Team, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, and neighboring communities. The press release described where to view the draft chapters on-line and how to offer input in writing by faxing, emailing, or mailing the Planning Department.

REVIEW AND INCORPORATION OF OTHER DOCUMENTS

The following plans, studies, reports, and technical information were reviewed and incorporated into the Door County Hazard Mitigation Plan:

- Natural hazard profiles:
 - *Discovery Report, Great Lakes Coastal Flood Study, Lake Michigan, Basin-Wide Report, Report Number 01, February 2013; Appendix F, Kewaunee, Door, and Brown Counties, WI, Discovery Report*
 - *State of Wisconsin Hazard Mitigation Plan, Wisconsin Emergency Management, Department of Military Affairs, October 2011*
 - *National Oceanic Atmospheric Administration (NOAA), Storm Events Database and additional drought information from the "Climate at a Glance" Web page.*
- Communicable diseases: *Center for Disease Control and Prevention*

- Roadway accidents: *Wisconsin Department of Transportation*
- Private water supply contamination, hazardous materials on roadways, and hazardous materials on waterways: *DNR Bureau of Remediation and Redevelopment*
- Groundwater Concern Areas: *Door County Greenprint modeling tool*

Additionally, county profile information can be found in the Door County Comprehensive and Farmland Preservation Plan 2035 – Volume II, including the following topics:

- Geographical Description of the County
- Population and Demographics
- Historical and Cultural Resources
- Housing
- Economic Development
- Natural Resources
- Agricultural Resources
- Transportation
- Community Facilities and Utilities
- Land Use
- Intergovernmental Cooperation

PLAN ORGANIZATION

The Door County Hazard Mitigation Plan is divided into three chapters. This chapter, Chapter 1, Introduction, discusses the federal Disaster Mitigation Act of 2000, grant funding for this plan, the planning process, and a list of documents reviewed and incorporated into this plan. Chapter 2, Risk Assessment, provides profiles for natural disasters that have affected Door County, including description, location, historical occurrences, probability of occurrence, impacts, and vulnerability. Chapter 2 also provides information on non-natural hazards that have affected Door County, primarily based on information from the Wisconsin Department of Natural Resources – Bureau of Redevelopment and Remediation. Chapter 3, Mitigation Strategies and Plan Maintenance, contains the goals and action items that represent what the county and municipalities seek to achieve through mitigation plan implementation. Chapter 3 also addresses the monitoring, evaluation, and maintenance of this plan.

Door County Hazard Mitigation Plan

Chapter 2: Risk Assessment



INTRODUCTION

An important component of hazard mitigation planning is conducting a risk assessment regarding the potential impacts of hazards to a community's people, economy, and built and natural environments. For the purpose of hazard mitigation planning, "risk" is the potential for damage, loss, or other impacts created by the interaction of hazards with community assets. Exposure of people, property, and other community assets to hazards can result in disaster, depending on the impacts. Impacts are the consequences or effect of the hazard on community assets. Risk assessment results provide the foundation for the rest of the planning process where action items to reduce risk are identified and prioritized.

At its April 2015 meeting, the Door County Hazard Mitigation Plan steering committee conducted a risk assessment for both natural and non-natural hazards based on a list of hazards provided by the Wisconsin Emergency Management division. For each hazard, the committee gave a separate ranking of one (low risk), two (medium risk), or three (high risk) for both frequency and probability. Specific hazards and their associated rankings for risk are listed below in order of highest ranking to lowest ranking or no ranking. All of the natural hazards, non-natural hazards with a ranking of 4 or higher, and "nuclear power plant" are described in further detail later in this chapter in the "Natural Hazard Profiles" and "Non-Natural Hazard Profiles" sections.

Natural Hazards

- lightning and thunderstorms (5)
- tornado/high winds (5)
- snow/ice/blizzard storms (5)
- extreme heat (4)
- extreme cold (4)
- stormwater flooding (3)
- flash, riverine, and lake flooding (3)
- hail storms (2)
- drought (2)
- wildfire
- coastal erosion
- landslide and subsidence
- dam failure
- climate change
- dense fog
- funnel clouds and waterspouts

Non-Natural Hazards

- communicable diseases (9)
- water supply contamination – private (8)
- hazardous materials – roadway (6)
- hazardous materials – waterway (5)
- loss of electrical system (5)
- transportation – roadway accidents (4)
- structural fire (4)
- loss of sewer system (4)
- nuclear power plant (3)
- contaminants (anthrax, etc.) (3)
- water supply contamination – public (3)
- transportation – airway (3)
- transportation – waterway (3)
- hazardous materials – aircraft (3)
- hazardous materials – pipeline (3)
- correction center incidence (3)
- school violence (2)
- workplace violence (2)
- terrorism (2)

Per Federal Emergency Management Agency (FEMA) requirements for hazard mitigation plan content, this chapter describes natural hazards that pose a threat to the county in terms of location, extent, previous occurrences, and probability of future occurrences. The natural hazard profiles are primarily based on information from the National Oceanic Atmospheric Administration and the state's hazard mitigation plan.

FEMA does not require non-natural hazard events to be included in a certified hazard mitigation plan, however, the Planning Team agreed to include non-natural hazard information. The non-natural hazards listed with a ranking of 4 or higher and "nuclear power plant" are discussed later in this chapter. The non-natural hazard profiles are primarily based on information from the Wisconsin Department of Natural Resources – Bureau of Redevelopment and Remediation, the state agency responsible for the investigation and cleanup of environmental contamination and the redevelopment of contaminated properties. Also included, as appropriate, is information from the Door County Comprehensive and Farmland Preservation Plan 2035.

HAZARD MITIGATION PLANNING RISK ASSESSMENT MAPS

FEMA flood zone areas (100-year), discussed in further detail later in this chapter, are shown on a county overview map located at the end of this chapter (see Map 2.1). Also included at the end of this chapter are two sets of maps, described below, for the five incorporated municipalities and for the unincorporated areas of Door County. (See Maps 2.2 – 2.17.)

“Facilities/Infrastructure and Hazardous Materials” Maps

The first map in the set of two, entitled “Facilities/Infrastructure and Hazardous Materials”, shows the features listed below. These maps were created for the purpose of identifying assets and infrastructure that could be destroyed or harmed in the event of a hazard, as well as assets and infrastructure potentially available to assist in the event of a hazard. Hazardous material storage sites are also shown on these maps in order to help assess proximity of harmful materials to human populations and because sites where there is hazardous material storage can also be part of a community’s assets, such as municipal wells and wastewater-related facilities.

- occupied buildings/vulnerable populations
 - child care centers
 - schools
 - vulnerable populations (elderly and handicapped)
- government/non-governmental organization buildings
 - administrative buildings
 - libraries
 - churches
 - post offices
 - club buildings
- emergency services
 - Coast Guard-related
 - clinic/hospital
 - emergency services stations
 - fire stations
 - police stations
- seasonal or temporary populations
 - popular beaches
 - community buildings
 - community events
 - public camping sites
 - seasonal group quarters
- utilities
 - communications-related
 - electric-related
 - propane
 - radio/television-related
 - water-related
 - power lines
 - gas lines
- transportation-related
 - airport or aircraft-related
 - boat ramp
 - ferry
 - highway shop
 - marina
 - stream-road intersections

- roads in 100-year floodplain
- hazardous materials storage
 - chemical storage (agricultural and utility-related)
 - manure storage
 - DNR open contamination sites
 - fuel storage
 - wastewater-related
 - landfill
 - solid waste storage
- Town of Forestville dam
- 100-year flood zone

“Contamination Sites, Hazardous Materials Storage, and Groundwater Concern Areas” Maps

The second map in the set of two, entitled “Contamination Sites, Hazardous Materials Storage, and Groundwater Concern Areas”, shows the feature listed below. Hazardous material storage sites and DNR redevelopment and remediation sites are shown on top of groundwater concern areas on these maps in order to assess historical and potential future occurrences of contamination of soil and groundwater.

- hazardous materials storage (see above for specific features)
- contamination redevelopment and remediation sites
- groundwater concern areas

The contamination redevelopment and remediation sites are discussed in further detail in the “Non-Natural Hazard Profiles” section of this chapter. The groundwater concern areas were developed using the county’s Greenprinting modeling tool. The Greenprint model incorporates a set of targeted land use management and planning goals specific to Door County, one of which is to protect groundwater quality. Criteria used to develop the groundwater concern areas map are depth to bedrock, depth to water table, soil infiltration rates, municipal water supply zones of contribution, closed depressions and principal bedrock outlets, and fractured bedrock and Karst features. More information on the Greenprinting model and process can be found at http://206.169.56.66/DoorCounty_Greenprint/.

NATURAL HAZARD PROFILES

The information provided in the natural hazard profiles is primarily from the state’s hazard mitigation plan and the National Oceanic Atmospheric Administration (NOAA). In 2015, the NOAA’s former three data centers—the National Climatic Data Center, the National Geophysical Data Center, and the National Oceanographic Data Center, which included the National Coastal Data Development Center—merged to form the National Centers for Environmental Information (NCEI). NCEI’s mission is to meet the demand for high-value environmental data and information. According to NCEI they are the world’s largest provider of weather and climate data, providing access to one of the most significant archives on Earth, with comprehensive oceanic, atmospheric, and geophysical data.

NCEI provides on its Web site a Storm Events database, which is searchable by state and county. NCEI receives storm data from the National Weather Service, which in turn receives their information from a variety of sources, including county, state and federal emergency management officials, local law enforcement officials, skywarn spotters, National Weather Service damage surveys, newspaper clipping services, the insurance industry, and the general public.

In Door County there were a total of 22 event types reported, listed in Table 2.1 below from highest to lowest by average number of events per year. The Storm Events database also tracks direct and indirect deaths, direct and indirect injuries, property damage, and crop damage resulting from a storm event. For Door County, there were 2 deaths and 12 injuries related to tornado, thunderstorm wind, high wind, heavy rain, and lightening events. Damages reported for Door County were over \$8.9 million in property damage

and over \$5.2 million in crop damage. Following is a description of the 22 Storm Event types that have occurred in Door County and any injuries, deaths, or damages resulting from those events.

PLANNING TEAM RISK ASSESSMENT RESULTS

For the purpose of this plan, all hazard events that have affected Door County are grouped into five general categories in Table 2.2: storms and/or hazardous wind events (with a “winter event” sub-category), hazardous temperatures, hazardous rain events, hail, and other hazards. Within each of these five general hazard categories, the NOAA Storm Event hazard types and associated data are listed. The left-hand column of the table shows the NOAA Storm Event hazard types, plus stormwater flooding (an event type not listed in the Storm Events database); the second to fourth columns show the total number of events, average number of events per year, and number of deaths and injuries. The NOAA Storm Event types are listed in order of highest to lowest average number of events per year (third column). In the last column, the hazard types ranked by the Planning Team are listed in the same row as the closest matching NOAA Storm Event category. Note that the NOAA Storm Event database was just released in April 2015, shortly before the April 29th Planning Team risk assessment meeting; Planning Department staff members discovered the database after this meeting took place. For future updates of this plan, hazard categories used for the risk assessment may change to be more consistent with the Storm Event categories.

The Planning Team hazard categories in the last column show the risk assessment ranking given by the Planning Team, in order from highest to lowest risk. As explained previously, the committee gave a ranking of one (low risk), two (medium risk), or three (high risk) for each of the three categories of risk (frequency, probability, and threat to public health and safety). The values assigned to each of these categories were then added together to come up with a total value or “ranking” for each hazard type. NOAA Storm Event data (number of events, average number of events per year, and number of direct deaths/injuries) is shown in columns three through five.

After Table 2.2, the five general hazard types are discussed in order of ranking from highest risk to those hazard events not ranked by the Planning Team, in terms of the specific Planning Team hazard categories. Each hazard discussion includes the NOAA Storm Events hazard descriptions/criteria and reported hazard occurrences. Descriptive and historical occurrence information from the state’s hazard mitigation plan is included, however, in some instances the two sources do not describe hazards similarly and/or the number of historical occurrences differs greatly. Also provided from the state’s hazard mitigation plan are assessments of the probability of future occurrences for all hazards and loss estimation for future occurrences of flood and tornado events.

STORM AND/OR WIND EVENTS

The NCEI Storm Events database categories included in this section are thunderstorm wind, strong and high winds, tornados, lightning, and winter storms. The Planning Team risk assessment categories and rankings are:

- tornados: 5
- lightning & thunderstorms: 5
- snow/ice/blizzard storms: 5

Description, Location, Historical Occurrences

Thunderstorm Wind

Although thunderstorms can occur throughout Wisconsin during any month of the year, their highest frequency is May through September. Thunderstorm wind occurs most often between 12:00 p.m. and 10:00 p.m., frequently peaking in severity between 6:00 p.m. and 7:00 p.m. Wisconsin averages around 30 thunderstorm days per year over the northeastern counties to around 42 days over the southwestern counties.

A “thunderstorm wind” event may get recorded in the Storm Events database when convective wind (rising and sinking air) reaches 58 mph or greater and occurs within 30 minutes of lightning being observed or detected. Thunderstorm winds greater than 74 mph, equivalent to estimated winds in the low-end category of the Enhanced Fujita damage (tornado intensity) scale, can cause what the NCEI considers extreme wind damage. Extreme wind can partially remove roofs, break windows, push over light trailer homes, and push automobiles off the road. Winds of any speed (including below 58 mph) that occur during a thunderstorm and produce a fatality, injury, or damage are also recorded as a thunderstorm wind event.

In Door County between 1966 and 2014 there were 90 thunderstorm wind events recorded in the Storm Events database, with eight events reaching extreme speeds (75 mph or greater); the highest wind speed reported was 128 mph. These thunderstorm wind events resulted in \$355,000 in property damages, \$500 in crop damages, and six indirect injuries. Door County averages 1.5 thunderstorm wind events per year.

Table 2.1: Natural Hazard Events, Door County

Event Type All events tracked between 1996 - 2014, except where noted.	Ave. # Per Year	NOAA # of Events	# Direct Deaths/ Injuries	\$ Property Damage	\$ Crop Damage
Winter Storm	1.79	34	--	--	--
Thunderstorm Wind (1955 - 2014)	1.50	90	0/6	\$355,000	\$500
Heavy Snow	1.32	25	--	--	--
Hail (1955 - 2014)	1.10	66	--	--	\$3,500,000
Strong Wind	0.95	18	--	\$40,000	--
High Wind (1 direct death)	0.84	16	1/1	\$185,000	--
Dense Fog	0.53	10	--	--	--
Waterspout	0.32	6	--	--	--
Blizzard	0.32	6	--	--	--
Drought	0.32	6	--	--	--
Lightning	0.32	6	0/1	\$444,700	--
Winter Weather	0.21	4	--	--	--
Extreme Cold/Wind Chill	0.21	4	--	--	--
Funnel Cloud	0.21	4	--	--	--
Cold/Wind Chill	0.16	3	--	--	--
Heavy Rain (1 indirect death)	0.16	3	1/0	--	--
Tornado (1950 - 2014)	0.12	8	0/4	\$8,017,500	\$1,770,000
Heat	0.11	2	--	--	--
Excessive Heat	0.05	1	--	--	--
Flash Flood	0.05	1	--	\$75,000	--
Flood	0.05	1	--	--	--
Ice Storm	0.05	1	--	--	--
Total	--	315	2/12	\$9,117,200	\$5,270,500

Source: National Oceanic Atmospheric Administration, Storm Events - National Centers for Environmental Data, June, 2015.

Table 2.2: Hazard Risk Assessment Results, Door County

NOAA Storm Event Type All events tracked between 1996 - 2014, except where noted.	# of Events	Ave. # Per Year	# Direct Deaths/Injuries	Planning Team Risk Assessment: Category & Ranking
Storms and/or Hazardous Wind Events				
Thunderstorm wind (1955 - 2014)	90	1.50	0/6	Thunderstorms: 5
Strong wind	18	0.95	--	--
High wind (1 direct death)	16	0.84	1/1	--
Tornado (1950 - 2014)	8	0.12	0/4	Tornados: 5
Lightning	6	0.32	0/1	Lightning: 5
Winter Events				
Winter storm	34	1.79	--	--
Heavy snow	25	1.32	--	Snow storm: 5
Blizzard	6	0.32	--	Blizzard storm: 5
Winter weather	4	0.21	--	--
Ice storm	1	0.05	--	Ice storm: 5
Hazardous Temperatures				
Extreme cold/wind chill	4	0.21	--	Extreme cold: 4
Cold/wind chill	3	0.16	--	--
Heat	2	0.11	--	Extreme heat: 4
Excessive heat	1	0.05	--	--
Hazardous Rain Events				
Heavy rain (1 indirect death)	3	0.16	1/0	--
Flood	1	0.05	--	Flash, riverine, & lake flooding: 3
Flash flood	1	0.05	--	--
--	--	--	--	Stormwater flooding: 3
Hail				
Hail (1955 - 2014)	66	1.10	--	Hail: 2
Drought				
Drought	6	0.32	--	Drought: 2
Other Hazards				
Wildfire	--	--	--	Not Ranked
Coastal erosion	--	--	--	
Landslide and land subsidence	--	--	--	
Dam failure	--	--	--	
Climate change	--	--	--	
Dense fog	10	0.53	--	
Waterspout	6	0.32	--	
Funnel cloud	4	0.21	--	
Total - All Hazard Events	315	--	2/12	

Source: Door County Hazard Mitigation Planning Team, April 2015; National Oceanic Atmospheric Administration, Storm Events - National Centers for Environmental Data, June 2015.

Strong and High Winds

- **Strong Wind.** A non-convective wind gusting less than 58 mph (typically for less than 20 seconds) may get recorded in the Storm Events database as a “strong wind” event. A non-convective wind sustained, typically for more than 20 seconds, at less than 40 mph that causes a fatality, injury, or damage may also be classified as a strong wind. In Door County, 18 strong wind events were recorded between 1996 and 2014, causing \$40,000 in property damages.
- **High Wind.** A non-convective wind sustained at 40 mph or greater for one hour or longer may get recorded as a “high wind” event in the Storm Events database. In Door County, 16 high wind events were recorded between 1997 and 2011, with one direct injury occurring in 1998. A total of \$205,000 in property damage from these events was recorded.

Tornados

Note: this section also includes NCEI Storm Event database information on funnel clouds and waterspouts. The state hazard mitigation plan addresses funnel clouds as part of its discussion on tornados and does not address waterspouts at all.

A tornado is a violently rotating column of air extending from the base of a convective cloud (usually cumulonimbus) to the ground. Tornados can form within many environments; however, three common environments include intense squall lines, super cell thunderstorms, and the right front quadrant of land-falling hurricanes within the spiral bands of thunderstorms. Though more uncommon, tornados may also result from earthquake-induced fires, wildfires, or atomic bombs. Additionally, severe weather spotter and research videotapes of tornados in the past twenty years have shown that a tornado can be in progress with no visible “funnel cloud” at the ground level. Tornado damage severity is measured by the Enhanced Fujita Tornado Scale (EF-Scale), as shown in Table 2.3 below. A detailed description of the EF-Scale can be found online at the National Weather Service Storm Prediction Center website.

Table 2.3: Enhanced Fujita (EF) Tornado Scale

Category	EF-Scale Wind Speed (mph)
EF0 (weak)	65 – 85 mph
EF1 (weak)	86 – 110 mph
EF2 (strong)	111 – 135 mph
EF3 (strong)	136 – 165 mph
EF4 (violent)	166 – 200 mph
EF5 (violent)	>200 mph

Source: NOAA National Weather Service, Milwaukee/Sullivan, WI, 2011.

Wisconsin lies along the northern edge of the nation’s maximum frequency belt for tornados, sometimes called “tornado alley,” which extends northeastward from Oklahoma into Iowa and then across to Illinois and southern Wisconsin. Generally, the southern portion of Wisconsin has a higher frequency of tornados, although every county in Wisconsin has had tornados.

Most tornados in the United States last less than 10 minutes, but some have occurred for more than an hour. Tornado paths can range from a few hundred feet to miles and tornado widths may range from tens of yards to a mile or two. The “average” Wisconsin tornado for the period between 1982 and 2007 had a life-span of 7.1 minutes, a path length of 3.7 miles, a path width of 118 yards, and an EF rating of 0.7 (mid-way between an EF0 and EF1).

Data collected between 1950 and 2010 for Wisconsin shows that most long-track tornados (25 miles or longer) tornados in the state travel southwest to northeast. A number of the tornados moved west to east, as well as northwest to southeast; northwest to southeast moving tornados tended to occur in the later part of the warm season. Data collected between 1982 and 2010 shows that over 85% of Wisconsin’s tornados were rated as “weak” (EF0 & EF1), over 13% were “strong” (EF2 & EF3), and just under 10% were “violent” (EF4 & EF5).

In Wisconsin, June has the highest tornado frequency, followed by July, May, and August. The only month with no documented tornados in the state is February. Historically, winter, spring, and fall tornados are more likely to occur in southern parts of the state more than in northern parts. Peak hours of occurrence in the state are between 3:00 p.m. and 10:00 p.m., when 75% of the tornados occur. The busiest “spin-up hour” is between 6:00 p.m. and 7:00 p.m.

A “tornado” event may be recorded in the Storm Events database when a violently rotating column of air extends to or from a cumuliform cloud or underneath a cumuliform cloud to the ground, and is visible (but not always) as a condensation funnel. In order for a rotating column of air to be classified as a tornado, it must be in contact with the ground and extend to/from the cloud base, and there should be some semblance of ground-based visual effects such as dust/dirt rotational markings/swirls, or structural or vegetative damage or disturbance. Between 1956 and 2000, eight tornados were recorded in the Storm

Events database for Door County. (See Table 2.4.) The most serious tornado occurred in 1998, which was given an EF3 ranking and was responsible for two injuries, over \$4.7 million in property damages, and over \$1.7 million in crop damages. The second worst tornado event occurred in 1970 when two EF2 tornados occurred on the same day, causing two injuries and \$500,000 in property damages.

Table 2.4: Tornado Events, Door County

Date	Time	F-Scale	# Direct Injuries	\$ Property Damage	\$ Crop Damage	Length (miles)	Width (yards)
7/1/1956	12:05 p.m.	F2	0	\$250,000	\$0	10.6	50
7/25/1966	6:20 p.m.	F0	0	\$2,500	\$0	2	17
4/22/1970	9:10 p.m.	F2	2	\$250,000	\$0	2.3	500
4/22/1970	9:30 p.m.	F2	0	\$250,000	\$0	4.3	500
7/12/1973	7:30 a.m.	F1	0	\$25,000	\$0	0	100
6/8/1985	8:00 p.m.	F2	0	\$2,500,000	\$0	5	150
8/23/1998	5:30 p.m.	F3	2	\$4,740,000	\$1,770,000	5.1	1,300
7/13/2000	2:55 p.m.	F0	0	\$0	\$0	0.1	50

Source: National Oceanic Atmospheric Administration, Storm Events - National Centers for Environmental Data, June, 2015.

Relative to the rest of the state, Door County is a low density (number of tornados per square mile) area for tornados, averaging 0.12 tornados per year between 1950 and 2015, compared to 21.6 tornados per year statewide for the same time frame.

Lightning

Lightning, typically a byproduct of a thunderstorm, is a sudden and violent discharge of electricity that occurs between clouds, from clouds to ground, or, if there are high structures involved, ground to clouds. The action of rising and descending air in a thunderstorm separates positive and negative charges, with lightning the result of the buildup and discharge of energy between positive and negative charge areas. Water and ice particles may also affect the distribution of the electrical charge. In only a few millionths of a second, the air near a lightning strike heats to 50,000°F, a temperature hotter than the surface of the sun. The rapid heating and cooling of air near the lightning causes a shock wave that results in thunder.

Warning signs for possible cloud-to-ground lightning strikes are high winds, rainfall, and a darkening sky. Many lightning casualties happen at the beginning of an approaching storm, however, more than half of lightning deaths occur after a thunderstorm has passed. While the threat of lightning significantly diminishes after the last sound of thunder, it may still occur up to 30 minutes later. The threat of lightning exists even when thunderstorms are in the area, but the sky is clear overhead; lightning has been known to strike more than ten miles from a storm.

A “lightning” event may be recorded in the Storm Events database when a sudden electrical discharge from a thunderstorm results in a fatality, injury, and/or damage. Between 1997 and 2011, six lightning events were recorded for Door County, including one injury and \$444,700 in property damage.

Winter Events

A variety of weather phenomena and conditions can occur during winter storms. The following are National Weather Service-approved descriptions of winter storm elements:

- Heavy snowfall. Accumulation of six or more inches of snow in a twelve-hour period or eight or more inches in a 24-hour period.
- Blizzard. Sustained wind speeds or frequent wind gusts of at least 35 mph accompanied by heavy snowfall or large amounts of blowing or drifting snow.
- Ice storm. Rain freezing upon contact with the ground and/or exposed objects near the ground; at least ¼ inch of ice must accumulate within twelve hours.

- Freezing drizzle/freezing rain. Drizzle or rain freezes upon impact on objects with a temperature of 32°F or below.
- Sleet. Solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes; does not cling to surfaces.

Generally, the winter storm season in Wisconsin runs from October through March. According to the state's hazard mitigation plan, Wisconsin's harsh winter temperatures have become slightly milder over the past couple of decades, while the number of severe winter storms are increasing. This may be partially related to better documentation generated by the National Weather Service, but also may be related to the fact that warmer air can hold more moisture, which ultimately can fall as snow.

Much of the snowfall in Wisconsin occurs in small amounts of one to three inches per occurrence. Total snowfall per season averages between approximately 30 inches in the extreme south-central area of the state to 120 to 160 inches in the Lake Superior snowbelt (Ashland and Iron Counties). Additionally, counties closer to Lake Michigan have had a higher number of blizzard events, due in part to the strong winds off of the lake.

According to the state's hazard mitigation plan, between 1982 and 2010, Door County had 98 winter weather events, averaging 3.4 events per year, including ice storms, blizzards, winter storms, or lake effect events. Door County's average seasonal snowfall between 1971 and 2000 was between 40 and 50 inches. In December of 2000, record or near-record snow depths of 15 to 34 inches occurred in much of the southern part of Wisconsin and counties along Lake Michigan. Fourteen counties, including Door County, received a Presidential Emergency Declaration as a result. In total, these counties received \$5,483,097 in federal funds to cover costs associated with snow removal and emergency response efforts.

NCEI criteria for its six categories of severe winter weather are listed below. Listed within each category are the number of events that occurred in Door County and the first and last years of the event's occurrence.

- Winter Storm. A winter weather event which has more than one significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet, and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements, on a widespread or localized basis. Normally, a winter storm would pose a threat to life or property. For Door County, 34 winter storm events were recorded between 1996 and 2014, an average of 1.8 events per year.
- Heavy Snow. Snow accumulation meeting or exceeding locally/regionally defined 12 and/or 24 hour warning criteria, on a widespread or localized basis. This could mean such values as 4, 6, or 8 inches or more in 12 hours or less; or 6, 8, or 10 inches in 24 hours or less. In some heavy snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event. For Door County, 25 heavy snow events were recorded between 1996 and 2014, averaging 0.8 events per year.
- Blizzard. A winter storm which produces the following conditions for 3 hours or longer on a widespread or localized basis: (1) sustained winds or frequent gusts 35 mph or greater and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile, on a widespread or localized basis. For Door County, six blizzard events were recorded between 1996 and 2010, averaging 0.4 events per year.
- Winter Weather. A winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation but does not meet locally/regionally defined warning criteria. A winter weather event could result from one or more winter precipitation types (snow, or blowing/drifting snow, or freezing rain/drizzle), on a widespread or localized basis. For Door County, four winter weather events were recorded between 1996 and 1997, averaging 2.0 events per year.

- Ice Storm. Ice accretion meeting or exceeding locally/regionally defined warning criteria (typical value is ¼ or ½ inch or more), on a widespread or localized basis. For Door County, one ice storm event was recorded in 1996. (Note that the state's hazard mitigation plan reports three ice storms having occurred in Door County between 1982 and 2010.)

Probability of Occurrence, Impacts, Vulnerability, and Economic Costs

When a thunderstorm became severe in Wisconsin during the period between 1982 and 2010, it was in the following form:

- damaging high wind 58% of the time,
- large hail 30% of the time,
- tornados 7% of the time, and
- flash floods from heavy rain 5% of the time.

Wisconsin experiences from two to five severe thunderstorm wind events per year, on average. Door County is on the low end of this range, averaging between two and three severe thunderstorm wind events per year.

Lightning occurs with most severe thunderstorms, but does not always produce damages. The probability of lightning itself occurring is quite high, due to the high number of severe thunderstorms in the state; however, the site-specific incidence of lightning is considered low because of the localized nature of the hazard.

The state's hazard mitigation plan estimates the annual probability of a tornado and associated dollar value of damage for all counties in Wisconsin. For Door County, the average loss per tornado is over \$1,002,250 million, based on eight tornados occurring in the county between 1950 and 2010 with associated damages of \$8,018,000 million. The state bases the probability of a tornado happening in the future on past occurrences, thus, the probability of a tornado occurring in Door County in any given year is 0.13115 (8 tornados/61 years). Future tornado dollar damage is projected to be at \$131,443 (0.13115 * \$1,002,250) per year. Compared to other counties, Door County is a low-risk area for tornados; Dodge County has the highest probability at 0.93 tornados, followed by Dane County at 0.91 tornados.

Compared to the rest of the state, Door County has a lower probability of heavy snowfall, since heavy snowfalls are more likely to occur in northern Wisconsin in counties along Lake Superior. However, blizzards are more likely to occur in the eastern counties along Lake Michigan, including Door County. Door and Manitowoc Counties have the highest historical occurrences of blizzards at 6 blizzard events between 1982 and 2010. Comparing all winter weather events, Door County is in the middle of the range of occurrences, with 98 total events occurring between 1982 and 2010, compared to 60 total occurrences on the low end and 120 or more total occurrences on the high end, for the same time frame.

All municipalities in Door County are equally vulnerable to storm and/or wind events. Northern Door, however, with approximately 56% of all the housing units in the county and only one transmission line serving the area is more vulnerable to power outages. The impacts of power outages include lost economic activity due to businesses not being able to operate properly and injuries occurring during the clean-up of debris.

HAZARDOUS TEMPERATURES

The NCEI Storm Events database categories included in this section are extreme summer heat and extreme cold/wind chill. The Planning Team risk assessment categories and rankings are:

- extreme cold: 4
- extreme heat: 4

Description, Location, Historical Occurrences

Extreme Summer Heat

According to the National Weather Service, “extreme summer heat” is the combination of very high temperatures and exceptionally humid conditions. If such conditions persist for an extended period of time, it is called a heat wave. When possible, the National Weather Service warns people and agencies that extreme heat conditions are forecasted:

- **Excessive Heat Outlook.** A warning is issued when conditions for an excessive heat event may occur in the next three to seven days; provides information to those who need to plan for heat (i.e. emergency management, public health officials, utility companies).
- **Excessive Heat Watch.** A warning is issued when conditions for an excessive heat event are expected to occur in the next twelve to 48 hours.
- **Excessive Heat Warning/Advisory.** A warning is issued when an excessive heat event is expected to occur in the next 36 hours.

The National Weather Service issues an outlook, watch, or warning/advisory when the heat index (or how hot it really feels) is expected to exceed 105° F to 110° F for two consecutive days. At a heat index of 105° F or higher, the heat is extreme enough to cause disorders associated with exposure to heat and/or physical activity. Heat index is a function of the actual temperature and the relative humidity. Table 2.5 below shows the danger categories and heat disorders with their corresponding heat index values. Note that caution should be taken when the heat index value approaches 90° F.

Table 2.5: Heat Index and Disorders

Danger Category	Heat Disorder	Heat Index Value (how hot it feels)
Extreme Danger	Heatstroke or sunstroke imminent	>130°F
Danger	Sunstroke, heat cramps, or heat exhaustion <i>likely</i> ; heat stroke possible with prolonged exposure and physical activity.	105°F - 130°F
Extreme Caution	Sunstroke, heat cramps, and heat exhaustion <i>possible</i> ; heat stroke possible with prolonged exposure and physical activity.	90°F - 105°F
Caution	Fatigue possible with prolonged exposure and physical activity.	89°F - 90°F

Source: NOAA National Weather Service, 2008.

Extreme heat is the number one weather killer nationwide, killing 162 people annually, according to the ten-year average from 2000-2009 from the National Weather Service. There are different stages of heat disorders associated with exposure to heat:

- **Heatstroke.** An often fatal medical emergency occurring when the body’s responses to heat stress are insufficient to prevent a substantial rise in the body’s core temperature, typically exceeding 105°F; even with rapid cooling and treatment, the average fatality rate is 15%.
- **Heat Exhaustion.** A less serious medical condition characterized by dizziness, weakness, or fatigue; body temperatures may be normal or slightly-to-moderately elevated; with fluid treatment, prognosis is typically good.
- **Heat Syncope.** A sudden loss of consciousness, typically associated with people exercising who are not acclimated to warm temperatures; causes little or no harm to the individual.
- **Heat Cramps.** May occur in people unaccustomed to exercising in the heat.

In addition to affecting people, extreme heat puts significant stress on plants and animals. Extreme heat may reduce crop yields or contribute to crop loss. Similarly, livestock may become overheated, leading to reduced milk production and other problems.

NCEI describes “excessive heat” as a combination of high temperatures (well above normal) and high humidity. An excessive heat event occurs whenever heat index values meet or exceed locally/regionally established excessive heat warning thresholds, on a widespread or localized basis. Fatalities (directly-related) or major impacts to human health occurring during excessive heat warning conditions are reported using this event category. One excessive heat event was recorded in the Storm Events database for Door County in 2000. Note that the state’s hazard mitigation plan reports that Door County experienced 25 heat wave days and nine heat wave events between 1982 and 2010. A heat wave event is a period of abnormally and uncomfortably hot and unusually humid weather, typically lasting two or more days.

Extreme Cold/Wind Chill

The combination of extremely cold temperatures and strong winds can result in wind chills that cause bodily injury such as frostbite and death due to exposure (hypothermia). Wind chill is an apparent temperature describing the combined effect of wind and low air temperatures on exposed skin; measurement is based on the rate of heat loss from exposed skin. A temperature of 0°F combined with a 15 mph wind results in a wind chill temperature of -19°F. At this wind chill temperature, exposed skin can freeze in 30 minutes. In general, the National Weather Service regional offices issue Wind Chill Advisories for Wisconsin when wind chill values are expected to drop to -20 to -34°F with winds 10 mph or higher. Similarly, the National Weather Service issues Wind Chill Warnings when wind chill values are expected to drop to -35°F or lower with winds 10 mph or higher.

NCEI describes “extreme cold/wind chill” as a period of extremely low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined warning criteria (typical value around -35°F or colder), on a widespread or localized basis. For Door County, four events were recorded in the Storm Events database, with two events occurring in the winter of 2008 and two events occurring in the winter of 2014.

NCEI describes “cold/wind chill” as a period of low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined advisory (typical value is -18°F or colder) conditions, on a widespread or localized basis. A combination of seasonably cold temperatures and low wind chill values (roughly 15°F below normal) is counted as a cold/wind chill event when it is the primary cause of death, as determined by a medical examiner. For Door County, three cold/wind chill events were recorded, with two events occurring in the winter of 1996 and one event occurring in the winter of 2006.

Probability of Occurrence, Impacts, Vulnerability, and Economic Costs

According to the state hazard mitigation plan, the probability of exceeding 89°F is high (“caution” category in Table 2.5), but temperatures are not the only determinant of effects that also include humidity, duration, and timing of the extreme temperature event.

All municipalities in Door County are equally vulnerable to extreme temperatures. Extreme temperatures tend to have the greatest impact on the elderly. Door County has a much larger percentage of adults aged 65 and over at 22.5% compared to 13.7% for the state. However, according the Wisconsin Environmental Public Health Tracking System, a lower rate of people visit the emergency room due to heat-related stress at 11.3 people per 100,000 in 2013 compared to 16.5 for the state for the same year.

HAZARDOUS RAIN EVENTS

The NCEI Storm Events database categories included in this section are heavy rain, flooding, and flash flooding. Note that there is no stormwater flooding category in the database. The Planning Team risk assessment categories and rankings are:

- flash, riverine, & lake flooding: 3
- stormwater flooding: 3

Description, Location, Historical Occurrences

Note: unless otherwise noted, the information on flooding below is copied from the state's hazard mitigation plan, with some minor editing.

Flooding, as defined by the National Flood Insurance Program, is “a general and temporary condition where two or more acres of normally dry land or two or more properties are inundated by water or mudflow.” Floods specifically affect floodplains, the lowlands adjacent to water bodies. Floods are natural events that are considered hazards only when people and/or property are affected. Nationwide, hundreds of flood hazard events occur each year, making it one of the most common hazards in all 50 states and U.S. territories.

There are a number of categories of floods in the U.S, however, the most common type of flooding event is riverine flooding, also known as overbank flooding. In Wisconsin, riverine floodplains range from narrow, confined channels in the steep valleys of hilly regions, to wide, flat areas in plains and coastal regions. The amount of water in the floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, geological characteristics, and land use attributes.

Much of Wisconsin's flooding on larger rivers occurs more than six hours after a causative event such as heavy rain, or rain combined with snowmelt. This kind of flooding can ultimately affect not only larger rivers, but also small streams and low areas outside of the floodplains of larger rivers. The cause of flooding in large rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the rivers and/or reservoirs in numerous smaller basins that drain into larger rivers. Localized weather systems, such as thunderstorms, may cause intense rainfall over smaller areas, leading to flooding in smaller rivers and streams. These events may also lead to flooding in larger waterways, as smaller rivers and streams feed into these larger systems. Annual spring floods, due to the melting of snowpack, may affect both large and small rivers and areas.

Wisconsin is prone to experiencing flash floods, ice jam floods, local drainage floods, and high groundwater floods. The most notable of these are flash floods because they occur the quickest, with little or no warning, and tend to be accompanied by other problems. Flash floods occur within six hours of a causative event such as heavy rains, ice jams, or dam failures. They usually involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage including the tearing out of trees, undermining of buildings and bridges, scouring of new channels, and creation of sink holes. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain. Flash flooding on larger rivers can transition to general river flooding that persists for days.

Though Wisconsin was not as severely affected as other states in the Midwest, the 1993 floods were one of the state's most significant disasters in terms of both damages and funds received through disaster relief programs. The total amount of disaster relief funds received by the state from all declarations prior to 1993 was \$352 million. Approximately \$300 million in disaster relief was received by the state for the 1993 Presidential Disaster Declaration alone.

While most flood events are not declared a Presidential Disaster, many get classified as a major flood event. Major flooding, as defined by the National Weather Service, involves extensive inundation of

structures and roads and significant evacuations of people and/or transfer of property to higher elevations. A Flood Warning is issued if major flooding is expected during the event. Examples of conditions that would be considered major flooding include:

- many buildings flooded, some with substantial damage or destruction
- infrastructure destroyed or rendered useless for an extended period of time
- multiple homes are flooded or moved off foundations
- everyone in threatened area is asked to evacuate
- National Guard units assist in evacuation efforts
- erosion problems are extreme
- airstrip, fuel tanks, and the generator station are likely flooded
- loss of transportation access, communication, power and/or fuel spills are likely
- fuel tanks may float and spill and possibly float downstream
- ice chunks floating through town that could cause structural damage
- high damage estimates and high degree of danger to residents

A major flood event in 1973 affected 35 counties in the state, including Door County. Estimated damages for Door County was \$24 million. Also, according to the state's hazard mitigation plan, eight flood events (non-major) occurred in Door County between 1982 and 2010.

NCEI describes a "heavy rain" event as an unusually large amount of rain which does not cause a flash flood or flood, but causes damage, e.g., roof collapse or other human/economic impact. Heavy rain resulting in urban and/or small stream flooding is also classified as a heavy rain event. For Door County, one heavy rain event was recorded in 2006 and two heavy rain events were recorded in 2008. One indirect death is attributed to a heavy rain event in 2008.

NCEI describes a "flood" event as any high flow, overflow, or inundation by water which causes or threatens damage. In general, this would mean the inundation of a normally dry area caused by an increased water level in an established watercourse, or ponding of water, generally occurring more than six hours after the causative event, and posing a threat to life or property. This can be on a widespread or localized basis.

NCEI describes a "flash flood" as a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam-related), on a widespread or localized basis. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters. Flash floods typically only exist for a day or two.

One flood event in 1996 and one flash flood event in 2014 (September 4th) were recorded in the Storm Events database for Door County. The flash flood occurred in the Village of Ephraim and was reported to cause \$75,000 in damages. The narrative recorded in the Storm Events database for this event is provided below:

"Thunderstorms developed in a moist and unstable air mass ahead of an approaching cold front. Clusters of storms with torrential rain caused flooding and flash flooding. Rainfall totals were mainly in the 1 to 3 inch range, with locally higher amounts. The heaviest rainfall was across northern Door County where more than 6 inches of rain fell in the Baileys Harbor area, flooding basements and campgrounds and washing out the shoulders of roads. The flooding caused damage to some documents at the Ephraim Historical Society. Isolated storms produced large hail and wind damage.

Heavy rainfall flooded basements, resorts, and campgrounds, and damaged roads in the Sister Bay, Fish Creek, and Baileys Harbor areas. In excess of 6 inches of rain in Baileys Harbor caused nearly every home there to sustain a backup from the sewage disposal plant. Flood waters damaged documents at the Ephraim Historical Society. The flooding also washed out shoulders of several roads in the area."

The flash flood event that was recorded for the Village of Ephraim could also be described as surface water runoff flooding. A description of surface water runoff flooding from FEMA and anecdotal impacts of the September 4th, 2014 flooding event are described below.

Surface Water Runoff Flooding

Note: The surface water runoff flooding description provided below is a slightly modified excerpt from a FEMA document on types of flood and floodplains.

When rainfall reaches the Earth's surface, it will either evaporate, infiltrate into the soil, or run over the surface (surface water runoff). The type of ground cover greatly influences the proportions of these events. Surface water runoff occurs when the rainfall intensity exceeds the evaporation rate and infiltration capacity of the soil. It also occurs when rainfall falls on impervious surfaces, such as buildings, roadways, and other paved areas. Water that flows along the surface may become trapped in depressions where it will either evaporate back into the air, infiltrate into the ground, or spill out of the depression as it fills. If local drainage conditions are inadequate to accommodate rainfall through a combination of evaporation, infiltration into the ground, and surface runoff, accumulation of water in certain areas may cause localized flooding problems.

Flooding problems resulting from runoff of surface water generally increase as areas become more urbanized. Greater population density generally increases the amount of impervious areas and reducing the amount of pervious areas that can absorb rainfall. Reduction in the amount of natural ground that can absorb rainfall results in an increase in the amount of surface runoff generated. Uncontrolled, this runoff may be channeled to areas that cause flooding of structures and roadways. This may be especially true where the predevelopment land surface had a gently sloping surface with no defined channels. Such areas are subject to shallow sheet flooding during storms, but urbanization and other development speeds up the accumulation of floodwater.

According to local reporting of the September 4, 2014 flooding event, parts of the county received seven to eight inches of rain within 24 hours, causing mostly surface runoff flooding and some sewer backup flooding. At least some of the sewer backup flooding was due to the fact that the power was out for approximately 12 hours. Both types of flooding primarily affected basements, where the large majority of the damage occurred. Door County Emergency Management Services received claims from 61 residents and businesses located in the Villages of Ephraim, Egg Harbor, and Sister Bay and the Towns of Baileys Harbor, Gibraltar, and Liberty Grove. Damages claimed ranged in value from a few thousand to a couple hundred thousand dollars.

Probability of Occurrence, Impacts, Vulnerability, and Economic Costs

Historical records are used to determine the probability of occurrence for different extents of flooding, expressed in percentages. The percentage describes the chance that the level of flood water will exceed a certain height, on average in any given year. The most widely adopted design and regulatory standard for floods in the United States is the one-percent annual chance flood (base flood or 100-year flood), which has a one-percent chance of occurring in any particular year. This measure is a simple and general way to express the statistical likelihood of a flood; actual recurrence periods vary from place to place.

Smaller floods occur more often than larger, deeper, and more widespread floods. Thus, a "10- year" flood has a greater likelihood of occurring than a "100- year" flood. Table 2.6 below shows a range of flood recurrence intervals and their probabilities of occurrence.

Table 2.6: Flood Recurrence Intervals

Occurrence	Annual Percent Chance of
10-year	10.0%
50-year	2.0%
100-year	1.0%
500-year	0.2%

Source: *Federal Emergency Management Administration*

It is important to note that risk of a flood event occurring changes over time. Since natural hazards, like floods, do not affect a particular location every single year, the focus is on the overall probability of the event occurring over a selected time horizon. Assuming that most hazard events are independent outcomes, the probability of a 100-year flood occurring at any given time is 1/100 or 0.01. However, the probability of a 100-year flood occurring at least once over the next 100 years is $1-(0.99)^{100}=0.634$.

The state's hazard mitigation plan includes results from a flood risk assessment conducted using Hazard USA (HAZUS), a FEMA-developed software tool used to estimate damages from wind, floods, and earthquakes, among other natural disasters. Loss estimates produced by HAZUS are based on current scientific and engineering knowledge of the effects of hurricane winds, floods, and earthquakes. HAZUS takes into account various impacts of a hazard event, including the following:

- physical damage to residential and commercial buildings, schools, critical facilities, and infrastructure
- economic loss, including lost jobs, business interruptions, and repair and reconstruction costs
- social impacts and impacts to people, including requirements for shelters and medical aid

HAZUS uses Geographic Information System software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. HAZUS provides for three levels of analysis, with the basic level using a nationwide database to provide rough estimates. The assessment conducted by the Wisconsin Emergency Management Division was done at the basic level, with the addition of Digital Flood Information Rate Maps where available. The state also included essential facilities data, including schools, hospitals, fire stations, Emergency Operation Centers, and police stations. Lastly, U.S. Census housing data was used to estimate construction dates.

The HAZUS default inventory data includes the following:

- general building stock
- essential facilities
- demographic information
- transportation lifeline systems
- utility lifeline systems
- high potential loss facilities
- hazardous materials facilities

The HAZUS model delineates a stream network for every square mile within a county and then performs an area weighted assessment of flood damage. The number of grid cells at a given depth is counted and then divided by the total number of cells within a census block. The result is used to "weight" damage at that flood depth for each building occupancy class. Buildings are considered a total loss once the 50% damage threshold is reached. The software analyzes building stock by occupancy and type to estimate:

- building losses
- full replacement value and depreciated replacement value
- shelter requirements
- building, content, and inventory losses

Essential facilities are not weighted, but evaluated for losses at their specific location. This evaluation is based on building and content losses, restoration time to 100% functionality, lifeline losses (for selected components), and losses to structures and equipment.

The HAZUS flood risk assessment results for Door County are listed below:

- Total damaged buildings: 305
- Total economic loss: \$58,146,000
- Building loss: \$30,818,000
- Short term shelter (population in need of): 354
- Moderately damaged essential facility buildings: 1 fire building

Map 2.1, Floodplains, illustrates Door County areas mapped by FEMA as being potentially located in the 100-year floodplain. Table 2.7 below shows the number of buildings located within the floodplain, total improved value, and average improved value for each municipality and the Northern and Southern Door unincorporated areas. Table 2.7 also lists if a municipality is participating in the National Flood Insurance Program (NFIP) and the number of repetitive loss structures. The City is the only municipality with a repetitive loss structure and the Village of Sister Bay is the only municipality not participating in the NFIP program.

Table 2.7: Number and Value of Buildings in the Floodplain

Municipality	# of Buildings in Floodplain	Improved Value	Ave Improved Value	NFIP Participation	# Repetitive Loss Structures
Northern Door (uninc. areas)	961	\$187,926,900	\$195,553	Yes	0
Southern Door (uninc. Areas)	855	\$95,788,300	\$112,033	Yes	0
City	257	\$60,097,200	\$233,841	Yes	1
Village of Egg Harbor	39	\$9,940,300	\$254,879	Yes	0
Village of Ephraim	59	\$17,187,100	\$291,307	Yes	0
Village of Forestville	0	\$0	\$0	Yes	0
Village of Sister Bay	17	\$7,039,000	\$414,059	No	0

Source: Door County Real Property, August 2015.

HAIL

Hail is only the only NCEI Storm Events database category included in this section. The Planning Team risk assessment ranking for hail is 2.

Description, Location, Historical Occurrences

Hail can develop within thunderstorms when strong currents of rising air, known as updrafts, carry water droplets high within the storm, exposing these droplets to cold air and freezing them. As the frozen droplets begin to fall toward the ground, rising currents within the storm lift them again. The hailstones gain an ice layer and grow increasingly larger with each ascent. Eventually the hailstones become too heavy for the updraft to support, and they fall to the ground.

Although hail typically accompanies severe thunderstorms, all strong thunderstorms have the potential to produce hailstones of small diameter (less than 0.75 inches). The size of hailstones varies and is a direct consequence of the severity and size of the thunderstorm; greater instability in the atmosphere causes stronger updrafts. Stronger updrafts can keep hailstones suspended for longer periods of time, resulting in larger hailstones at ground level. Severe hail is considered 0.75 inches in diameter (the size of a penny) or greater. Hailstorms can occur throughout the year, however, most hail events occur between April and October.

Hail can cause extensive crop and property damage, particularly during the months May through September when approximately 85% of hailstorms occur. This timeframe coincides with the growing and harvesting seasons for many of Wisconsin's crops, causing economic losses and damages for the agriculture industry.

NCEI describes hail as frozen precipitation in the form of balls or irregular lumps of ice. Hail that is 0.75 inches or larger may be recorded as an event; hail that is smaller in size which causes property and/or

crop damage, or casualties, may also be recorded as a hail event. Between 1963 and 2014, 66 hail events were recorded for Door County, with one event in 2014 causing \$3.5 million in crop damage. The largest hail size recorded for the county was in 1998 at 2.75" in diameter.

Probability of Occurrence, Impacts, Vulnerability, and Economic Costs

According to the state's hazard mitigation plan, the average land area affected by an individual hail event is about 225 square miles or a diameter of 17 miles surrounding the center of the storm. Hail risk at a single point or over an area is a function of the target at risk (property or crop) and the hail frequency and intensity. The annual probability of hail occurring somewhere in the state is quite high. However, the site-specific incidence of hail is lower, due to the localized nature of the hazard.

All municipalities in Door County are equally vulnerable to hail, however, the impact is greatest in the unincorporated areas due to large areas of agricultural use. Table 2.8 below shows agriculturally assessed land area and value for the Northern and Southern Door areas. Although Southern Door has approximately one-third more agricultural land, its per acre average is \$8 less than Northern Door's per acre average. Assuming the proportion of crops to livestock is the same in both Northern and Southern Door, a hail event in Northern Door is likely to cause slightly greater crop damage due to its higher per acre average value.

Table 2.8: Agriculturally Assessed Land Area and Value

Area	Agricultural		Per Acre Average
	\$	Acres	
Northern Door	\$7,413,900	42,424	\$175
Southern Door	\$10,532,200	62,945	\$167
Door County	\$17,999,300	105,717	\$170

Source: Door County Real Property Listing, May 2013.

DROUGHT

Drought is the only NCEI Storm Events database category included in this section. The Planning Team risk assessment ranking for drought is 2.

Description, Location, Historical Occurrences

Due to its multi-dimensional nature, drought is a complex and difficult hazard to define in exact terms, partly because of the ways it differs from other natural hazards:

- The onset and end of a drought are difficult to determine due to slow accumulation and lingering effects after its apparent end.
- The lack of an exact and universally accepted definition adds to the confusion of existence and severity.
- The impact of drought is less obvious and may be spread over a larger geographic area.

Drought is the result of a natural decline in expected precipitation over an extended period of time, and occurs in virtually every climate on the planet, including areas of high and low precipitation. A drought's severity depends on its duration, intensity, geographic extent, and water supply demands for both human use and vegetation. The severity of a drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity. The following four definitions are commonly used to describe drought:

- Meteorological drought: degree of dryness, expressed as a departure of actual precipitation from expected average or normal amount, based on monthly, seasonal, or annual time scales

- Hydrological drought: effects of precipitation shortfalls on streamflows, reservoir, lake, and groundwater levels
- Agricultural drought: soil moisture deficiencies relative to water demands of crop life
- Socioeconomic drought (or water management drought): demand for water exceeds the water supply, resulting in a water shortage

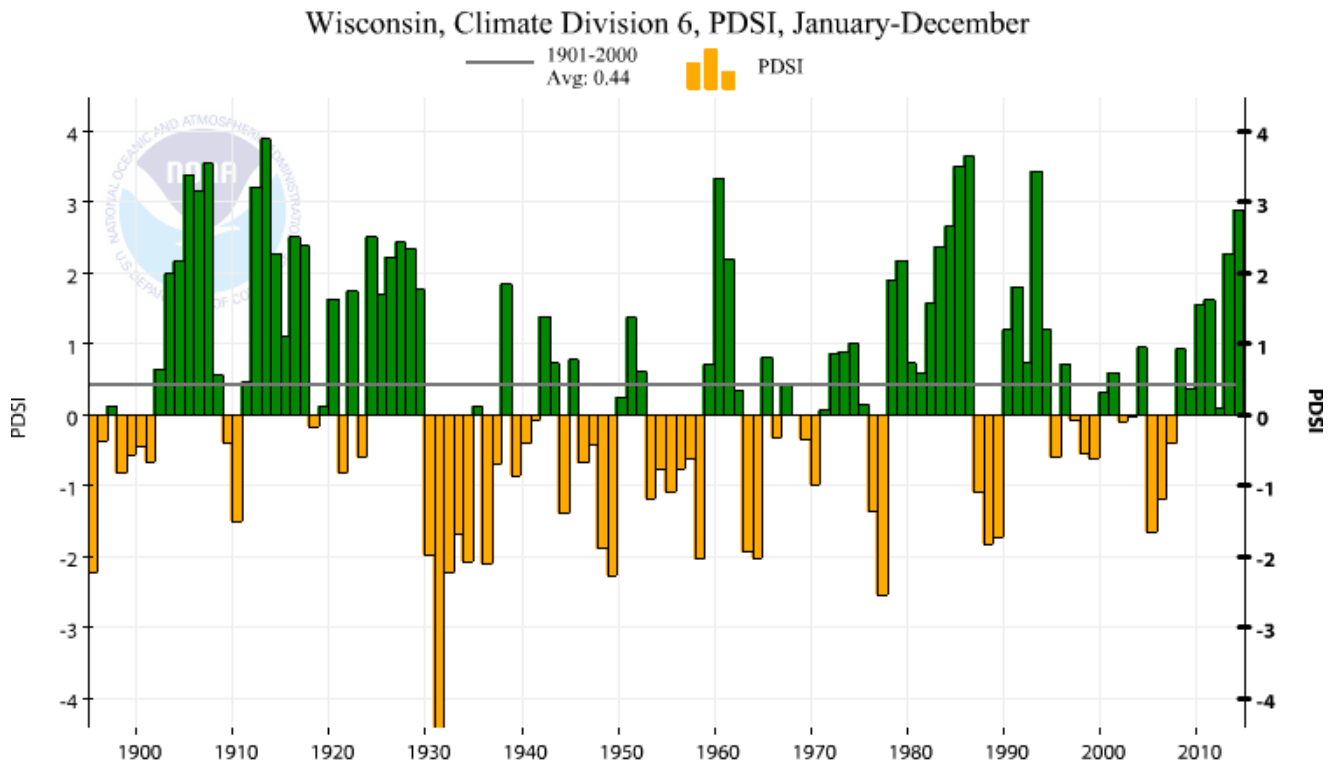
Wisconsin is most vulnerable to agricultural drought. The state has approximately 15.2 million acres of farmland on 78,000 farms and was ranked ninth in the country in overall farm receipts in 2010 (National Agricultural Statistics Service). Even small droughts of limited duration can significantly reduce crop growth and yields, adversely affecting farm incomes and local economies. Droughts also significantly increase the risk of forest fires and wildfires. Additionally, the loss of vegetation in the absence of sufficient water can result in flooding, even from average rainfall, following drought conditions.

During the 20th century, seven notable drought events occurred in Wisconsin, as described below. These droughts affected NOAA Climate Division 6, which includes Door County.

- **1929-1934:** The drought of 1929-1934 was probably the most significant in Wisconsin history, due to its duration and severity. In some parts of the state, the drought continued with somewhat decreased effect until the early 1940s.
- **1948-1950:** The 1948-1950 drought was most significant in the northern part of the state.
- **1955-1959:** This drought affected all areas of the state, but less so in the northwestern corner.
- **1976-1977:** During this drought, the federal government declared 64 Wisconsin counties as drought areas, deeming them eligible for assistance under the 1988 Disaster Relief Act. Federal assistance was used to help communities drill new wells to obtain new water supplies. State agricultural losses due to this drought were valued at \$624 million.
- **1987-1988:** Some believe the 1987-1988 drought to be the most severe ever experienced in Wisconsin and much of the Midwest. It was characterized by below normal precipitation, persistent dry air, and above normal temperatures. Its effects were most severe in north-central and northeastern Wisconsin. Crop losses statewide were between 30% and 60%, valued at \$1.3 billion. A combination of state and federal drought assistance programs helped Wisconsin farmers recover a portion of their losses.
- **2003:** In August 2003, drought conditions affected parts of south-central and southeast Wisconsin.
- **2007:** Between January and July of 2007, drought gradually affected most of Wisconsin, spreading from north to south. Summer temperatures averaged one to three degrees above normal, and eventually moderate to extreme drought covered 85% of the state. Only the southern tier counties had normal to abnormally dry conditions.

In addition to these seven droughts, a brief moderately severe drought occurred in Division 6 in 1963 and 1964. Figure 2.1 below shows the Palmer Drought Severity Index (PDSI) between 1895 and 2015 for Division 6. The PDSI, devised in 1965, was the first drought indicator to comprehensively assess moisture status. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. The PDSI primarily reflects long-term drought and has been used extensively to initiate drought relief. The index values are categorized as follows:

- -4.0 or less, extreme
- -3.0 to -3.9, severe
- -2.0 to -2.9, moderate
- -1.9 to +1.9, near normal
- +2.0 to +2.9, unusually moist
- +3.0 – +3.9, very moist

Figure 2.1: Palmer Drought Severity Index, Door County

Source: <http://www.ncdc.noaa.gov/cag/>.

Note that the NCEI Storm Events database shows only six drought events occurring between 1999 and 2007; one drought was reported in 1999, two in 2005, and three in 2007.

Probability of Occurrence, Impacts, Vulnerability, and Economic Costs

According to the state hazard mitigation plan, the future incidence of drought is highly unpredictable, and may also be localized, making it difficult to determine probability with any accuracy. NOAA is improving its methodology to accurately forecast drought conditions using a combination of current and historical precipitation, streamflow, ground water, and crop data to perform short-term and long-term forecasts.

All municipalities in Door County are equally vulnerable to drought, however, the impact is greatest in the unincorporated areas due to large areas of agricultural use. Table 2.8 shows agriculturally assessed land area and value for the Northern and Southern Door areas. A drought is likely to have the same impact on both areas since it would be widespread and the average value per acre is similar, with Southern Door at \$167 per acre and Northern Door at \$175 per acre.

HAZARDS NOT ASSESSED

Wildfire

Note that “wildfire” is a category within the NCEI Storm Events database, however, there are no recorded wildfire events for Door County.

Chapter 26.01(2) of the Wisconsin State Statutes defines forest fires as any “uncontrolled, wild, or running fires burning in forest, marsh, field, cutover, or other lands or involving farm, city, or village property and improvements incidental to the uncontrolled, wild, or running fires occurring on forest, marsh, field, cutover, or other lands.” Forest fires often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires in Wisconsin are primarily human-caused

through acts such as burning yard debris, arson, or campfires. They can also be caused by natural events such as lightning.

According to the Wisconsin Department of Natural Resources (DNR), an average of over 1,500 wildfire events occur annually in Wisconsin, causing thousands of dollars of damage to property and destroying natural resources. While most of the wildfire starts in Wisconsin are quickly contained and kept to less than ten acres in size, Wisconsin has experienced catastrophic fires throughout its history. The most disastrous fire in the state's history is the Peshtigo Fire, when more than 1.5 million acres of forest burned in northeastern Wisconsin, mainly in Oconto, Marinette, Shawano, Brown, Kewaunee, Door, and Manitowoc Counties. The fire killed an estimate 1,152 people, displaced an estimated 3,000 people, and left another 350 people missing. Although this event represents the greatest single loss of human life by fire in American history, the Great Chicago Fire, which occurred at the same time, received much more publicity than the Peshtigo fire.

NCEI describes a "wildfire" event as any wildland-urban interface fire or forest, grassland, or rangeland fire that causes one or more fatalities, one or more injuries, and/or property damage (including equipment damaged in fighting the fire). In general, forest fires smaller than 100 acres, grassland or rangeland fires smaller than 300 acres, and wildland use fires not actively managed as wildfires are not recorded. There are no recorded wildfire events for Door County in the NCEI Storm Event database.

Probability of Occurrence

In 2011, in cooperation with federal and tribal partners, the DNR finished a statewide wildfire assessment to identify communities-at-risk. The three factors used to assess potential wildfire damage are as follows:

- Hazard: the relative likelihood that an ignited wildfire will achieve sufficient intensity to threaten life or property based on land cover type, and historic fire regime (pattern, frequency, intensity).
- Wildland-Urban Interface (WUI): the relative vulnerability of each 2000 census block to wildfire damage based on housing density and spatial relationships with undeveloped vegetation in the area. Wisconsin's WUI was layered with a weighted vegetation layer to accentuate proximity to flammable vegetation.
- Ignition Risk: the relative likelihood of a wildfire ignition within a given area based on historic fire occurrence, population density, and proximity to a potential ignition source.

Each of Wisconsin's 1,864 towns, villages, and cities were defined as a "community" and assigned one of five threat levels: very low, low, moderate, high, and very high. Communities determined to have a high or very high threat of wildfire are considered at-risk. Statewide, 337 communities were determined to be at-risk, including the Town of Liberty Grove.

Coastal Erosion

Note that "coastal erosion" is not a category within the NCEI Storm Events database.

Coastal erosion is defined as the wearing away of land and the loss of or displacement of lands along coastlines, beaches, or dune material over a period of time as a result of natural coastal processes or human influences. Natural processes and human influences affecting coastal erosion are listed below.

Natural processes:

- lake level change
- currents
- tides
- waves and storm surges
- winds
- flooding
- orientation of shoreline

- sediment influx
- littoral processes
- ice floes
- overwash

Human influences:

- dredging
- jetty and groin construction
- hardening shorelines with seawalls
- revetments
- beach nourishment
- boat wakes
- construction of harbors
- construction of sediment-trapping dams in the river tributaries

Rates of bluff and dune erosion along the shores of the Great Lakes vary from no erosion to tens of feet per year due to annual variability in wave climate and lake levels. Times of high water or wave action accelerate the erosion process, with bluff erosion more likely to occur during major storm events as a result of increased wave action on the shoreline. The effects of wave-induced erosion are usually greater during periods of high water-levels. Other significant factors contributing to shoreline erosion involve the movement of beach sediments for navigational improvements and shoreline structures and some dredge-material disposal practices that deplete both tributary and shoreland sources of sediment.

The state's hazard mitigation plan describes all of Wisconsin's 15 coastal counties as experiencing bluff erosion, coastal flooding, fluctuating water levels, and damage to shoreline structures. Additionally, the Wisconsin Coastal Management Program's "Needs Assessment and Strategy, 2011-2015" describes the 185 miles of shoreline from southern-most Kenosha County to the Sturgeon Bay Canal as being the most vulnerable, as well as the northeastern part of Brown County. The report describes erosion along the remainder of the Lake Michigan shore (from the Sturgeon Bay Canal in Door County to Green Bay) as limited to smaller segments of bays and clay banks.

Probability of Occurrence

According to the Wisconsin Initiative on Climate Change Impacts report, the state's coastal regions will face unique challenges due to lower water levels, with Lake Michigan's average water level predicted to decrease by about a foot by the end of the century. Additionally, reduced ice cover due to warmer temperatures, combined with an increase in wind strength, will expose shorelines to larger waves for longer periods of time, resulting in shoreline erosion. Predicted immoderate rain events will make shorelines exceedingly vulnerable to erosion as the soil will retain moisture more of the time, making it unstable and inordinately prone to erosion. Shoreline erosion eventually leads to shoreline recession, the change in distance from a shoreline feature's original position to the eroded position, the most visible aspect of erosion. However, recession does not immediately follow erosion and can take years to occur. Shoreline damage can also occur with fluctuating water levels and excessive wave impact. As waves down-cut the lakebed during low-water times, shoreline erosion happens more quickly; then when water levels rise again, waves can reach further inland and lead to shoreline damage.

The state's hazard mitigation plan includes a risk assessment that estimates losses from coastal erosion. The assessment used HAZUS default data from the 2000 Census to determine the number and types of structures subject to low- and high-risk erosion. The erosion risk zones are based on distance in miles from coastal water, with the high-risk erosion zone defined as $\frac{1}{4}$ mile from coastal water and the low-risk erosion zone defined as $\frac{1}{4}$ to $\frac{1}{2}$ mile from coastal water. The replacement values of structures were estimated based on structure type and dimensions, with the replacement value assumed to be equal to the total loss of the structure.

Table 2.9 shows the HAZUS loss estimation for the high-risk and low-risk erosion zones. Door County has a total of 7,956 structures subject to high-risk erosion, valued at about \$254 million. Within the low-risk erosion zone, Door County has a total of 9,747 structures, valued at \$604,386,720. The state's hazard mitigation plan ranks both low- and high-risk erosion zones as "high" risk for potential losses in Door County.

Table 2.9: Coastal Erosion Zone Loss Estimation, Door County

Door County	Number of Structures				Loss Estimation			Risk
	Res.	Com.	Gov.	Total	Res.	Com.	Gov.	
High-Risk								
Erosion Zone	7,889	66	1	7,956	\$252,104,420	\$2,074,860	\$14,140	High
Low-Risk								
Erosion Zone	9,654	92	1	9,747	\$598,461,600	\$5,896,840	\$28,280	High

Source: State of Wisconsin Hazard Mitigation Plan, 2011.

Landslide and Land Subsidence

Note: Neither "landslide" nor "land subsidence" is a category within the NCEI Storm Events database.

Landslides, the downward and outward movement of slopes, refers to various kinds of events, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and earth flows. Landslides may include any combination of natural rock, soil, or artificial fill, and are classified by the type of movement and the type of material, as described below:

- Slides are downward displacements along one or more failure surfaces of soil or rock. The material may be a single intact mass or a number of pieces. The sliding may be rotational (turning about a point) or translational (movement roughly parallel to the failure surface). The most common type of slide is called a slump. A slump is a rotational slide occurring when a portion of a hillside moves downslope under the influence of gravity.
- Flows are a form of rapid mass movement by loose soils, rocks, and organic matter, together with air and water that form a rapidly downhill flowing slurry mixture. Flows are distinguished from slides by high water content and velocities that resemble those of viscous liquids.
- Lateral spreads are large movements of rock, fine-grained soils (i.e., quick clays), or granular soils, distributed laterally. Liquefaction may occur in loose, granular soils, and can occur spontaneously due to changes in pore-water pressure or due to earthquake vibrations.
- Falls and topples are masses of rocks or material that detach from a steep slope or cliff that free-fall, roll, or bounce. Movements typically are rapid to extremely rapid. Earthquakes commonly trigger rock falls.

Land subsidence occurs when subsurface supports (i.e., bedrock or soils) fail, causing a loss of surface elevation. This hazard is primarily caused by human activities in relation to mining and drainage of soils, but can also be caused by geologic conditions. In certain parts of the state, sinkholes are more likely to be caused by human activity, such as abandoned mines or storm sewers. In other areas, such as Door County, sinkholes are caused from Karst formations, prevalent in areas where carbonate rocks, such as limestone or dolomite, are present. As the limestone rock under the soil dissolves over time from rainfall or flowing groundwater, a hollow area may form underground into which surface soil can sink.

Probability of Occurrence

Landslide probability is highly site-specific, and cannot be accurately characterized on a statewide basis, except in the most general sense. Statewide analyses for karst potential have been performed by the US Geological Survey and the Wisconsin Geological and Natural History Survey. Most areas at greatest risk of shallow karst potential (less than five feet below surface) are found in the far western and southwestern

portions of the state, however, Door County makes up the majority of an outlying area. Deeper karst potential (five to 300 feet below ground surface) is found largely in the eastern portion of the state, along the Fox River and into southeastern Wisconsin. In Door County, deeper karst potential is found in the southeast and southwest parts of the county.

According to the state's hazard mitigation plan, areas of Door County have had "moderate" landslide incidences. These areas are shown along the coast in contiguous stretches in the Towns of Brussels and Union, the Towns of Sturgeon Bay and Clay Banks, and the Towns of Liberty Grove (west coast) and Gibraltar. Although these areas have been designated as "moderate incidence" areas, they have not been given a "susceptibility" designation. As such, these moderate incidence areas do not seem to pose any significant threat at this time.

Dam Failure

Note that "dam failure" is not a category within the NCEI Storm Events database.

A dam is a barrier, typically constructed of earth, rock, concrete, or mine tailings, used to store, control, or divert water. The water impounded behind a dam is referred to as the reservoir and its volume is measured in acre-feet, with one acre-foot being the volume of water that covers one acre of land to a depth of one foot.

A dam failure is the collapse, breach, or other failure of a dam that causes downstream flooding. Dam failures usually occur when the spillway capacity is inadequate and water overtops the dam or when internal erosion through the dam foundation occurs (also known as piping). If internal erosion or overtopping causes a full structural breach, a high-velocity, debris-laden wall of water is released and rushes downstream, damaging or destroying whatever is in its path. Dam failures may result due to one or more the following:

- prolonged periods of rainfall and flooding (the cause of most failures)
- inadequate spillway capacity which causes excess overtopping flows
- landslides into reservoirs
- high winds
- improper maintenance
- internal erosion erosions due to embankment or foundation leakage or piping
- improper design
- negligent operation
- failure of upstream dams
- earthquakes

For emergency planning purposes, dam failures are categorized as one of the following:

- **Rainy Day Failures.** Rainy day failures involve periods of excessive precipitation leading to unusually high runoff. This high runoff increases the reservoir level, and if not controlled, the overtopping of the dam or excessive water pressure can lead to dam failure. Normal storm events can also lead to rainy day failures if water outlets are plugged with debris or otherwise made inoperable.
- **Sunny Day Failures.** Sunny day failures occur due to poor dam maintenance, damage/obstruction of outlet systems, or vandalism. This is the worst type of failure and can be catastrophic because the breach is unexpected and there may be insufficient time to properly warn downstream residents.

The DNR has records on 23 dams located in Door County; most are private dams, classified as "small" dams, except for the one "large" dam located in the Town of Forestville, owned and operated by Door County. The reservoir associated with this dam is 72 acres in size and 7 feet deep.

Probability of Occurrence

The direct economic impact of a dam or levee failure includes, but is not limited to, the cost of repair of the dam or levee, the flood damage resulting from the failure, and loss of income due to displaced businesses or workers. Though there have been very few dam failures in Wisconsin resulting in major damages or loss of life, many existing dams are starting to need more frequent repairs. The DNR administers the Dam Safety program, authorized under Ch. 31, Wis. Stats., which regulates all dams and bridges affecting navigable waters in the state. DNR administrative code NR333 mandates that an Inspection, Operation, and Maintenance (IOM) Plan be approved by the DNR in accordance with the following situations:

- when a new dam is being designed and constructed
- within ten years of performing a hazard analysis on an existing dam
- when an existing dam is reconstructed
- after a dam failure analysis is approved by the DNR
- when a dam is referred to in an adopted floodplain zoning ordinance
- when the DNR issues a department directive ordering a dam safety inspection

Under NR 333, the DNR assigns hazard ratings to large dams in the state. Two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in one of three categories that identify the potential hazard to life and property:

- high hazard – failure of dam would probably result in loss of life
- significant hazard – failure of dam could result in appreciable property damage
- low hazard – failure would result in only minimal property damage and loss of life is unlikely

In 2012, the Town of Forestville dam was reassigned by the DNR from “significant hazard” to “low hazard” per a substantiated formal request made by the Door County Airport and Parks Department.

Climate Change

Note that “climate change” is not a category within the NCEI Storm Events database.

NOAA defines climate change as a non-random change in climate that is measured over several decades or longer. The change may be due to natural or human-induced causes. The Wisconsin Initiative on Climate Change Impacts (WICCI) has been researching effects of climate change specific to Wisconsin. WICCI is a partnership between the University of Wisconsin, DNR, and other state agencies and institutions. The group was formed in 2007 as a response to a bi-partisan state legislative committee wanting to better understand the potential effects of climate change within the state.

In its preliminary work, WICCI found that Wisconsin’s climate has changed in a pattern that is consistent with well-documented global trends. The WICCI analysis was based on daily weather data recorded between 1950 and 2006 at 176 weather stations from throughout the state. The key findings from this analysis are as follows:

- There was a statewide increase in annual average temperature of 1.1°F, with peak warming in the northwest portion of Wisconsin.
- The observed average temperature increase in the state has been highest for winter; statewide winter temperatures have increased 2.5°F since 1950, with 3.5°F to 4.5°F increases in the northwest portion of the state.
- Wisconsin experiences fewer nights below 0°F than in 1950. Specifically, most of the state experiences between two and six fewer nights, while the extreme northwestern portion of the state experiences between 18 and 24 fewer nights below 0°F.
- Statewide, the average growing season lasts 12 days longer than it did in 1950. In other words, the “spring thaw” comes sooner, and the “fall freeze” comes later.
- Wisconsin has experienced a 10% increase in average annual precipitation over the 56-year period from 1950 to 2006. This is an annual average of about three more inches of precipitation than in

the 1950s. Noteworthy is the additional precipitation, as much as seven inches, in areas with high population density, such as near Madison (Dane County), Milwaukee (Milwaukee County), Eau Claire (Eau Claire County), and Hudson (Saint Croix County).

According to the state hazard mitigation plan, Door County experienced the following temperature changes between 1950 and 2006:

- 1.0 – 1.5 degree increase in average temperature;
- 1.0 – 1.5 degree increase in average winter temperature; and
- 1.5 – 3.5 inch increase in average annual precipitation.

Probability of Occurrence

Historical temperature and precipitation data for Wisconsin have shown that the state has become warmer and wetter since 1950. According to WICCI, between 1950 and 2006, Wisconsin's average annual temperature rose by 1.1 degrees Fahrenheit and average annual precipitation has increased by 3.1 inches. Circulation models predict that this warming trend will continue and increase, with future precipitation also likely to increase. More precipitation is likely to occur in the form of rain and freezing rain during the winter, as well as increasing in both frequency and intensity during the spring and fall. By 2050, temperatures for the state are predicted to warm between 6° and 7° Fahrenheit.

The combination of warmer temperatures, more precipitation, and more intense precipitation will have a critical impact on the quantity and quality of the state's water resources, natural habitats, agriculture, and the social and built environment. The state's coastal regions will face unique challenges in the form of shoreline erosion and recession and threats to coastal wetlands due to lower water levels, with Lake Michigan's average water level predicted to decrease by about a foot by the end of the century.

According to the state's hazard mitigation plan, the future is uncertain with regard to climate change, with varying models predicting a range of outcomes. It is unknown how much the climate will change and at what speed it will change. As further research is performed, better models to predict the effects of climate change will become available.

Dense Fog

NCEI describes a "dense fog" event as water droplets suspended in the air at the Earth's surface, over a widespread or localized area, reducing visibility to values equal to or below locally/regionally established values for dense fog (usually ¼ mile or less) and impacting transportation or commerce. A dense fog event is also reported anytime an accident or injury occurs due to fog. Between 1996 and 2000, ten dense fog events were recorded for Door County, with six of those events recorded in 1996.

Funnel Clouds and Waterspouts

NCEI describes a "funnel cloud" as a rotating, visible, extension of a cloud pendant from a convective cloud with circulation not reaching the ground. It includes cold-air funnels which typically form in a shallow, cool air mass behind a cold front. The funnel cloud should be large, noteworthy, or create strong public interest to be reported. Between 1999 and 2009, four funnel clouds were recorded for Door County.

NCEI describes a "waterspout" event as a rotating column of air, pendant from a convective cloud, with its circulation extending from cloud base to the water surface of an area assigned as a Marine Forecast Zone, including the Great Lakes. A condensation funnel may or may not be visible in the vortex. Between 1998 and 2001, six waterspouts were recorded for Door County.

NON-NATURAL HAZARD PROFILES

The non-natural hazards described in this section are as follows:

- communicable diseases
- private water supply contamination
- hazardous materials – roadway
- hazardous materials – waterway
- loss of electrical system
- transportation – roadway accidents
- structural fire
- loss of sewer system
- nuclear power plant

The data provided below regarding communicable diseases comes from the Center for Disease Control and Prevention. The roadway accident information comes from the Wisconsin Department of Transportation. The private water supply contamination, hazardous materials on roadways, and hazardous materials on waterways come from the DNR's Remediation and Redevelopment Program, which oversees the investigation and cleanup of environmental contamination and the redevelopment of contaminated properties. The Bureau for Remediation and Redevelopment Tracking System (BRRTS) is the DNR's on-line database that provides information about contaminated properties and other activities related to the investigation and cleanup of contaminated soil or groundwater in Wisconsin for both state and federal cleanup programs. The database includes (but is not limited to) the following contamination data:

- investigations and cleanups of contaminated soil and/or groundwater
- spills
- Superfund sites
- DNR funding assistance

The BRRTS divides the data into groups of activities, as listed below:

- Abandoned container. An abandoned container with potentially hazardous contents has been inspected and recovered. No known discharge to the environment has occurred. If the container discharged a hazardous substance, a "Spills" activity is created at this location (see "Spills" below).
- Leaking Underground Storage Tank (LUST). A LUST site has soil and/or groundwater contaminated with petroleum, which includes toxic and cancer causing substances. However, given time, petroleum contamination naturally breaks down in the environment (biodegradation). Some LUST sites may emit potentially explosive vapors.
- Environmental Repair Program (ERP). ERP sites are sites other than LUSTs that have contaminated soil and/or groundwater. Examples include industrial spills (or dumping) that need long term investigation, buried containers of hazardous substances, and closed landfills that have caused contamination. The ERP module includes petroleum contamination from above-ground (but not from underground) storage tanks.
- Spills. A discharge of a hazardous substance that may adversely impact, or threaten to impact, public health, welfare, or the environment. Spills are usually cleaned up quickly. A spill is reportable to the DNR if there is an impact to human health; to the environment; there is a fire, explosion or safety hazard; or the spill has been cleaned up immediately. Spills more than the quantities listed below must be reported to the DNR:
 - Petroleum compounds
 - petroleum product spilled and completely contained on an impervious surface
 - less than 1 gallon of gasoline or light grade petroleum product spilled onto a pervious surface or which runs off an impervious surface
 - less than 5 gallons of medium or heavy grade petroleum products spilled onto a pervious surface or which runs off an impervious surface

- Agrichemical compounds
 - less than 250 pounds dry fertilizer
 - less than 25 gallons of a liquid fertilizer
 - pesticides that would cover less than 1 acre of land if applied according to label instructions
- General Property Information. This consists of records of various milestones related to liability exemptions, liability clarifications, and cleanup agreements that have been approved by the DNR to clarify the legal status of a property.
- Voluntary Party Liability Exemption (VPLE). VPLEs are an elective process in which a property owner conducts an environmental investigation and cleanup of an entire property and then receives limits on future liability for that contamination under s. 292.15, Wisconsin Statutes. An individual, business, or unit of government can receive the liability exemption after a completed cleanup is approved.
- No Action Required. There was, or may have been, a discharge to the environment and, based on the known information, DNR has determined that the responsible party does not need to undertake an investigation or cleanup in response to that discharge.

COMMUNICABLE DISEASES

The Planning Team assigned communicable diseases a total of nine points out of a possible nine points for level of risk.

- **Meningitis** (3 occurrences reported in Door County between 1997 and 2014). Meningitis is an inflammation of the membranes (meninges) surrounding the brain and spinal cord. The swelling associated with meningitis often triggers the "hallmark" signs and symptoms of this condition, including headache, fever, and a stiff neck. Most cases of meningitis in the U.S. are caused by a viral infection, but bacterial and fungal infections also can lead to meningitis. Depending on the cause of the infection, meningitis can get better on its own in a couple of weeks or it can be a life-threatening emergency requiring urgent antibiotic treatment.

It's easy to mistake the early signs and symptoms of meningitis for the flu (influenza). Meningitis signs and symptoms may develop over several hours or over one or two days. The signs and symptoms that may occur in anyone older than the age of two include:

- sudden high fever
 - severe headache that isn't easily confused with other types of headache
 - stiff neck
 - vomiting or nausea with headache
 - confusion or difficulty concentrating
 - seizures
 - sleepiness or difficulty waking up
 - sensitivity to light
 - lack of interest in drinking and eating
 - skin rash in some cases, such as in meningococcal meningitis
- **Tuberculosis** (7 TB and 34 latent TB occurrences reported in Door County between 1997 and 2014). Tuberculosis (TB) is a disease caused by germs that are spread from person to person through the air. TB usually affects the lungs, but it can also affect other parts of the body, such as the brain, the kidneys, or the spine. A person with TB can die if they do not get treatment. The general symptoms of TB disease include feelings of sickness or weakness, weight loss, fever, and night sweats. The symptoms of TB disease of the lungs also include coughing, chest pain, and the coughing up of blood. Symptoms of TB disease in other parts of the body depend on the area affected.

TB germs spread into the air when a person with TB disease of the lungs or throat coughs, sneezes, speaks, or sings. These germs can stay in the air for several hours, depending on the environment. Persons who breathe in the air containing these TB germs can become infected; this is called latent TB infection. People with latent TB infection have TB germs in their bodies, but they are not sick because the germs are not active. These people do not have symptoms of TB disease, and they cannot spread the germs to others, however, they may develop TB disease in the future. They are often prescribed treatment to prevent them from developing TB disease.

People with TB disease have TB germs that are active, meaning that the germs are multiplying and destroying tissue in their body and can be spread to others. They usually, but not always, have symptoms of TB disease, which include those listed below. Drugs that can treat TB disease are available.

- a bad cough that lasts three weeks or longer
 - pain in the chest
 - coughing up blood or sputum
 - weakness or fatigue
 - weight loss
 - no appetite
 - chills
 - fever
 - sweating at night
- **Cryptosporidium** (33 cases of cryptosporidiosis reported in Door County between 1997 and 2014). Cryptosporidium is a microscopic parasite that causes the diarrheal disease cryptosporidiosis. Both the parasite and the disease are commonly known as "Crypto." There are many species of Cryptosporidium that infect animals, some of which also infect humans. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection. While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common way the parasite spreads.

Cryptosporidium is a leading cause of waterborne disease among humans in the United States. Cryptosporidium parasites are found in every region of the United States and throughout the world. Travelers to developing countries may be at greater risk for infection because of poorer water treatment and food sanitation. In the United States, an estimated 748,000 cases of cryptosporidiosis occur each year.

Crypto lives in the intestine of infected humans or animals that shed Cryptosporidium parasites in the stool. Millions of Crypto parasites can be released in a bowel movement from an infected human or animal. Shedding begins when the symptoms begin and can last for weeks after the symptoms (e.g., diarrhea) stop. Crypto may be found in soil, food, water, or surfaces that have been contaminated with the feces from infected humans or animals. Crypto is not spread by contact with blood. Crypto can be spread by:

- putting something in the mouth or accidentally swallowing something that has come in contact with the stool of a person or animal infected with Crypto
- swallowing recreational water or beverages contaminated with Crypto
- eating uncooked food contaminated with Crypto
- touching your mouth with contaminated hands

Contaminated water may include water that has not been boiled or filtered, as well as contaminated recreational water sources. Several community-wide outbreaks of cryptosporidiosis have been linked to drinking municipal water or recreational water contaminated with Cryptosporidium. Once infected, people with decreased immunity are most at risk for severe disease, depending on a person's degree of immune suppression.

- ***E. Coli*** (5 cases of Shiga Toxin-Producing occurrences reported in Door County between 1997 and 2014). *Escherichia coli* (*E. coli*) bacteria normally live in the intestines of people and animals. Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. Some *E. coli* are pathogenic, however, meaning they can cause illness, either diarrhea or illness outside of the intestinal tract.

In 2002, the Door County Public Health Department began an extensive effort to monitor *E. coli* in the water at many beaches around Door County, largely due to the outbreak of a gastrointestinal illness traced back to one of the county's most popular beaches. In 2003, the Door County Soil & Water Conservation Department (SWCD) began identifying *E. coli* contamination sources at 31 beaches around the county, with a final report published in 2007. The final report concluded that storm water discharge during and after rain events is one of the clear sources of *E. coli* contamination in beach water throughout the county, with the most contaminated sources originating from onshore sources. Eleven beaches in nine different municipalities throughout the county were shown to have elevated *E. Coli* levels during or after rain events, the contamination likely due to the storm water discharge pipes located on or near the beaches. Since the 2007 report, the SWCD, through its Beach Contamination Reduction program, has worked with the county, City of Sturgeon Bay, Villages of Egg Harbor, Ephraim, and Sister Bay, and the Towns of Baileys Harbor, Gibraltar, Jacksonport, and Liberty Grove to develop construction plans to reduce stormwater contamination in public beach water.

- **Pneumonia.** Pneumonia can be caused by viruses, bacteria, and fungi. In the United States, common causes of viral pneumonia are influenza and respiratory syncytial virus, and a common cause of bacterial pneumonia is *Streptococcus pneumoniae* (pneumococcus).
- **Norovirus.** Norovirus is very contagious, transmitted from an infected person, contaminated food or water, or by touching contaminated surfaces. The virus causes the stomach or intestines or both to get inflamed (acute gastroenteritis), leading to stomach pain, nausea, diarrhea, and vomiting. It is the most common cause of acute gastroenteritis in the United States. Norovirus illness can be serious, especially for young children and older adults. Each year, it causes 19-21 million illnesses and contributes to 56,000-71,000 hospitalizations and 570-800 deaths. Norovirus is also the most common cause of foodborne-disease outbreaks in the United States. The best way to help prevent norovirus is to practice proper hand washing and general cleanliness.
- **Influenza** (3 hospitalizations between 1996 and 2014)
 - Seasonal Flu. A contagious respiratory illness caused by influenza (flu) viruses occurring every year. It affects an average of 5 percent to 20 percent of the U.S. population by causing mild to severe illness, and in some instances can lead to death.
 - H1N1 Influenza (swine flu; 18 cases in 2009). H1N1 influenza is a respiratory disease of pigs caused by type A influenza viruses that cause regular outbreaks in pigs. People do not normally get H1N1 influenza, but human infections can and do happen. H1N1 influenza viruses have been reported to spread from person-to-person.
 - Avian Influenza. Commonly known as bird flu, this strain of influenza virus is naturally occurring in birds. Wild birds can carry the virus and may not get sick from it; however, domestic birds may become infected by the virus and often die from it.

WATER SUPPLY CONTAMINATION – PRIVATE

The Planning Team assigned private water supply contamination a total of eight points out of a possible nine points for level of risk.

Many of the soils in Door County are very shallow, especially in the northern two-thirds of the county. Across most of the county, soils are less than five feet in depth to bedrock; 22% of the soil is less than 18 inches in depth and another 17% is between 18 to 36 inches in depth. The soils in the northern two-thirds of the county are rough and/or shallow, with much of the land cover remaining in woodland or wetland.

The soils in the southern one-third of the county are deeper, smoother, and predominantly farmed. The largest acreage of the county's wetlands are also found in this region.

Since the county's groundwater is recharged from water that infiltrates through a land surface consisting of thin soils and bedrock formations, Door County has one of the highest risks of surface water pollution to groundwater of any county in Wisconsin. The dolostone bedrock contains many karst features that provide for large water-holding capacity and lateral flow, but also allow water and accompanying contaminants to quickly and directly enter the dolostone aquifer.

As development in an area increases, so does the impervious surface area, such as roofs, driveways, and parking lots. This affects the amount and quality of water that infiltrates to the groundwater due to the changes to vegetative cover, slope, soil composition, and soil depth. Groundwater may be contaminated by construction and agricultural runoff events, which can lead to contamination of private wells, fish kills, and an influx of nutrients into surface waters, causing algal blooms. Additionally, leaking private septic system tanks, usually made out of steel, or other malfunctioning portions of private septic systems, are primary contributors of bacteria such as fecal coliform and *E. coli* to groundwater.

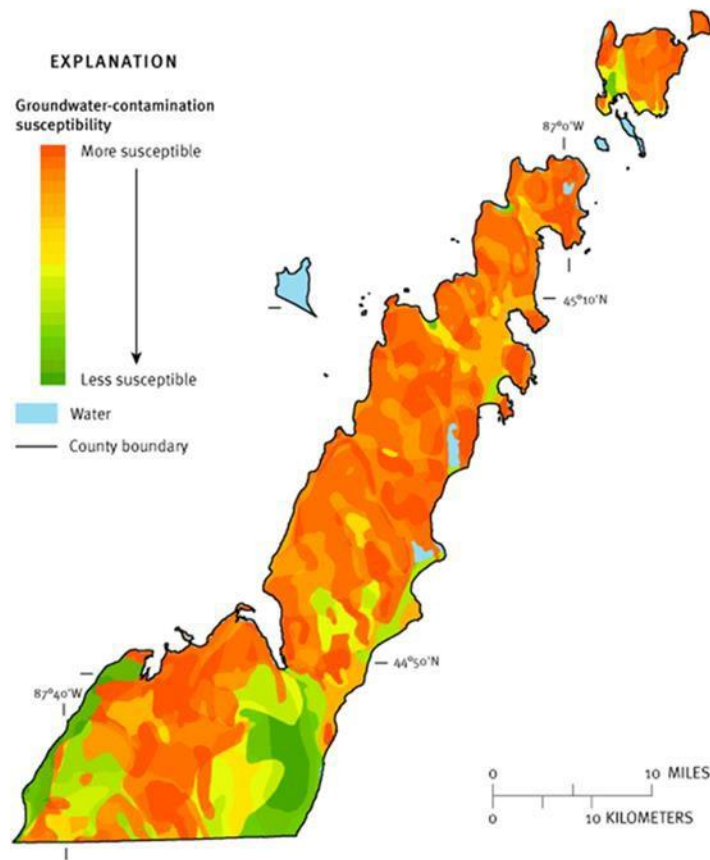
Figure 2.2 is a groundwater contamination susceptibility map, created by the DNR in partnership with the United States Geological Survey, University of Wisconsin-Extension, and Wisconsin Geological and Natural History Survey. Five physical resource characteristics were identified as important in determining how easily a contaminant can be carried through overlying materials to the groundwater. These characteristics are depth to bedrock, type of bedrock, soil characteristics, depth to water table, and characteristics of surficial deposits (glacial deposits lying between bedrock and soil).

Municipal wells serve approximately one-third of the county's households, while private wells serve approximately two-thirds of the county's households. Only the City of Sturgeon Bay, the Villages of Forestville and Sister Bay, and Maplewood (Town of Forestville) have municipal water. The Village of Sister Bay also serves some households located in the Town of Liberty Grove. The City of Sturgeon Bay and the Villages of Forestville and Sister Bay have mapped their "zones of contribution," the surface area on the land that contributes rain and snowfall to the groundwater for a particular well site. Subsequent to mapping their zones of contributions, the City of Sturgeon Bay, Town of Liberty Grove, and the Village of Sister Bay have adopted wellhead protection ordinances.

Due to Door County's high risk for groundwater contamination, the county has requirements above and beyond the typical state requirements for well-drilling in place, such as additional casing requirements. The well casing is a steel or plastic pipe that lines the well, keeping it from caving in and protecting contamination of the ground water by surface water. In 1971, based on the findings of a study conducted by the Wisconsin Geological Survey of the county's groundwater, the county set casing depths for two different "zones," with minimum requirements of 100 feet and 170 feet depending upon which zone the well was located within. (State-wide, wells constructed prior to 1957 were required to have a uniform minimum casing of 40 feet; between 1957 and 1971, a uniform minimum casing of 100 feet was required. Currently, state-wide requirements vary depending on site conditions.) Since 2006, the transition areas between those zones are now required to have a minimum of 140 feet of casing. In some situations, the DNR grants variances for construction and/or usage of a well with less than the minimum required casing amounts. The DNR may also recommend more casing based on known contamination in an area.

While municipal wells are routinely tested for contaminants, proper monitoring of contaminants in private wells often does not occur. Known problems for private wells are primarily bacterial contamination and nitrates. Copper and lead can also be present in groundwater, but usually come from plumbing/piping and sometimes from pesticides or herbicides. Lead can also be present in groundwater because of the county's past agricultural practice of using lead arsenic for controlling diseases in orchards.

Figure 2.2: Groundwater Contamination Susceptibility Analysis, Door County
 Door County – Groundwater-Contamination
 Susceptibility Analysis



This groundwater-contamination susceptibility map is a composite of five resource characteristic maps, each of which was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987. Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

Contaminants may enter the groundwater through spills and leaking underground tanks. Water supply contamination from such occurrences has been reported to the DNR 14 times between 1984 and 2009, as listed below by type:

- 2 ERP – open
- 1 LUST – open
- 1 historical Spill
- 5 closed LUST
- 5 closed Spills

The type of substances causing the contamination and number of events reported are as follows:

- petroleum: 8
- volatile organic compounds: 2
- agriculture chemicals: 2
- food: 1
- manure: 1

Note that the one manure event listed in the database occurred in 2005. Not included in the database is a manure event that occurred in 2014 when manure was spread too close to a sinkhole and ended up in the

drinking water supply of nearby homes in the Town of Jacksonport. Sixteen people became ill and one person was hospitalized, according to the Door County Department of Public Health.

HAZARDOUS MATERIALS – ROADWAY

The Planning Team assigned hazardous material spills along or near a roadway a total ranking of six points out of a possible nine points.

Hazardous material spills along or near a roadway in Door County have been reported to the DNR 12 times between 1996 and 2014. The types of substances and number of events reported are listed below:

- petroleum: 8
- agriculture chemicals: 2
- sewage: 1
- anti-freeze: 1
- mineral oil: 1
- manure: 1

HAZARDOUS MATERIALS – WATERWAY

The Planning Team assigned hazardous material spills in a waterway a total of five points out of a possible nine points.

Hazardous material spills resulting in surface water contamination in Door County have been reported to the DNR 193 times between 1971 and 2015. The status of all events are either “closed spill,” “historic spill,” or “closed ERP.” The types of substances and number of events reported are listed below:

- petroleum: 134
- unknown or historical spill with no substance listed: 45
- sewage: 4
- other: 4
- mineral oil: 3
- industrial chemical: 2
- volatile organic compound: 1
- animal product: 1
- food: 1
- industrial chemical: 1
- anti-freeze - 1
- manure - 1

Out of these 193 events, 163 (84%) took place in the Sturgeon Bay area, primarily taking place at the ship building/repair businesses.

LOSS OF ELECTRICAL SYSTEM

The Planning Team assigned loss of electrical system a total of five points out of a possible nine points for level of risk.

According to a federal report issued by the Executive Office of the President, “Economic Benefits of Increasing Electric Grid Resilience to Weather Outages,” severe weather is the leading cause of power outages in the United States. During a power outage, the normal operation of homes, businesses, public buildings and other critical community facilities may be interrupted. The costs of outages take various forms, including lost output and wages, spoiled inventory, delayed production, inconvenience, and damage to the electric grid. Grid resilience is increasingly important as climate change increases the frequency and intensity of severe weather. Scientific research predicts more severe hurricanes, winter storms, heat waves, floods and other extreme weather events induced by climate change. Continued investment in grid

modernization and resilience will mitigate these costs over time, saving the economy billions of dollars and reducing the hardship experienced when extreme weather strikes.

In addition to the economic costs of power outages, the loss of home heating and cooling systems may lead to heat exhaustion and hypothermia. Note that there are no recorded deaths or hospitalizations in Door County due to the loss of home heating and cooling systems. Described below are the primary electric, natural gas, and other fuel sources that keep homes heated/cooled in Door County.

Electric Service

Except for a few small home-based alternative energy systems, all of the county's energy for electricity is imported from outside the county. Wisconsin Public Service (WPS) supplies the majority of power to Door County's residential, agricultural, commercial, and industrial customers, except for the Sturgeon Bay Utilities service area and the Town of Washington.

Sturgeon Bay Utilities (SBU) maintains an electric distribution system that services over 8,300 customers in the City of Sturgeon Bay and the Towns of Clay Banks, Nasewaupee, Sevastopol, and Sturgeon Bay. Utility staff members are responsible for maintaining three substations with current capacity of over 98 megawatts and over 281 miles of overhead and underground transmission lines. Over 3,300 transformers regulate the voltage measured by 9,400 meters used by its customers.

SBU is customer-owned and a member of Wisconsin Public Power, Inc. (WPPI). WPPI, created to provide reliable, low-cost power and services to its member/owners, is a regional power company serving 50 customer-owned electric utilities. Through WPPI, these public power utilities share resources and own generation facilities that provide reliable, affordable electricity to more than 190,000 homes and businesses in Wisconsin, Upper Michigan, and Iowa. WPPI supplies electricity to approximately 60 percent of the load served by municipal electric systems in Wisconsin, based on energy sales.

The Washington Island Electric Cooperative Inc., a private electric service utility established in 1945, serves approximately 700 year-round residents and 1,300 seasonal residents on Washington Island.

Most electric power for the county is transmitted along high voltage electric transmission lines owned and operated by the American Transmission Company (ATC). The ATC, formed in 2001, is a transmission-only utility that owns and operates approximately 9,350 miles of transmission lines and 500 substations. It serves approximately two-thirds of Wisconsin, including Door County. Four transmission lines run through Southern Door to the City. Only one transmission line serves all of northern Door County (north of the Dunn Road station). Major transmission lines within Door County include 138 kilovolt lines. Smaller electric transmission lines (69 kilovolt) also traverse throughout the county.

The ATC publishes an annual 10-year Transmission System Assessment Summary Report that outlines systems limitations and solutions for each of their five zones in Wisconsin. The September 2014 report recommends rebuilding a 69 kilovolt line between Dyckesville and the City, to be in service by the year 2016. ATC also plans to upgrade equipment at the Canal substation.

Natural Gas and Other Fuels

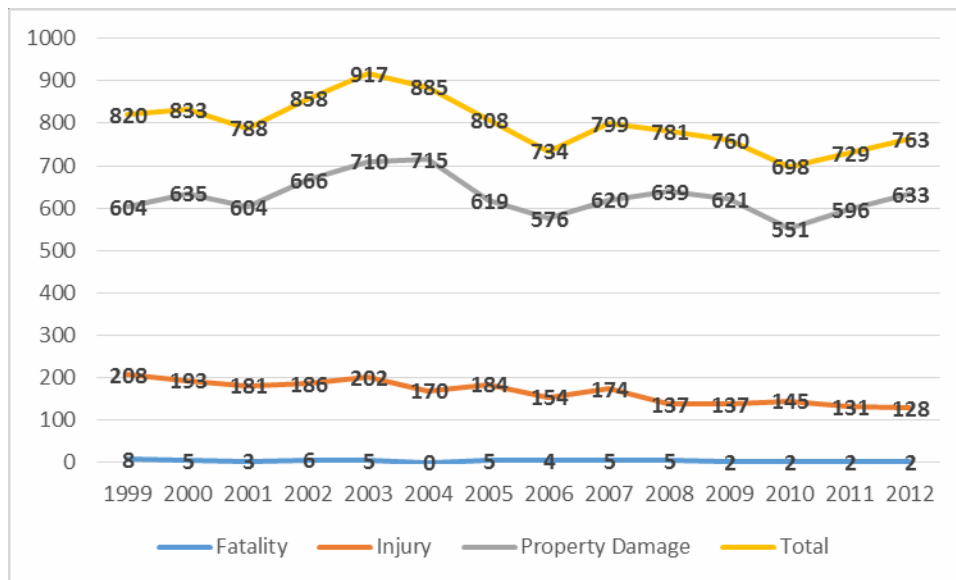
WPS provides natural gas service to the City of Sturgeon Bay and Southern and Central Door, including the Towns of Brussels, Forestville, Gardner, Nasewaupee, Sevastopol, Sturgeon Bay, and Union. County residents and businesses without natural gas service have individual on-site tanks for liquid propane or fuel oil, purchased from other private vendors. Wood stoves and pellet stoves have also become increasingly popular as energy costs rise and renewable energy sources receive greater attention in the media. Pellets are made from recycled sawdust, wood shavings, corn, walnut and peanut shells, and similar biomass wastes that are ground up, compressed, and extruded.

TRANSPORTATION – ROADWAY ACCIDENTS

The Planning Team assigned transportation, roadway accidents, a total of four points out of a possible nine points for level of risk.

Vehicle crash reports are filed with WisDOT by county and city police departments, providing the time, location, type, and severity of the crash. The number, location, and severity of accidents often indicate problems with road and street alignments, construction, or the geometric design of the street. A variety of measures, including alterations in the street geometry, enlargement of the intersection turning radii, placement of more prominent signs, relocation of access drives, and speed changes, are often used to alleviate problem areas. Detailed crash information for Door County can be found on-line from WisDOT. Figure 2.3 below shows the most recent data available for number and severity of vehicle crashes in Door County between 1999 and 2012.

Figure 2.3: Number and Severity of Crashes, Door County, 1999 - 2012



Source: <http://www.dot.wisconsin.gov/safety/motorist/crashfacts/>.

STRUCTURAL FIRE

The Planning Team assigned structural fire a total of four points out of a possible nine points for level of risk. House fires pose a health risk primarily due to smoke inhalation and burns.

LOSS OF SEWER SYSTEM

The Planning Team assigned loss of sewer system a total of four points out of a possible nine points for level of risk. A private septic system failure can cause pooling of sewage on the ground, which kids sometimes play in and get sick. Failure of a municipal sewer system can cause structural damage, as well as pose health risks. There no recorded deaths or hospitalizations in Door County due to failure of a sewer system.

NUCLEAR POWER PLANT

The Planning Team assigned nuclear power plant a total of three points out of a possible nine points for level of risk.

Note: the information below is condensed from a Door County Environmental Council newsletter, sourced from Star Tribune, Power Engineering, Associated Press.

The Nuclear Regulatory Commission defines two emergency planning zones around nuclear power plants: a plume exposure pathway zone with a radius of 10 miles, concerned primarily with exposure to, and inhalation of, airborne radioactive contamination, and an ingestion pathway zone of about 50 miles, concerned primarily with ingestion of food and liquid contaminated by radioactivity.

The Point Beach nuclear power plant is located in Two Rivers, approximately 30 miles from Door County's southern border. This plant provides approximately one-sixth of the total electric power generated for Wisconsin. The Kewaunee Nuclear Power Station, now closed, is located in Kewaunee County on the shore of Lake Michigan, 15 miles from Door County's southern border. The plant ceased operation on May 7th, 2013. As of 2015, Dominion Resources, the current owner, was seeking a waiver of this requirement, contending that the rule is outdated and overly conservative. The Nuclear Regulatory Commission's estimate of the risk each year of an earthquake intense enough to cause core damage to the reactor at Kewaunee was 1 in 83,333, according to a study they published in 2010.

Door County Hazard Mitigation Plan

Chapter 3: Mitigation Strategies

HAZARD MITIGATION GOALS AND ACTION ITEMS

Per FEMA requirements, a hazard mitigation plan must contain goals and action items that represent what the community seeks to achieve through mitigation plan implementation. Mitigation action items are a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people and property from the impact of hazards.

LEGEND

Door County Departments:

Door County Aging and Disability Resource Center (ADRC)
 Door County Buildings and Grounds (Buildings and Grounds)
 Door County Emergency Management Services (EMS)
 Door County Highway (Highway)
 Door County Human Services (Human Services)
 Door County Information Systems (IS)
 Door County Land Information Office (LIO)
 Door County Parks (Parks)
 Door County Planning (Planning)
 Door County Public Health (Public Health)
 Door County Sheriff's (Sheriff's)
 Door County Soil and Water Conservation (SWCD)

Other agencies/committees:

Communications Advisory Technical Subcommittee (CATS)
 Door County Economic Development Corporation (DCEDC) Attainable Housing Committee
 Lakeshore Community Action Program (CAP)
 Local Emergency Planning Committee (LEPC)

HAZARD MITIGATION GOALS

1. Minimize human, economic, and environmental disruption and reduce the potential for injury and loss of life from natural and non-natural hazards.
2. Enhance public education about disaster preparedness and resilience, and expand public awareness of natural hazards.
3. Encourage and promote continued comprehensive hazard mitigation planning and implementation of the plan.
4. Support coordination and collaboration among federal, state, and local authorities and non-governmental organizations regarding hazard mitigation activities.
5. Improve the disaster resistance of buildings, structures, and infrastructure whether new construction, expansion, or renovation.

Mitigation Strategy	Priority/Timeline	Lead and Participating Agencies
GENERAL ACTION ITEMS		
1. Maintain and enhance CodeRed as the single most important source to alert the public to a hazard.	High/On-going	EMS
2. Incorporate some hazard mitigation planning, as appropriate, into future updates of the county's comprehensive and farmland preservation plan.	Medium – Every 10 yrs; next update no later than 2025	Planning
3. Distribute hazard mitigation materials at housing workshops, trainings, and orientation sessions.	Low/On-going	EMS DCEDC Attainable Housing Committee Lakeshore CAP
4. Utilizing the Wisconsin Historical Society's GIS database on historical and archeological sites, develop a GIS layer identifying those that are located within the 100-year floodplain.	Low	Planning
5. Continued use and further development of the county's Geographic Information System for emergency service purposes.	Medium – Inventoried assets and potential hazards going on-line by mid-2016	EMS IS/LIO Planning
6. Research/install backup power supply system for county critical facilities.	High	EMS Buildings and Grounds
7. Research alternative communication opportunities to assist overloaded dispatch capabilities due to a catastrophic event.	High – 2016*	Sheriff's CATS
8. Continue to add to and update information on the Sheriff's Department Web site regarding types of hazards and how to respond in the event of a hazard or potential hazard, as well as links to sites with information related to weather conditions, burning practices/regulations, hazardous material spills, etc.	Low	Sheriff's IS

* The Door County Sheriff's Department has a command vehicle that can also serve as a 911 call center. Testing of the 911 call center function will take place in 2016. In the meantime, the current 911 call center has a manual switch that will transfer calls to Brown County in the event the call center becomes overloaded.

STORMS AND/OR HAZARDOUS WIND EVENTS		
1. Continue to utilize public awareness methods such as radio and television stations and outdoor warning systems.	High – On-going V. SB – Medium	EMS Local municipalities
2. Investigate the feasibility of increasing the number of sirens located throughout the county. <i>(Note: the City and Village of Forestville already have outdoor warning systems.)</i>	Low	Local municipalities
3. Continue to prepare and distribute educational materials to the public on severe weather safety procedures.	High/On-going V. SB – Medium	EMS
4. Inventory and investigate the feasibility of providing safe shelters and signage at state, county, and local parks and recreation areas.	Low City – not doing	Parks Local parks
5. Install lightning protection devices and methods such as lightning rods and grounding on each community's communications infrastructure and other critical facilities. <i>(Note: the City has already done this.)</i>	Low, but possibly prioritize those without first vs. newer buildings	Sheriff's CATS Local municipalities IS
6. Analyze lightning grade surge protection for critical electronic equipment used for response and recovery.	Low – Already done for data centers	Sheriff's/CATS IS*
7. Promote tornado safety public information as well as other summer severe weather public awareness/educational efforts through continued partnership with the National Weather Service.	High/On-going	EMS
8. Assist personnel in schools and businesses, public facility managers, and individuals in determining "best available" tornado safety areas.	High/On-going	EMS
9. Develop and maintain a comprehensive safety plan for each publicly-owned building. <ul style="list-style-type: none"> Government and Senior Centers have plans and are reviewed annually. Library plan is in process. Airport and Highway Departments do not have plans. <i>(Note: the City has already done this.)</i>	Low V. SB – Medium	Airport Building and Grounds EMS Highway Sheriff's Library Local municipalities
10. Continue efforts to improve mobile home safety in windstorms and tornadoes through public education efforts and assistance in locating safe shelter sites, the requirement of tie-downs in mobile home parks, and the installation of outdoor warning sirens.	Low City – Medium V. SB – N/A	Planning Local municipalities
11. Establish/maintain intergovernmental cooperation agreements with neighboring communities and private vendors to acquire any necessary additional equipment needed for storm clean-up. <i>(Note: the City has already done this.)</i>	V. SB – High	Local municipalities

12. Establish/continue tree trimming, drainage system clearance, and other maintenance programs. For example: <ul style="list-style-type: none"> Village of Egg Harbor – Public Tree Removal Ordinance City – annual maintenance by Public Works Department and Sturgeon Bay Utilities 	City – On-going (high for tree trimming; low for drainage clearance) V. SB – Low	Highway Local municipalities
13. Encourage utility companies and development firms to bury power lines in new developments or when upgrades are made to existing lines.	On-going City – No	EMS Planning Local municipalities
14. Work with communities to develop and/or enforce restrictions on planting large or rapidly growing trees near power lines. <i>(Note: City policy exists.)</i>	City – On-going V. SB – High	Highway Local municipalities
WINTER STORMS (HEAVY SNOW, BLIZZARDS, ICE)		
1. Continue to ensure plowing and salting/sanding equipment is operational and available to handle potential emergencies.	High/On-going	Highway Local public works
2. Continue to ensure/establish communication lines between municipalities, police, fire, EMS, hospital/clinics, and highway/street departments.	Medium/On-going City – High V. SB – High	EMS Sheriff's Highway Local municipalities
3. Provide for coordination of public safety, support agencies (such as American Red Cross and United Way), and resource acquisition during emergencies through implementation of the Door County Emergency Operations Plan.	High/On-going	EMS American Red Cross United Way
4. Ensure/continue inclusion of driver safety strategies for severe weather events in driver education classes and materials.	Low	EMS Sheriff's Public schools
5. Collaborate with Soil and Water Conservation Department and the NRCS to expand windbreak planting, such as snow fences or “living snow fences” (rows of trees or other vegetation) to limit blowing and drifting of snow over critical roadway segments.	City – No V. SB – Medium	Highway SWCD Local municipalities
HAZARDOUS TEMPERATURES		
1. Encourage the county's human service entities and energy providers to continue to expand programs to assist at-risk populations in paying their utility bills and in acquiring appliances to mitigate extreme weather conditions.	On-going	Public Health Human Services United Way
2. Work with the local community and social service agencies such as the Door County Aging and Disability Resource Center to establish and maintain a “friendly visitor” program designed to have volunteers call vulnerable individuals during temperature advisory situations.	On-going	Public Health Human Services/ADRC United Way

3. Establish/maintain agreements with such entities as local malls, libraries, and schools to serve as heating and cooling centers.	On-going	Public Health
HAZARDOUS RAIN EVENTS		
1. Provide sewer back-flow prevention information and other floodproofing measures to communities through public information programs.	City – Low V. SB – Low	Local municipalities
2. Encourage sewer utilities to provide back-up power sources at lift stations to help prevent sewer back-flow flooding. <i>(Note: the City and Villages of Forestville & Sister Bay have backup generators.)</i>	Low (cost-prohibitive)	Local municipalities
3. Prepare and maintain an evacuation plan for people and property, including dissemination of storm preparation measures and evacuation instructions to the public through the media.	High/As-needed	EMS
4. Continue to monitor the National Weather Service flood forecasts.	High/On-going	EMS
5. Maintain a process for the preparation of the opening and operation of congregate care facilities.	High/As-needed	EMS
6. Establish/maintain protective measures such as sandbagging, protection of buildings and other structures, and emergency gas and electricity cut-off procedures.	City – Low V. SB – Low	Local municipalities
7. Prepare, adopt, and maintain proactive land use planning methods through the county's and municipalities' comprehensive plans and implementation tools such as land use regulations (codes and ordinances) and stormwater management plans.	On-going City – Medium	Planning Local municipalities
8. Adopt/enforce land use regulations that preserve natural resources adjacent to and in defined floodplains.	On-going	Planning Local municipalities
9. Inventory and assess areas throughout both the rural and urban areas of the county that have repeated flash-flooding problems and identify activities to remediate or rectify problems at those locations.	Medium City – No	EMS Local municipalities
10. Utilize FEMA floodplain mapping when adopted to update existing flood maps and data sources to better determine areas and facilities susceptible to recurring flooding. <i>(Note: the City has already done this.)</i>	As-Needed City – Medium	Planning Local municipalities
11. Maintain a stormwater management plan that includes such remediation techniques as surface detention basins and in-street detention units. <i>(Note: the City has already done this.)</i>	City – Medium V. SB – Low	Local municipalities
12. Implement a rural drainage improvement program that would include ditch, bridge, and culvert maintenance and improvements. <i>(Note: the City has already done this.)</i>	City – Medium/On-going V. SB – Medium	Local municipalities

13. Research WisDOT's Flood Damage Aid Program; disseminate information as appropriate.	Medium/On-going	EMS Planning
HAIL		
1. Continue distribution of information through the UW-Extension and other appropriate sources on various hail insurance options such as the commercial stock and mutual companies, and Federal Crop Insurance Corporation (FCIC).	TBD	UW-Extension
2. Document hail damage.	TBD	UW-Extension
3. Promote Crop Hail Insurance programs for the agricultural community.	TBD	UW-Extension
COMMUNICABLE DISEASES		
1. Continue maintenance of a community public health system with adequate numbers of medical staff and sufficient disease monitoring and surveillance capabilities to adequately protect the population from small- and large-scale epidemics.	On-going	Public Health
2. Continue to encourage residents to receive immunizations against communicable diseases, including annual and special-strain flu shots.	On-going	Public Health
3. Promote public awareness and personal preparedness.	On-going	Public Health
4. Seek guidance from the State Pandemic Preparedness Plan.	On-going	Public Health
PRIVATE WATER SUPPLY CONTAMINATION		
1. Research/implement expanded monitoring programs.	City – No V. SB – Low	SWCD Public Health Local municipalities
2. Manage the impact of new development on water quality through appropriate land use designations, decisions, and conditions.	On-going	Planning
3. Partner with county Soil and Water Conservation and Sanitarian Departments to review and potentially update ordinances, programs, and policies in order to better protect water quality.	High (1-5 yrs.)	Planning
HAZARDOUS MATERIALS – ROADWAY AND WATERWAY		
1. Work with the Wisconsin Department of Natural Resources to develop a database of hazardous materials being transported through Door County.	Medium/On-going	EMS Highway
2. Ensure that any business which uses, stores, or manufactures hazardous material is in compliance with the Occupational Safety and Health Administration regulations detailed in 29 CFR 1910.120 (hazardous waste operations and emergency response).	Medium/On-going	EMS LEPC

3. Continue diligent the Emergency Planning and Community Right-to-Know Act program.	On-going	EMS LEPC
4. Continue to exercise with regional HAZMAT teams.	On-going	EMS Highway
5. Continue to coordinate and collaborate with private utility companies.	Low/As-needed	EMS
6. Promote state enforcement of federal requirements for transporting hazardous materials.	High/On-going	EMS
LOSS OF ELECTRICAL, FUEL, AND SEWER SYSTEMS		
1. Develop and coordinate county and regional exercises with utility companies.	Medium/On-going	EMS
2. Research and inventory Energy Assistance Programs offered by private utility companies.	On-going	Human Services/Contracted Agency
3. Inventory backup power generation capabilities.	High/On-going	EMS
TRANSPORTATION – ROADWAY ACCIDENTS (from the Door County Comprehensive and Farmland Preservation Plan 2035)		
1. Require, when appropriate, safe and convenient pedestrian, bike, and walking paths, sidewalks, and crosswalks, particularly within dense or community core areas, that connect to residential and commercial areas.	On-going City – Medium	Planning Local municipalities
2. Address safety and efficiency issues by identifying dangerous intersections, providing adequate traffic controls, assessing lines-of-sight, providing appropriate access points, maintaining a minimum Level of Service (LOS) on all highways and roads, and other appropriate safety/efficiency methods.	On-going City – High	Planning Highway Local municipalities
STRUCTURAL FIRE		
1. Assess building codes and standards that apply to fire protective strategies.	On-going	Local fire departments
2. Establish/support community watch programs.	On-going	Local fire departments
3. Assess availability to high capacity wells for use in recharging response equipment during fires.	On-going	Local fire departments
4. Participate with the County Fire Chiefs Association.	On-going	Local fire departments
5. Inventory the details of existing Mutual Aid Agreements.	On-going	Local fire departments

**IS follows best practices and electrical codes (i.e., proper grounding and UPS protection) when computer infrastructure is installed. Analysis is only done when the equipment does not work.*

PLAN MAINTENANCE

Per the FEMA handbook guidelines, plan maintenance is the process the planning team establishes to track the plan's implementation progress and to inform the plan update. The plan must include a description of the method and schedule for monitoring, evaluating, and updating it within a 5-year cycle. These procedures help to:

- Ensure that the mitigation strategy is implemented according to the plan.
- Provide the foundation for an ongoing mitigation program in the community.
- Standardize long-term monitoring of hazard-related activities.
- Integrate mitigation principles into community official's daily job responsibilities and department roles.
- Maintain momentum through continued engagement and accountability in the plan's progress.

Plan updates provide the opportunity to consider how well the procedures established in the previously approved plan worked and then revise them as needed.

MONITORING, EVALUATING, UPDATING

The Door County Emergency Services Department (EMS) is the agency responsible for monitoring, evaluating, and updating this plan. EMS will monitor the implementation of this plan by discussing it annually (approximately one year from the date of adoption) with the Emergency Services/Communications and Local Emergency Planning Committees. Within three years of the date of adoption, the plan's action items will be evaluated for effectiveness at achieving the plan's goals by contacting the agencies identified in the Mitigation Strategies chart for an update. Within five years of the date of adoption, this plan will be reviewed and revised as necessary to reflect any changes in progress or priority.

In addition to the processes described above, EMS will incorporate as appropriate any action items from the hazard mitigation plan into the Door County Emergency Operations Plan. The purpose of the Emergency Operations Plan is to:

1. Facilitate the protection of lives, property, and the environment in major disasters of any nature.
2. Coordinate response to disasters, assess damages, identify mitigation opportunities, and implement recovery efforts.
3. Describe the county's relationship in support of local units of governments during response and recovery.
4. Serve as a coordinating document for supporting inter policies and procedures.
5. Reflect information collected, decisions made, and procedures developed in the planning process and during response.
6. Provide a link between the county and municipal plans.

Lastly, the Door County Hazard Mitigation Plan will be posted on both the Planning and Emergency Management Services Departments' Web sites along with contact information for providing input.

Door County Hazard Mitigation Plan

Appendix A





STATE OF WISCONSIN
DEPARTMENT OF MILITARY AFFAIRS
 '4/IP-'4/IP-'IN-'IN-'IN- '4N-'P-'P-'P-'4/IP-'4/IP-'IN-
DIVISION OF EMERGENCY MANAGEMENT

Brian I\1, Satula
 Administrator

Scott Walker
 Governor

June 17, 2014

Dan Williams, Director
 Door County Emergency Management
 319 S. 18th Avenue
 Sturgeon Bay, WI 54235

Dear Dan,

I am pleased to inform you that the Federal Emergency Management Agency (FEMA) has approved funding for the Door County Hazard Mitigation Grant Program planning grant application submitted under Disaster Declaration FEMA-4141-DR-WI declared August 8, 2013. The grant is approved in the amount of \$33,000.00 for the development of a countywide all-hazards mitigation plan. FEMA provides 75% of the funding or \$24,750.00; Wisconsin Emergency Management (WEM) provides 12.5% or \$4,125.00; and the remaining \$4,125.00 is the community's required 12.5% local match.

Enclosed are two originals of the State-Local Hazard Mitigation Grant Program Assistance Agreement. Please carefully review the agreement and sign both copies. Keep one for your files and return the other to this office. **This agreement must be signed before funds can be drawn on the grant.** The grant performance period began on June 10, 2014 and will end on June 10, 2017. Per the work schedule in your application, the draft plan will be due in our office by January 31, 2016, with the final plan completed and approved by FEMA by July 31, 2016. All costs must be incurred during the performance period. Grant funds may be used for those items identified in the County's approved application and may not be used for any other purposes. A budget summary (enclosed) was developed based on the budget in your approved application.

The County may request reimbursements of planning expenses up to 90% of the federal and state shares of the grant, or \$25,987.50, as work progresses on the development of the updated plan. The remaining funds will not be paid until the plan update is completed and approved by FEMA.

Recoupment of all funds will be pursued if the County fails to complete a FEMA-approved updated all-hazards mitigation plan. In order to receive reimbursement of expenses you will need to complete and submit to this office a Request for Reimbursement of Expenses, DMA Form 167 (enclosed) along with supporting documentation (copies of invoices and payments). Advancement of funds requires prior approval from this office and will only be made in extraordinary circumstances. The final request for reimbursement is due 30 days after plan approval.

Mr. Williams
June 17, 2014
Page 2

Per the agreement you are required to submit Quarterly Status Reports, DMA Form 168 (enclosed) within 15 days of the end of each quarter (October 15, January 15, April 15, and July 15).

You should refer to the Assurances for Non-Construction Projects, DMA Form 1017A, which was signed and submitted with the application for other state and federal laws and program requirements relating to the grant which are to be adhered to.

In developing the plan, please refer to the new "Local Mitigation Planning Handbook" dated March 2013 and the "Local Mitigation Plan Review Guide" dated October 1, 2011. When the draft updated plan is completed, submit one copy along with a completed "Local Mitigation Plan Review Tool" to this office for review. Both documents can be downloaded from FEMA's website <http://www.fema.gov/mitigation-planning-laws-regulations-guidance>. We will need one electronic copy of the draft plan for review and one electronic copy of the final plan.

If you have any questions, please call me at 608-242-3222 or Roxanne Gray, Mitigation Section Supervisor, at 608-242-3211.

Sincerely,

Kxhn,, 0

Katie Sommers
State Hazard Mitigation Officer
Wisconsin Emergency Management

Enclosures:

- FEMA approval letter dated June 10, 2014
- State-Local Hazard Mitigation Grant Program Assistance Agreement (two copies)
- Budget Summary Form
- Request for Reimbursement, DMA Form 167
- Quarterly Report, DMA Form 168

Cc: Steve Fenske, East Central Regional Emergency Management Director
Becky Powers, East Central Regional Office Operations Associate
Angela Pierce, Bay-Lake Regional Planning Commission



COUNTY OF DOOR

Planning Department

County Government Center
421 Nebraska Street
Sturgeon Bay, WI 54235
Phone: (920) 746-2323
FAX: (920) 746-2387
Website: map.co.door.wi.us/planning

Emergency Services

Emergency Services Building
319 South 18th Avenue
Sturgeon Bay, Wisconsin 54235
Phone: (920) 743-5461
FAX: (920) 743-4917

August 20, 2014

Re: Your Invitation to the Door County Hazard Mitigation Planning Team

Greetings!

The Door County Emergency Services and Planning Departments are partnering to facilitate the development of a hazard mitigation plan in compliance with Federal Emergency Management Agency's (FEMA) guidelines. It is our goal that this plan will be adopted by Door County and each of its five incorporated municipalities, making the county and these municipalities eligible for future disaster relief and mitigation project funds from FEMA. We are forming a planning team consisting of the county, incorporated municipalities, and other agencies with an interest in disaster management in order to guide the hazard mitigation plan development process. (See attached list of "Planning Participants.") **You or a representative from your agency are invited to participate on this team, starting with attendance at a kick-off meeting, as described below, being held to go over the plan purpose, responsibilities, and project scope/schedule.** Including this kick-off meeting, the team will meet approximately 4 times between now and January 2016. (See attached "Schedule of Tasks.")

Door County Hazard Mitigation Plan - Planning Team Kick-Off Meeting

5:30 – 7:00 p.m., Tuesday, September 30th

Peninsula Room, 1st Floor, Door County Government Center
421 Nebraska Street, Sturgeon Bay, WI 54235

Topics: Purpose of hazard mitigation plan, planning team responsibilities, project scope/schedule

In 2000, the U.S. Congress passed the Disaster Mitigation Act intending to reduce public and private expenses associated with disasters, and to speed up response time to and reduce recovery time from disasters. This Act included a new requirement for local governments to prepare hazard mitigation plans in order to be eligible for funding from FEMA for mitigation activities. FEMA has created guidelines for developing hazard mitigation plans, the two main components of which are conducting a risk assessment and developing mitigation strategies. The Planning Team's risk assessment will involve an evaluation of the county's potential exposure to natural hazards such as tornadoes, floods, wild fires, and severe thunderstorms. The Planning Team could also potentially evaluate man-made disasters, such as hazardous material spills or airplane accidents. Using this risk assessment, the Planning Team and participants at smaller area meetings will develop countywide and jurisdictional mitigation strategies. Issues such as incompatible land uses, protection of critical facilities, and reduction of community and taxpayer costs associated with disasters will be addressed during development of the mitigation strategies.

Please feel free to contact Becky Kerwin at (920) 746-2327 or rkerwin@co.door.wi.us with any questions.

Door County Hazard Mitigation Plan
Planning Team Kick-Off Meeting
Tuesday, September 30, 2014
5:30 –7:00 p.m.

Peninsula Room, First Floor
Door County Government Center
421 Nebraska Street
Sturgeon Bay, Wisconsin

Agenda

1. Open meeting/introductions
2. Review hazard mitigation plan development process, responsibilities, and timeline
3. Review Memorandum of Agreement
4. Review "capabilities" worksheet
5. Set next meeting date
6. Adjourn

Door County Hazard Mitigation Plan

Planning Team Meeting Minutes

Tuesday, September 30, 2014

1. Open meeting/introductions.

The first Planning Team meeting for the development of the Door County Hazard Mitigation Plan was held in the Peninsula Room, Door County Government Center, 421 Nebraska Street, Sturgeon Bay, Wisconsin, on Tuesday, September 30, 2014. The meeting started at approximately 5:30 p.m. Note that all documents referred to below are posted to the Hazard Mitigation Planning Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

Present:

- Door County
 - o Maureen Murphy, County Administrator
 - o Keith Kasbohm, Director, Airport
 - o Wayne Spritzka, Director, Building and Grounds
 - o Emergency Services
 - o Dan Williams, Director
 - o Tony Luchini, Deputy Director
 - o Joe Krebsbach, Director, Human Services
 - o Tom Haight, Land Information Officer
 - o Planning
 - o Mariah Goode, Director
 - o Becky Kerwin, Planner II
 - o Rhonda Kolberg, Q. Public Health
 - o John Teichtler, Director, Sanitarian
 - o Terry Vogel, Sheriff
 - o David Enigl, Supervisor
- City of Sturgeon Bay
 - o Mayor Olejniczak, Director
- Village of Ephraim
 - o Josh Vellmer, Mayor
- Village of Ephraim
 - o Britney Carey, Administrator
 - o Jahe Olson, Trustee
- U.S. Coast Guard
 - o John Sehn, Senior Chief
 - o Stan Rittner
 - o Jake Timmon
- Wisconsin Public Service
 - o Wpij Swanson, Manager
- American Red Cross - Jud Peregory, Regional Director, Northeast WI
- Ministry Door County Medical Center - Steve Schwenke, Safety Manager

Director Williams opened the meeting with a few comments explaining why Emergency Medical Services is embarking on a hazard mitigation planning process.

- ## 2. Review hazard mitigation plan development process, responsibilities, and timeline.
- Planner Kerwin gave a presentation regarding hazard mitigation planning benefits, requirements, responsibilities, and timeline. The Planning Team reviewed and approved the draft Schedule of Tasks, which outlines what needs to be done and when. The Planning Team also agreed that the process and final plan will include discussion on man-made hazards.

3. **Review Memorandum of Agreement.** The jurisdictions reviewed the draft Memorandum of Agreement and asked for specific names to be removed, keeping only titles, in the event that an individual cannot participate in the future.
4. **Review "capabilities" worksheet.** The Planning Team reviewed the capabilities worksheet and agreed on a due date of January 9th, 2015 for the worksheet to be returned to the Planning Department.
5. **Set next meeting date.** 5:30 p.m., Thursday, January 29th, 2015.
6. **Adjourn.** The meeting adjourned at 6:08 p.m.

Reported by:

Rebecca Kerwin, Planner II

DRAFT



COUNTY OF DOOR

Planning Department

County Government Center
421 Nebraska Street
Sturgeon Bay, WI 54235
Phone: (920) 746-2323
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Emergency Services

Emergency Services Building
319 South 18th Avenue
Sturgeon Bay, Wisconsin 54235
Phone: (920) 743-5461
FAX: (920) 743-4917

FOR IMMEDIATE RELEASE

CONTACT:

Rebecca Kerwin
Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
(920) 746-2323

Door County Planning and Emergency Services Departments Kick-Off the Door County Hazard Mitigation Plan

Sturgeon Bay, WI, December 12, 2014 – Door County recently kicked-off a multi-jurisdictional hazard mitigation planning process, headed up by the Door County Emergency Services and Planning Departments. The plan will be developed in compliance with Federal Emergency Management Agency (FEMA) guidelines for a multi-jurisdictional hazard mitigation plan. The county's five incorporated municipalities (City of Sturgeon Bay and Villages of Egg Harbor, Ephraim, Forestville, and Sister Bay) have agreed to participate in the development of this plan, as well as other county departments and outside agencies with an interest in disaster management. This planning team will evaluate and assess risk from both natural and human-induced disasters and develop countywide mitigation strategies. Smaller area meetings will also be held to include unincorporated areas, at which participants will develop jurisdictional mitigation strategies, if needed. Issues such as incompatible land uses, protection of critical facilities, and reduction of community and taxpayer costs associated with disasters will be addressed during development of mitigation strategies.

Door County is one of only two counties in the state that does not have a hazard mitigation plan in place. Having such a plan enables municipalities to apply for both pre- and post-disaster hazard mitigation funding from FEMA. Earlier this year, Emergency Services applied for and received grant funding from FEMA to develop a plan and subsequently selected the Planning Department to draft it. Per terms of the grant, Door County is required to have a final draft submitted to FEMA by the end of January 2016. More information regarding the plan may be found on the Planning Department's Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

Please contact Becky Kerwin at (920) 746-2327 or rkerwin@co.door.wi.us with any questions or inquiries regarding how to get involved in the planning process.

-END-

Door County Hazard Mitigation Plan

Planning Team Meeting

Thursday, January 29, 2015

5:30 – 7:00 p.m.

Peninsula Room, First Floor
Door County Government Center
421 Nebraska Street
Sturgeon Bay, Wisconsin

Agenda

1. Open meeting
2. Review state hazard mitigation goals and hazard profiles
3. Discuss local capabilities
4. Handout base maps and discuss asset identification
5. Set next meeting date
6. Adjourn

Door County Hazard Mitigation Plan

Planning Team Meeting Minutes
Thursday, January 29, 2015

1. Open meeting/introductions.

The second Planning Team meeting for the development of the Door County Hazard Mitigation Plan was held in the Peninsula Room, Door County Government Center, 421 Nebraska Street, Sturgeon Bay, Wisconsin, on Thursday, January 29th, 2015. The meeting started at approximately 5:30 p.m. Note that the agenda, Powerpoint presentation, and summary of municipal capabilities are posted to the Hazard Mitigation Planning Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

Present:

- Door County
 - o Keith Kasbohm, Director, Airport
 - o Tony Luchini, Deputy Director, Emergency Services
 - o Tom Haight, Land Information Officer, Information Systems
 - o Planning
 - Mariah Goode, Director
 - Becky Kerwin, Planner II
 - o Rhonda Kolberg, Director, Public Health
- City of Sturgeon Bay, Community Development – Matt Olejniczak, Director
- U.S. Coast Guard – Brian O'Neil, Safety Manager
- Ministry Door County Medical Center – Steve Schwenke, Safety Manager

2. **Review state hazard mitigation goals and objectives.** Becky Kerwin gave a Powerpoint presentation regarding the state hazard mitigation plan goals. The historical natural hazard events identified in this plan have occurred in Door County.

3. **Discuss local capabilities.** A participant received a summary of the capabilities worksheets, with individual worksheets for each municipality, except for the Village of Ephraim, completed and returned to the Planning team. The Planning team is to review these documents and provide the Planning Department with any comments.

4. **Handout base maps and delineate assets and critical infrastructure.** Base maps showing countywide assets and critical infrastructure were laid out. Base maps were created for each incorporated municipality, as well as the southern, central, and northern areas of the county. Instructions for updating these maps were also handed out. Meeting participants reviewed the base maps and discussed ideas for updating and improving them. The municipalities are responsible for reviewing their maps and returning them to the Planning Department by February 27, 2015.

5. **Set next meeting date.** 5:30 p.m., Tuesday, March 31, 2015.

6. **Adjourn.** The meeting adjourned at approximately 6:30 p.m.

Reported by:

Rebecca Kerwin, Planner II

**Door County Hazard Mitigation Plan
Planning Team Meeting
Tuesday, April 28th, 2015
3:00-4:30 p.m.**

Peninsula Room, First Floor
Door County Government Center
421 Nebraska Street
Sturgeon Bay, Wisconsin

Agenda

1. Open meeting/introductions
2. Review/approve minutes from September 30th, 2014 and January 29th, 2015 meetings
3. Presentation on natural and human-induced hazards
4. Review/discuss **DNR** redevelopment and remediation information
5. Review/discuss infrastructure and hazardous materials/sites maps
6. Conduct risk assessment
7. Discuss mitigation strategies
8. Set next meeting date
9. Adjourn

Door County Hazard Mitigation Plan

Planning Team Meeting Minutes

Tuesday, April 28th, 2015

1. Open meeting/introductions.

The third Planning Team meeting for the development of the Door County Hazard Mitigation Plan was held in the Peninsula Room, Door County Government Center, 421 Nebraska Street, Sturgeon Bay, Wisconsin, on Tuesday, April 28th, 2015. The meeting started at approximately 3:00 p.m. Note that the agenda and Powerpoint presentation are posted to the Hazard Mitigation Planning Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

Present:

- Door County
 - Emergency Services
 - Dan Williams, Director
 - **Tony Luchini, Deputy Director**
 - Tom Haight, Land Information Officer
 - John Teichtler, Director, Sanitarian
 - Steve Delaware, Sheriff, Sheriff's Department
 - Planning
 - Mariah Goode, Director
 - Becky Kerwin, Planner II
- City of Sturgeon Bay, Community Development - Marty Qiczak, Director

2. Review/approve minutes from the January 29th, 2015 meetings. MSC Williams/Luchini to chair.
3. Review state hazard mitigation goals and hard profiles. Planner Kerwin gave a PowerPoint presentation summarizing the natural hazards that have occurred in Door County. She also covered the Door County Hazard Mitigation Plan and the Federal Emergency Management Agency's (FEMA) Great Lakes Coastal Study, Lake Michigan regarding potential future potential hazards.
4. Review/talk about DNR remediation information. During the PowerPoint presentation, planning staff members handed out information from the Wisconsin Department of Natural Resources' Bureau of Development and Remediation's (BRRTS) Web site regarding definitions for activity types and activities that have occurred in Door County since 1973. Activities are broken out by incorporated municipality, as well as for unincorporated areas, and are available on the planning department's Web site. Summaries of the top ten activity types countywide and activity types by municipality are provided in the PowerPoint presentation, also available on the Web site.
5. Review/Discuss infrastructure and hazardous materials/sites maps. Meeting participants reviewed the draft "Facilities/Infrastructure and Hazardous Materials" maps that were initially reviewed at the January 29th meeting and since updated. A new set of maps entitled "Contamination Sites, Hazardous Materials Storage, and Groundwater Concerns Areas" were also reviewed and discussed.
6. Conduct Risk Assessment. Planning staff members handed out a risk assessment evaluation form based on the form provided within the state's "A Resource Guide to All Hazards Mitigation Planning in Wisconsin." Meeting participants decided to rank the "hazard frequency" and "hazard probability" ranking categories as a group. For hazards that received a ranking higher than "1" for future probability, planning staff members will research other ranking criteria listed within the form regarding magnitude and economic losses. The hazards that received a ranking higher than "1" for future probability are:

- lightening and thunderstorms (2)
- HazMat roadway (2)
- HazMat waterway (2)
- loss of electrical system (2)
- nuclear power plant" (2)
- water supply contamination for private systems (3)

The risk assessment worksheet responses for all hazards that were ranked at the meeting are available on the Planning Department's Web site.

7. **Set next meeting date.** Planning staff members will send out a Doodle poll to set the next meeting date.
8. **Adjourn.** The meeting adjourned at approximately

From: Kerwin, Rebecca
Sent: Wednesday, July 08, 2015 12:25 PM
To: ALESON, ERIK; Birmingham, Thad; 'Brent Bristol'; Brett Belanger; Brian O'Neil; ddschwanson@wisconsinpublicservice.com; DELARWELLE, STEVE; GOODE, MARIAH; Haight, Tom; Jane Olson (Jolson@ephraim-wi.sconsin.com); 'johnJ.sehn@uscg.mil'; 'jsmith@villageofeggharbor.org'; 'jvanlieshout@villageofeggharbor.org'; Kasbohm, Keith; KOLBERG, RHONDA; KOLODZIEJ, JOHN; KREBSBACH, JOE; Lienau, David; 'lohnesorge@villageofeggharbor.org'; Luchini, Anthony; 'MaryAnn Salmon'; McNeil, Stephen; 'Mike Mccutcheon'; 'Nick Cluppert'; Olejniczak, Marty; SPRITKA, WAYNE; 'sshallow@ephraim-wisconsin.com'; TEICHTLER, JOHN; 'Terry McNulty'; WILLIAMS, DAN; 'Zeke.Jackson@sisterbaywi.gov'
Subject: Door County Hazard Mitigation Plan - DRAFT Risk Assessment Chapter

Hello, Hazard Mitigation Planning Team -

The draft risk assessment chapter (text and maps) for the Door County Hazard Mitigation Plan is now posted to our Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>. Please review and email me any comments by **Friday, July 31st**. In approximately two weeks, you will be also be receiving draft mitigation strategies for your review and comment.

Please contact me with any questions.

Thank you,

Becky

Rebecca Y. Kerwin, AICP
Planner II
Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
Ph: (920) 746-2323
Email: rkerwin@co.door.wi.us

From: Kerwin, Rebecca
Sent: Wednesday, July 29, 2015 1:40 PM
To: ALESON, ERIK; Birmingham, Thad; 'Brent Bristol'; Brett Belanger; dds완son@wisconsinpublicservice.com; DELARWELLE, STEVE; GOODE, MARIAH; Haight, Tom; Jane Olson (Jolson@ephraim-wisconsin.com); JohnJ.sehn@uscg.mil'; 'jsmith@villageofeggharbor.org'; 'jvanlieshout@villageofeggharbor.org'; Kasbohm, Keith; KOLBERG, RHONDA; KOLODZIEJ, JOHN; KREBSBACH, JOE; Lienau, David; 'lohnesorge@villageofeggharbor.org'; Luchini, Anthony; 'MaryAnn Salmon'; McNeil, Stephen; 'Mike Mccutcheon'; 'Nick Cluppert'; Olejniczak, Marty; SPRITKA, WAYNE; 'sshallow@ephraim-wisconsin.com'; TEICHTLER, JOHN; 'Terry McNulty'; WILLIAMS, DAN; 'Zeke.Jackson@sisterbaywi.gov'
Subject: Door County Hazard Mitigation Plan - Draft Risk Assessment and Mitigation Strategies Chapters

Hello, Hazard Mitigation Planning Team -

Just a reminder that comments regarding the draft risk assessment chapter of the Door County Hazard Mitigation Plan are due back to me this Friday, July 31st. The draft risk assessment chapter (chapter 2) is posted on the Planning Department's Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

Also posted to the Web site is the draft mitigation strategies chapter for your review and comment (chapter 3). These draft action items are based on hazard mitigation plans from Manitowoc, Iron, Racine, and Shawano Counties. The Manitowoc County plan was used because it is current (2014) and because of proximity to Door County. The Iron, Racine, and Shawano County plans were used because they included both natural and non-natural hazards and are also relatively current. **Please send me your comments on the mitigation strategies by Friday, August 14th.**

As always, feel free to contact me with any questions. Thank you!

Becky

Rebecca Y. Kerwin, AICP
Planner II
Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
Ph: (920) 746-2323
Email: rkerwin@co.door.wi.us

From: Kerwin, Rebecca
Sent: Friday, August 14, 2015 11:12 AM
To: ALESON, ERIK; Birmingham, Thad; 'Brent Bristol'; Brett Belanger; dds완son@wisconsinpublicservice.com; DELARWELLE, STEVE; GOODE, MARIAH; Haight, Tom; Jane Olson (Jolson@ephrain-wisconsin.com); 'john.j.sehn@uscg.mil'; 'jsmith@villageofeggharbor.org'; 'jvanlieshout@villageofeggharbor.org'; Kasbohm, Keith; KOLBERG, RHONDA; KOLODZIEJ, JOHN; KREBSBACH, JOE; Lienau, David; 'lohneshorge@villageofeggharbor.org'; Luchini, Anthony; 'MaryAnn Salmon'; McNeil, Stephen; 'Mike Mccutcheon'; 'Nick Cluppert'; Olejniczak, Marty; SPRITKA, WAYNE; 'sshallow@ephrain-wisconsin.com'; TEICHTLER, JOHN; 'Terry McNulty'; WILLIAMS, DAN; 'Zeke.Jackson@sisterbaywi.gov'
Subject: Door County Hazard Mitigation Plan - Comments re: Draft Chapters

Hello, Hazard Mitigation Planning Team –

A last reminder to get me any comments regarding the Door County Hazard Mitigation Plan draft chapters and associated maps by **Tuesday, August 18th**. The Risk Assessment and Mitigation Strategies chapters, and associated maps, can be found on our Web site at [http://map.eo.door.wi.us/planning/Hazard-Mitigation-Plan .htm](http://map.eo.door.wi.us/planning/Hazard-Mitigation-Plan.htm). I am in the process of finalizing these chapters in preparation for the town-level meetings, which will be held in late September. Later next week, you will receive a press release with the dates/times and locations for these meetings.

Thank you,

Becky

Rebecca Y. Kerwin, AICP
Planner II
Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
Ph: (920) 746-2323
Email: rkerwin@co.door.wi.us



FOR IMMEDIATE RELEASE

CONTACT:

Rebecca Kerwin
Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
(920) 746-2323

Door County Planning and Emergency Services Departments to Hold Open House Meetings Regarding the Door County Hazard Mitigation Plan

Sturgeon Bay, WI, August 19, 2015 – The Door County Planning and Emergency Services Departments are in the process of developing a multi-jurisdictional hazard mitigation plan in compliance with Federal Emergency Management Administration (FEMA) requirements. Having a hazard mitigation plan certified by FEMA enables municipalities to apply for both pre- and post-disaster hazard mitigation funding. Under the guidance of a planning team, draft risk assessment and mitigation strategies chapters have been developed to address both natural and non-natural hazards. Municipal-level meetings, described below, have been scheduled in order to present these draft chapters to and gather input from local officials, public administrators, and the general public.

- **Monday, September 21st, 4 – 6pm**, Forestville Town Hall in Maplewood, 7705 County Hwy. H
- **Monday, September 28th, 4 – 6pm**, Peninsula Room, Door County Government Center, 421 Nebraska St., Sturgeon Bay
- **Tuesday, September 29th, 4 – 6pm**, Egg Harbor Town Hall, 5242 County Hwy. I

There will be a short presentation at approximately 4:15 p.m., repeated again around 5:15 p.m. Participants will have the opportunity to review and comment on the risk assessment chapter, which describes natural and non-natural hazards that have occurred in the county in the past, and hazards that may potentially affect the county in the future. Maps associated with the risk assessment chapter showing facilities/infrastructure, hazardous material storage and contamination sites, and groundwater concern areas will be available for review and comment. Participants will also have the opportunity to review the mitigation strategies chapter, which includes specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from the impact of hazards.

These documents and maps may be found on the Planning Department's Website at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm> or viewed at the Planning Department during regular business hours (8:00 a.m. - 4:30 p.m., Monday - Friday). Comments regarding the plan may be submitted at any time by e-mail to rkerwin@co.door.wi.us, by FAX to (920) 746-2387, or by mail to Door County Planning Department, 421 Nebraska Street, Sturgeon Bay, WI 54235. Please contact Becky Kerwin at (920) 746-2323 or rkerwin@co.door.wi.us with any questions or inquiries regarding how to get involved in the planning process.

-EiN(),ppendix A: Planning Process Documents



YOU ARE INVITED!

Door County

Hazard Mitigation Plan

Open House Meetings

All local officials, public administrators, and the general public are encouraged to attend an open house meeting regarding the draft Door County Hazard Mitigation Plan.

Please see the reverse side for more details.

- Monday, September 21st, 4 – 6pm, Forestville Town Hall in Maplewood, 7705 County Hwy. H
- Monday, September 28th, 4 – 6pm, Peninsula Room, Door County Government Center, 421 Nebraska St., Sturgeon Bay
- Tuesday, September 29th, 4 – 6pm, Egg Harbor Town Hall, 5242 County Hwy. I

Door County Hazard Mitigation Plan Open House Meetings

- **Monday, September 21st 4 – 6pm**, Forestville Town Hall in Maplewood, 7705 County Hwy. H
- **Monday, September 28th, 4 – 6pm**, Peninsula Room, Door County Government Center, 421 Nebraska St., Sturgeon Bay
- **Tuesday, September 29th, 4 – 6pm**, Egg Harbor Town Hall, 5242 County Hwy. I

Agenda

1. Open meeting (4:00)
2. Overview: Hazard mitigation plan development process (4:15 - 4:30)
3. Public review and input regarding plan (4:30 - 5:15)
4. Overview: Hazard mitigation plan development process (5:15 - 5:30)
5. Public review and input regarding plan (5:30 - 6:00)
6. Adjourn (6:00)

Door County Hazard Mitigation Plan
Open House Meeting
4 – 6pm, Monday, September 21, 2015
Forestville Town Hall in Maplewood, 7705 County Hwy. H

Minutes

Present

Door County:

- Emergency Management Services - Dan Williams, Director
- Planning
 - o Mariah Goode, Director
 - o Becky Kerwin, Planner

Others:

- Village of Forestville: Terry McNulty, President
 - Town of Forestville: Ruth Kerscher, Clerk and Dena Schmidt, Town Treasurer
 - o Residents: David Gaworek and Larry Huber
 - Town of Union: Gale Guilette, Plan Commission Chair
 - Kewaunee County Emergency Management: Tracy Nollenberg
1. **Open meeting.** Planner Kerwin opened the meeting at 4:00 p.m. by welcoming everyone and inviting them to review the draft plan maps prior to the presentation starting at 4: 15 p.m. The following documents were available for review or handed out at the meeting and are also posted on the Planning Department's Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.
 - meeting agenda
 - presentation
 - summary of municipal capabilities
 - Chapter 2, Risk Assessment
 - Chapter 3, Mitigation Strategies
 - Maps for Northern Door, Central Door, Southern Door, City of Sturgeon Bay, and Villages of Egg Harbor, Ephraim, Forestville, and Sister Bay:
 - o Facilities/Infrastructure, Hazardous Materials, and Flood Zone
 - o Contamination Sites, Hazardous Material Storage, and Groundwater Concern Areas.
 2. **Overview: Hazard mitigation plan development process.** At 4:15 p.m., Planner Kerwin gave a presentation regarding the hazard mitigation plan development process. She then invited participants to review and comment on the draft risk assessment and mitigation strategies chapters, as well as the maps.
 3. **Public review and input regarding plan.** Participants reviewed and commented on the documents described above 1. Comments and subsequent changes made or responses from PlanninQ Department staff members are listed at the end of these minutes.

4. **Overview: Hazard mitigation plan development process.** At approximately 5:15 p.m., Planner Kerwin gave the same presentation and invitation to review/comment on the documents provided as described above in 2.
5. **Public review and input regarding plan.** Participants reviewed and commented on the documents described above in 1. Comments and subsequent changes made or responses from Planning Department staff members are listed at the end of these minutes.
6. **Adjourn.** The meeting adjourned at approximately 6:00 p.m.

Comments:

- Drain field behind Holy Name of Mary Church, Co. H, is not identified on map. Ruth Kerscher. *Note: Since the Maplewood wastewater treatment plant is identified and other drainfields around the county have not been identified, this change was not made.*
- Add communications warning siren @ fire station for Village of Forestville; Map 2.14. Terry McNulty. *Note: A "communications-related" symbol for the siren was added to the map.*
- Village of Forestville "vulnerable population" is now a privately owned apartment complex; Map 2.14. Terry McNulty. *Note: The "vulnerable population" symbol for this apartment complex was deleted.*
- Should fuel storage be noted @ NW corner of CTH J + STH 42? Terry McNulty. *Note: A "fuel storage" symbol was added for this property.*
- Add a fireworks storage site in Maplewood. Larry Huber. *Note: completed.*
- The Southern Door Map 2.3, Contamination Sites, Hazardous Materials Storage, and Groundwater Concern Areas, needs a blow-up of the Maplewood area. *Note: completed.*
- The mitigation action items need to be numbered. *Note: completed.*
- Chapter 2, Risk Assessment, should include a description noting that the groundwater concern areas are due to physical features of the land, not the land use occurring on the surface. *Note: The criteria used for developing groundwater concern areas is described in Chapter 2.*

Respectfully Submitted,

Rebecca Kerwin

Door County Hazard Mitigation Plan Open House Meeting

4 - 6pm, Monday, September 28, 2015

Peninsula Room, Door County Government Center, 421 Nebraska St., Sturgeon Bay

Minutes

Present

Door County:

- Emergency Management Services - Dan Williams, Director
- Information Systems - Tom Haight, Land Information Officer
- Planning
 - o Mariah Goode, Director
 - o Becky Kerwin, Planner

Others:

- City of Sturgeon Bay: Marty Olejnik, Community Development Director
- Town of Egg Harbor: David Enigl, County and Town Board Supervisor
- Town of Forestville: Roy Englebert, County Board Supervisor and Town Board Chair;
Monica Nelson, Plan Commission Chair
 - o Resident: David Gaworek
- Town of Gardner: Bob Batal, Plan Commission Chair; Wally Butz, Plan Commission Member

1. **Open meeting.** Planner Kerwin opened the meeting at 4:00 p.m. by welcoming everyone and inviting them to review the draft plan maps prior to the presentation starting at 4:15 p.m. The following documents were available for review or handed out at the meeting and are also posted on the Planning Department's Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

- meeting agenda
- presentation
- summary of municipal capabilities
- Chapter 2, Risk Assessment
- Chapter 3, Mitigation Strategies
- Maps for Northern Door, Central Door, Southern Door, City of Sturgeon Bay, and Villages of Egg Harbor, Ephraim, Forestville, and Sister Bay:
 - o Facilities/Infrastructure, Hazardous Materials, and Flood Zone
 - o Contamination Sites, Hazardous Material Storage, and Groundwater Concern Areas.

2. **Overview: Hazard mitigation plan development process.** At 4:15 p.m., Planner Kerwin gave a presentation regarding the hazard mitigation plan development process. She then invited participants to review and comment on the draft risk assessment and mitigation strategies chapters, as well as the maps.
3. **Public review and input regarding plan.** Participants reviewed and commented on the documents described above 1. Comments and subsequent changes made or responses from Planning Department staff members are listed at the end of these minutes.
4. **Overview: Hazard mitigation plan development process.** At approximately 5:15 p.m., Planner Kerwin gave the same presentation and invitation to review/comment on the documents provided as described above in 2.
5. **Public review and input regarding plan.** Participants reviewed and commented on the documents described above in 1. Comments and subsequent changes made or responses from Planning Department staff members are listed at the end of these minutes.
6. **Adjourn.** The meeting adjourned at approximately 6:00 p.m.

Comments:

- Incorrect WPS gas line shown in industrial park – it now follows Neenah Ave from new WPS regulator station north. *Note: A current GIS shapefile was requested from WPS on 10/01/2015.*
- Remove "cable network" symbol from assets and infrastructure map. *Note: completed.*
- Landfills are missing in the Town of Egg Harbor. *Note: An enlarged map of the Town of Egg Harbor was sent to Dave Enigl on 9/30/2015 for him to identify the landfills so that the Planning Department can map them.*

Respectfully Submitted,

Rebecca Kerwin

Door County Hazard Mitigation Plan Open House Meeting

4 – 6pm, Tuesday, September 29, 2015
Egg Harbor Town Hall, 5242 County Hwy. I

Minutes

Present

Door County:

- Emergency Management Services - Dan Williams, Director
- Planning
 - o Mariah Goode, Director
 - o Becky Kerwin, Planner

Others:

- Village of Egg Harbor: Michelle Anderson, Deputy Clerk
- Village of Ephraim: Brent Bristol, Zoning Administrator; Jane Olson, Trustee
- Village of Sister Bay: Zeke Jackson, Administrator; Patrick Johnson, Operator; Michael Schell, Operations Supervisor
- Town of Jacksonport: Randy Halstead, County Board Supervisor and Town Board Chair
- Town of Sevastopol: Linda Wait, Clerk

1. **Open meeting.** Planner Kerwin opened the meeting at 4:00 p.m. by welcoming everyone and inviting them to review the draft plan maps prior to the presentation starting at 4:15 p.m. The following documents were available for review or handed out at the meeting and are also posted on the Planning Department's Web site at <http://map.co.door.wi.us/planning/Hazard-Mitigation-Plan.htm>.

- meeting agenda
- presentation
- summary of municipal capabilities
- Chapter 2, Risk Assessment
- Chapter 3, Mitigation Strategies
- Maps for Northern Door, Central Door, Southern Door, City of Sturgeon Bay, and Villages of Egg Harbor, Ephraim, Forestville, and Sister Bay:
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2. **Overview: Hazard mitigation plan development process.** At 4:15 p.m., Planner Kerwin gave a presentation regarding the hazard mitigation plan development process. She then invited participants to review and comment on the draft risk assessment and mitigation strategies chapters, as well as the maps.
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5. **Public review and input regarding plan.** Participants reviewed and commented on the documents described above in 1. Comments and subsequent changes made or responses from Planning Department staff members are listed at the end of these minutes.
6. **Adjourn.** The meeting adjourned at approximately 6:00 p.m.

Comments:

- Village of Sister Bay – add hazardous chemical storage at municipal well sites. *Note: completed.*
- Town of Jacksonport – add a closed landfill site. *Note: completed.*

Respectfully Submitted,

Rebecca Kerwin

DOOR COUNTY HAZARD MITIGATION PLAN

Door County Hazard Mitigation Plan

Appendix B

MEMORANDUM OF AGREEMENT FOR A MULTI-JURISDICTIONAL DOOR COUNTY HAZARD MITIGATION PLAN

I. Purpose

A Memorandum of Agreement (MOA) is hereby executed between the "Participating Jurisdictions", as listed below, for the development of the Door County Hazard Mitigation Plan (Plan).

- Door County
- City of Sturgeon Bay
- Village of Egg Harbor
- Village of Ephraim
- Village of Forestville
- Village of Sister Bay

The purpose of this MOA is to establish commitment from and a cooperative working relationship between all Participating Jurisdictions in the development and implementation of the Door County Hazard Mitigation Plan. In addition, the intent of this MOA is to ensure that the multi-jurisdictional hazard mitigation plan is developed in accordance with Title 44 of the Federal Code of Regulations (CFR) Part 201.6; that the planning process is conducted in an open manner involving community stakeholders; that it is consistent with each Participating Jurisdiction's policies, programs and authorities; and it is an accurate reflection of the community's values.

This MOA sets out the responsibilities and identifies the work to be performed by the Participating Jurisdictions. Planning tasks, schedules, and finished products are identified in the attached Schedule of Tasks. The Plan created as a result of this MOA will be presented for adoption to the governing body (Board of Supervisors, City Council, or Village Board) of each Participating Jurisdiction.

II. Background

Door County has received a grant from the Federal Emergency Management Agency to prepare a multi-jurisdictional hazard mitigation plan in accordance with 44 FEMA requirements at 44.C.F.R. 201.6. Hazard mitigation plans form the foundation for a community's long-term strategy to reduce losses from disaster and to break the cycle of damage, reconstruction, and repeated damage. The Participating Jurisdictions in a mitigation planning process may benefit by:

- identifying cost effective actions for risk reduction;
- directing resources on the greatest risks and vulnerabilities;
- building partnerships by involving people, organizations, and businesses;
- increasing education and awareness of hazards and risk;
- aligning risk reduction with other community objectives; and
- providing eligibility to receive federal hazard mitigation grant funding.

III. Planning Team Responsibilities

Door County will act as the Lead Agency. The Participating Jurisdictions authorize Door County to manage and facilitate the planning process in accordance with the attached Schedule of Tasks. The Participating Jurisdictions understand that representatives must engage in the following planning process, as more fully described in the Local Mitigation Planning Handbook (FEMA, 2012), including, but not limited to:

- Develop/approve the Schedule of Tasks with the Planning Team
- Attend regular meetings of the Planning Team and any applicable sub-county meetings.
- Assist the Planning Team with developing and conducting an outreach strategy to involve other stakeholders and the public, in order to appropriately represent the Jurisdiction.

- Provide data and feedback to develop the risk assessment and mitigation strategy, including a specific mitigation action plan for the Jurisdiction.
- Submit drafts of plan to the Jurisdiction for review.
- Work with the Planning Team to incorporate Jurisdiction comments into the draft plan.
- Submit the draft plan to their respective governing body for consideration and adoption.
- After adoption, coordinate a process to monitor, evaluate, and work toward plan implementation.

IV. Planning Team

The participants listed below are authorized on behalf of the governing bodies to participate as members of the Planning Team for the Door County Hazard Mitigation Plan.

- Door County
 - Emergency Services – Director, Deputy Director
 - Planning Department – Director, Planner II
- City of Sturgeon Bay – Mayor, Administrator, Director of Community Development
- Village of Egg Harbor – President, Administrator
- Village of Ephraim – President, Administrator
- Village of Forestville – President, Administrator
- Village of Sister Bay – President, Administrator

V. MOA Implementation

This MOA will be in effect from the date of signature by all parties, will remain in effect through the duration of the planning process, and will terminate after adoption of the final FEMA-approved mitigation plan by all participating jurisdictions, or 5 years after FEMA approval, whichever is earlier. It may be terminated prior to that time by any Participating Jurisdiction giving 30 days written notice. This MOA is to be implemented through the attached Schedule of Tasks.

Signature: _____

Date: _____

Name and Title: _____

Don Williams, Emergency Services Director

Municipality: _____

DOOR COUNTY

VI. Attachment

Schedule of Tasks

- Provide data and feedback to develop the risk assessment and mitigation strategy, including a specific mitigation action plan for the Jurisdiction.
- Submit drafts of plan to the Jurisdiction for review.
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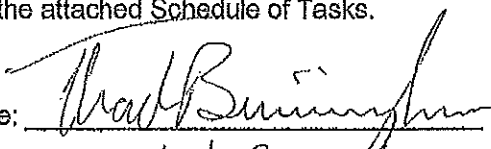
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Signature:  Date: 11/14/14

Name and Title: Chad Birmingham, Mayor

Municipality: City of Sturgeon Bay

VI. Attachment

Schedule of Tasks

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- Submit drafts of plan to the Jurisdiction for review.
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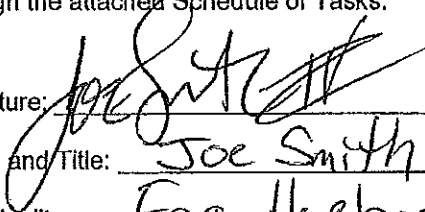
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Signature: 

Date: 10-15-14

Name and Title: Joe Smith, President

Municipality: Egg Harbor Village

VI. Attachment

Schedule of Tasks

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Signature: [Signature] Date: 8-25-15
 Name and Title: MEMCUTCHEON MD PRES. Bd OF TRUSTEES
 Municipality: EPHRAIM

VI. Attachment

Schedule of Tasks

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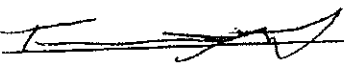
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Signature:  Date: 10/10/14

Name and Title: Terry McNulty, President

Municipality: Village of Forestville

VI. Attachment

Schedule of Tasks

- Provide data and feedback to develop the risk assessment and mitigation strategy, including a specific mitigation action plan for the Jurisdiction.
- Submit drafts of plan to the Jurisdiction for review.
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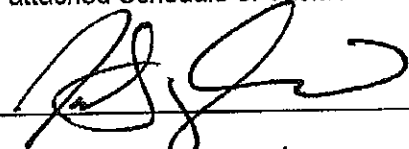
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- Village of Ephraim – President, Administrator
- Village of Forestville – President, Administrator
- Village of Sister Bay – President, Administrator

V. MOA Implementation

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Signature:  Date: 10/9/14
 Name and Title: ZEE JACKSON, ADMINISTRATOR
 Municipality: SISTER BAY

VI. Attachment

Schedule of Tasks

Door County Hazard Mitigation Plan

Appendix C

SUMMARY OF MUNICIPAL CAPABILITIES

Note: The county and municipalities will review the Door County Hazard Mitigation Plan when updating the plans and ordinances listed below in order to identify any opportunities for integrating this plan into other planning mechanisms. The county and municipalities will also post this plan on their individual Web sites with instructions on how the public may comment.

Door County

Planning and Regulatory

Plans:

- Comprehensive and farmland preservation plan 2035
- Capital improvements plan (2005 – 2009)
- Economic development plan (2005)
- Local emergency operations plan (2012)
- Continuity of operations plan (Emergency Services and Public Health)
- Transportation plan (2012)
- Continuity of Operations Plan (for county buildings)

Land Use Planning and Ordinances

- Zoning ordinance
- Subdivision ordinance
- Floodplain ordinance, flood insurance rate maps
- Land division ordinance, stormwater runoff control for major land divisions

Administrative and Technical

Administration

- Planning commission
- Emergency Services committee, mitigation planning
- Tree trimming (highway department?)
- Mutual aid agreements (Door County Emergency Operations Plans)
- Emergency manager

Staff

- Floodplain zoning administrators
- Emergency manager
- Community planner
- GIS coordinator

Technical

- Hazard data and information
- Grant writing
- Warning systems/services (CodeRed)
- Reverse 911

Financial (funding resources)

- Capital improvements project funding
- Incur debt through general obligation bonds and/or special tax bonds
- Community development block grant
- Other federal funding programs
- State funding programs

Education and Outreach

- Door County Public Health
- Door County Sheriff's Department
- United Way
- Local Emergency Planning Committee (educates the community on hazardous materials located throughout the community)

City of Sturgeon Bay

Planning and Regulatory

Plans:

- Comprehensive plan (2010)
- Capital improvements plan (2014)
- Economic development plan (2005)
- Local emergency operations plan (2014)
- Transportation plan (2000)
- Stormwater management plan (2005)
- Continuity of Operations Plan (2006)
- Port security plan (2006)

Building Code, Permitting, and Inspections

- State building code
- ISO rating of 3
- Site plan review requirements

Land Use Planning and Ordinances

- Zoning ordinance (includes wellhead protection standards)
- Subdivision ordinance (includes land suitability, cul-de-sac length, water main looping, and other mitigation standards; includes acquisition of land for open space and public recreation uses)
- Floodplain ordinance, flood insurance rate maps
- Stormwater management ordinance (requires new development to reduce runoff to guard against downstream flooding)
- Shoreland Wetland Zoning Code
- Property Maintenance Code

Administrative and Technical

Administration

- Planning commission
- Maintenance programs (Public Works Department and Sturgeon Bay Utilities)
- Mutual aid agreements (Door County Emergency Operations Plans)
- Mutual Aid Box Alarm System division #154 (statewide mutual aid, July 2014)

Staff

- Chief building official
- Floodplain zoning administrator
- Community planner
- Civil engineer
- GIS coordinator
- All city staff is trained in National Incident Management System and Incident Command System 100 & 200

Technical

- Emergency Planning and Community Right-to-Know Act reporting and Fire Department inspection records
- Grant writing
- Outdoor warning systems (six sirens)
- Cable TV warning system

Financial (funding resources)

- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Incur debt through general obligation bonds and/or special tax bonds
- Storm water utility fee
- Incur debt through private activities
- Community development block grant
- Other federal funding programs
- State funding programs

Education and Outreach

- Ham radio operators provide communications during disaster
- Civil Air Patrol and U.S. Coast Guard Auxiliary
- Fire department has ongoing fire safety, household preparedness, and weather emergency programs provided to businesses, schools, etc.
- Fire department prepares and educates schools on disaster plans

Village of Egg Harbor

Planning and Regulatory

Plans:

- Comprehensive plan (2008)
- Capital improvements plan (2015)
- Local emergency operations plan (2014)

Building Code, Permitting, and Inspections

- State building code
- ISO rating of 7
- Site plan review requirements

Land Use Planning and Ordinances

- Zoning ordinance
- Subdivision ordinance
- Floodplain ordinance, flood insurance rate maps
- Public tree removal

Administrative and Technical

Administration

- Planning commission
- Maintenance programs
- Mutual aid agreements

Staff

- Chief building official (part-time)
- Floodplain zoning administrator
- Civil engineer (part-time)

Technical

- Hazard data and information (municipal owned/operated)
- Grant writing

Financial (funding resources)

- Capital improvements project funding
- Fees for water, sewer, gas, or electric services
- Incur debt through general obligation bonds and/or special tax bonds
- Incur debt through private activities
- Community development block grant
- Other federal funding programs (beach/storm water improvement, marina repairs)
- State funding programs (marina repairs)

Education and Outreach

- Ham radio operators provide communications during disaster
- Civil Air Patrol and U.S. Coast Guard Auxiliary
- Fire department has ongoing fire safety, household preparedness, and weather emergency programs provided to businesses, schools, etc.
- Fire department prepares and educates schools on disaster plans

Village of Ephraim

Planning and Regulatory

Plans:

- Comprehensive plan (2009)
- Transportation plan (currently discussing)
- Stormwater design standards (within erosion control ordinance)

Building Code, Permitting, and Inspections

- State building code
- ISO rating of 7

Land Use Planning and Ordinances

- Zoning ordinance
- Subdivision ordinance
- Floodplain zoning ordinance, flood insurance rate maps
- Erosion control ordinance with specific Niagara escarpment language
- Acquisition of land for open space and public recreation uses

Administrative and Technical

Administration

- Planning commission
- Tree trimming and flushing storm sewers annually
- Mutual aid agreements through fire department

Staff

- Zoning/floodplain administrator and community planner
- Fire chief

Technical

- Grant writing

Financial (funding resources)

- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Incur debt through general obligation bonds and/or special tax bonds
- Incur debt through private activities
- Community development block grant
- Other federal funding programs

- State funding programs

Education and Outreach

- Ongoing public education or information programs (fire department gives presentations to Gibraltar and Peninsula Preschools, and at an annual fire station open house)

Village of Forestville

Planning and Regulatory

Plans:

- Comprehensive plan (2010)
- Economic development plan (2010)
- Local emergency operations plan (2014)
- Transportation plan (2010)
- Stormwater management plan (2010)

Building Code, Permitting, and Inspections

- State building code
- ISO rating of 6
- Site plan review requirements

Land Use Planning and Ordinances

- Zoning ordinance
- Subdivision ordinance
- Floodplain zoning ordinance, flood insurance rate maps

Administrative and Technical

Administration

- Planning commission
- Mitigation planning committee
- Mutual aid agreements

Technical

- Outdoor warning siren

Financial (funding resources)

- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Impact fees for new development
- Other federal funding programs (beach/storm water improvement, marina repairs)
- State funding programs (marina repairs)

Village of Sister Bay

Planning and Regulatory

Plans:

- Comprehensive plan (2003)
- Capital improvements plan (2014)
- Economic development plan (2014)

Building Code, Permitting, and Inspections

- State building code
- ISO rating of 4/5 (hydrants/1,000' beyond hydrants)
- Site plan review requirements

Land Use Planning and Ordinances

- Zoning ordinance
- Subdivision ordinance
- Natural hazard specific ordinance (bluff protection)
- Acquisition of land for open space and public recreation uses
- Flood insurance rate maps

Administrative and Technical

Administration

- Planning commission
- Maintenance programs
- Mutual aid agreements

Staff

- Chief building official (part-time)
- Community planner

Technical

- Limited outdoor warning capacity

Financial (funding resources)

- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Impact fees for new development
- Incur debt through general obligation bonds and/or special tax bonds
- Incur debt through private activities
- Community development block grant?
- Other federal funding programs
- State funding programs

Education and Outreach

- Sister Bay & Liberty Grove Fire Fighters Association
- Northern Door First Responders Association
- Open house at fire station