County of Milwaukee
Office of Emergency Management

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4 Milwaukee County Hazard Mitigation Plan 2016

Published 9/26/2016 07:31 by John Rogan

4.1 Introduction and Overview

Published 9/26/2016 07:41 by John Rogan

MILWAUKEE COUNTY, WISCONSIN

HAZARD MITIGATION PLAN

PREPARED BY:

MILWAUKEE COUNTY HAZARD MITIGATION STEERING COMMITTEE

MILWAUKEE COUNTY OFFICE OF EMERGENCY MANAGEMENT

MILWAUKEE COUNTY COMMUNITIES

ADOPTED [INSERT DATE]

BY THE MILWAUKEE COUNTY BOARD OF SUPERVISORS

I. Introduction and Overview

The Milwaukee County Hazard Mitigation Plan is intended to provide strategies for reducing susceptibility to future damage to public and private infrastructure in the county. The procedures utilized in preparing this plan are based on guidance provided by Federal Emergency Management Agency (FEMA) and Wisconsin Emergency Management (WEM) and should therefore be considered consistent with the requirements and procedures in the Disaster Mitigation Act of 2000.

Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-228, as amended) is the impetus for involvement of state and local governments in evaluating and mitigating natural hazards as a condition of receiving federal disaster assistance. The Federal Emergency Management Agency has rules in 44 CFR Part 206 Subpart M for implementing Section 409.

Section 409 states that the county is obligated to try to reduce any hazard that has received relief funding in the past. Developing a hazard mitigation plan provides an opportunity for communities to meet this requirement by developing strategies for reduction of potential losses from future natural disasters. Hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people and property from hazards and their effects. Completion of this plan should put Milwaukee County in an advantageous position when competing for pre- and post-disaster mitigation project dollars because projects have been pre-identified. The cooperation of government, private and volunteer agencies is essential in mitigation efforts and over the long term it is hoped that implementation of this plan will save taxpayer dollars because less money is needed for post-disaster recovery activities. Furthermore, mitigation planning measures incorporated in economic or community development goals support more comprehensive and effective government. This plan evaluates the risks that all natural hazards pose to the citizens and property of Milwaukee County by presenting:

- A profile and analysis of past hazardous events
- An assessment of vulnerability of community assets
- Potential hazard mitigation strategies
- Methods for building community support and ensuring plan adoption

Plan Overview

The Milwaukee County Hazard Mitigation Plan provides background information on Milwaukee County and identifies those hazards that have occurred or could occur in the county. It includes a description of each hazard, its frequency of occurrence, appropriate actions in case of emergency and possible steps to mitigate the hazard. These hazards are the basis for the development of all county emergency plans.

A well-prepared plan allows emergency management to act swiftly and efficiently in the event of a hazard, reducing the damage and the cost incurred from displacing residents and businesses. Hazard mitigation activities will be emphasized in the plan as a major component of overall emergency management. The plan is intended to provide strategies for reducing future damages to public and private infrastructure in the county, including flood damage.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element D Plan Review, Evaluation, and Implementation (UPDATES ONLY)
  - D1. Was the Plan revised to reflect changes in development? 44 CFR 201.6(d)(3)
    - D1.1. Changes in development in hazard prone areas that increased or decreased the vulnerability of each jurisdiction
    - D1.2. If no changes in development impacted the jurisdiction's vulnerability, validate the information in the previous plan

4.2 Executive Summary

Published 4/6/2017 12:15 by Leah Redding

Overview

The Federal Emergency Management Agency (FEMA) local mitigation planning handbook (March 2013) provides a doctrinal foundation to understand the importance of mitigation activities and the mitigation planning process. FEMA description of hazard mitigation:

> *Disasters can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard mitigation reduces disaster damages and is defined as sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Outreach programs that increase risk awareness, projects to protect critical facilities, and the removal of structures from flood hazard areas are all examples of mitigation actions. Local mitigation actions and concepts can also be incorporated into land use plans and building codes.*

Stafford Act

The Stafford Act, amended by the Disaster Mitigation Act of 2000 (DMA 2000), is designed "to reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters." Section 322 of the Act, is focused on mitigation planning and the requirements of state and local governments to prepare multi-hazard mitigation plans as a requirement for for receiving FEMA mitigation project grants.

A county mitigation plan must be updated at least once every five years in order to maintain eligibility for FEMA hazard mitigation project grant funding. Regulation at 44 CFR §201.6(d) (3) reads:

> *A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.*

Milwaukee County Office of Emergency Management (OEM)

In 2016 the Office of Emergency Management (OEM) started the five year mitigation review process; this process was finalized in early 2017. Milwaukee County OEM is committed to using the 2016 plan as more of a five year strategic plan anchoring a mitigation program. This mitigation strategic plan and programmatic process is designed to increase the effectiveness of the mitigation activities in Milwaukee County and enable a more efficient update process for 2021.

Review of the 2011 Milwaukee County Mitigation Plan

The 2011 Milwaukee County Pre-Disaster Hazard Mitigation Plan is a 197 page word document that was created by Milwaukee County Emergency Management in collaboration with the 18 Milwaukee suburbs. The City of Milwaukee was not included in the plan and created a separate plan for the city. The purpose of the plan is to analyze the hazards that affect Milwaukee County, which areas are historically most vulnerable to them, and to engage municipal stakeholders in a dialogue to implement projects that will minimize these risks. The 2011 plan gives a brief summary of Milwaukee County, it's demographics, general land trends, weather data, and historical disasters. The plan has six planning sections followed by a list of tables, maps, and five appendices. Each of the 18 Milwaukee County municipalities filled out hazard assessments of their own areas, which were used in addition to historical hazard data to calculate the county's risk for all hazards. This information was used by each municipality to focus in on community projects that could help mitigate this risk.

Summary of the 2016 Milwaukee County Mitigation Plan

The 2016 Milwaukee County Pre-Disaster Hazard Mitigation Plan is the result of a collaboration between the Milwaukee County Office of Emergency Management and Integrated Solutions Consulting, using their Knowledge Management System to house the new plan, a copy of the old plan, and administrative information for stakeholders. The first part of this plan gives a detailed community profile of Milwaukee County: features of its land, infrastructure, and population. The second piece of the plan includes separate sections for all hazards that could impact Milwaukee, which includes

descriptions of these hazards and historical records of when and where they have hit the county. Most importantly, these sections contain a lists of mitigation projects for each municipality, including what projects have been completed since the last plan and timelines for new projects. This format makes it easier for stakeholders to update their project lists, critical facilities, etc., before five years passes.

Updates to the 2011 Version Contained in the 2016 Milwaukee County Mitigation Plan

Because disasters know no borders, hazard mitigation plans are only effective when locals who know their area and it's history participate in the county-wide plan. The 2016 Milwaukee County Pre-Disaster Hazard Mitigation Plan enhanced the participation and cooperation between county and local entities by increasing the usability and ease with which municipalities could review and edit the plan. The old word document format made it hard for participants to find relevant sections and created multiple versions of the same document when they did update their section. There were no changes to the plan since the 2011 update because of this process. **The 2016 plan prioritizes jurisdictional participation**, hence the last piece of the plan separates the 18 municipalities into sections, each containing a specific local hazards analysis and vulnerability information.This new process allows users to get directly to the section they want to edit, while also keeping track of changes and comments made on every section. The new planning system makes Milwaukee County's hazard mitigation plan a living document, encouraging continuous updating which helps fulfill the purpose of the plan: to be relevant and useful during a disaster, no matter when it hits on the FEMA update timeline. Other updates in the 2016 include:

- The addition to hazard list: rail transportation incident
- Specific GIS maps of every municipality
- Detailed demographic and NFIP information on every municipality
- Detailed record of historical severe weather events dating back 65 years
- Hazard analysis done by Milwaukee County experts and tweaked to fit specific jurisdictions

Milwaukee County Mitigation Project 2017-2021

The Milwaukee County Mitigation Plan and Program 2016-2021 is a designed as a more proactive and consistent strategic and programmatic approach. The intent of the program is not to wait five years to update the 2016 plan for the directed 2021 plan update deadline.

- Milwaukee County Office of Emergency Management (OEM) forms and maintains a County/Municipal Mitigation Steering Committee
- Mitigation Steering Committee meets once a year for five years: 2017, 2018, 2019, 2020, and 2021. The focus on the 2021 meeting is to complete the review, modification, and update of the 2016 plan.
- County OEM coordinates and organizes five public meetings; at a minimum; one a year from 2017-2021.
- County OEM provides public information on the importance of mitigation planning and activities to private sector, non-profit, and community-based organizations.
- County OEM implements its Knowledge Management System (KMS) to make available for on-line continual review and comment the 2011 and 2016 mitigation plans and the 2021 plan under-development. The KMS Mitigation Steering Committee Workgroup organizes the administration of the committee and public meetings.

The combination of an active Mitigation Steering Committee, public meetings, and the KMS making the 2011, 2016, and 2021 (under development) available increases the effectiveness of the plan (and program) maintenance process. FEMA Mitigation Handbook describes plan maintenance:

“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.

- Ensure that the mitigation strategy is implemented according to the plan.
- Provide the foundation for an ongoing mitigation program in your community.
- Standardize long-term monitoring of hazard-related activities.
- Integrate mitigation principles into community officials’ 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 revise them as needed."

Conclusion

Milwaukee County OEM is the organization responsible for coordinating the mitigation planning process for County. County OEM requires active participation in the planning process from County and Municipal organizations; private and non-profit organizations; and the general public. Nationally, large-scale public, private, and non-profit participation in the mitigation planning process has been challenging. Milwaukee County OEM is going to coordinate a bi-annual effort, at a minimum, to promote mitigation planning and activities and strategically organize the County's mitigation program. We look forward to your active participation.

4.3 Plan Adoption

Published 4/6/2017 10:35 by Leah Redding

II. Plan Adoption

Milwaukee County, Wisconsin

Pre-Disaster Mitigation Plan

Plan Update:

Year: 2016-2017

Prepared for:

Milwaukee County Office of Emergency Management

9501 W. Watertown Plank Road, Milwaukee, WI 53226

Standard:

- ***Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element E: Plan Adoption***
  - ***After FEMA issues their "meets requirements" letter, each participating jurisdiction must adopt the Plan within one year and submit an adoption resolution to WEM and FEMA for final plan approval.***
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Prerequisites
  - 1. Adoption by the Local Governing Body; Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).
    - 1.A. Has the local governing body adopted new or updated plan?
    - 1.B. Is supporting documentation, such as a resolution, included?

4.3.1 Promulgation and Adoption

Published 5/25/2017 12:30 by Leah Redding

***Waiting on FEMA approval. This page will be updated when approval letters are received.**

When the plan is approved by FEMA, a resolution adopting the plan will be put on publicly-posted agendas for the county board and every participating municipality for review and adoption. Links to those documents will be posted in** Appendix A: Notice of Endorsement & Adoption ***when they are approved and received.

Wisconsin Emergency Management Approval

- WEM Plan Submittal

FEMA Approval

- FEMA Plan approval (contingent on Milwaukee County adoption)
- FEMA Plan Review Tool
- FEMA Formal Approval (after County adoption)

Milwaukee County Adoption

- MC Executive Order

4.4 Plan Development & Planning Process

Published 9/26/2016 07:45 by John Rogan

III. Plan Development & Planning Process

All citizens and businesses of Milwaukee County are the ultimate beneficiaries of this hazard mitigation plan update. The plan reduces risk for those who live in, work in, and visit the County. It provides a viable planning framework for the foreseeable hazards that may impact the County. Participation in development of the plan by key stakeholders in the County helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

This sections provides the efforts undertaken to develop/update the Plan, and a detailed description of the process.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process
  - A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
    - A1.1. Schedule or timeframe of activities that made up the Plan's development

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
  - 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
    - 4.A. Does the plan provide a narrative description of the process followed to prepare the new or updated plan?
    - 4.F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?

4.4.1 The Previous Plan

Published 12/23/2016 11:38 by Leah Redding

2011 Hazard Mitigation Plan

The Milwaukee County All Hazard Mitigation Plan was approved in 2011. It contains information relative to the hazards and vulnerabilities facing Milwaukee County, Wisconsin. The jurisdictions participating in the previous Plan included those incorporated jurisdictions within the County.

As a requirement of the Disaster Mitigation Act of 2000, this plan is updated every five years.

Ongoing Planning Efforts

The Milwaukee County Office of Emergency Management has completed and regularly updates the Milwaukee County Hazard Analysis. This Hazard Analysis identifies all likely natural and technological hazards that might or have occurred within the County.

4.4.1.1 Why Update

Published 12/4/2015 09:13 by Daiko Abe

Title 44 of the Code of Federal Regulations (44 CFR) stipulates that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. This provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

4.4.1.2 The Updated Plan and the Key Differences

Published 3/24/2017 10:26 by Leah Redding

The previous plan has been improved for Milwaukee County using the best available data and from feedback by key stakeholders. All participating municipalities were fully involved in the preparation of the plan. The updated plan includes an updated hazard analysis. Mitigation initiatives were reviewed and amended, as appropriate. Emphasis was placed on reducing redundancy and to include those initiatives that were deemed feasible, practical and implementable.

Key changes include, but are not limited to:

- Addition of the **Railroad Transportation Incident** hazard.
- The update recommends nineteen new mitigation initiatives and 53 updated mitigation actions that are either in-progress or are ongoing.
- The plan also documents 17 completed mitigation actions since the last update.
- Mitigation project sections are separated by municipality.
- Hazard assessment and mapping is separated by municipality.
- Detailed GIS maps of Milwaukee County were added to community profile sections.

4.4.2 Plan Organization

Published 9/26/2016 09:23 by John Rogan

Test update -

This plan includes all federally required elements of a disaster mitigation plan:

- A description of the planning process
- The public involvement strategy
- A list of goals and objectives
- A countywide hazard risk assessment
- Countywide mitigation initiatives
- A plan maintenance strategy

The following appendices include information or explanations to support the main content of the plan:

- Appendix A: Notice of Endorsement & Adoption
- Appendix B: Public Outreach & Participation
- Appendix C: Mitigation Project Examples
- Appendix D: Federal Funding Sources and Programs
- Appendix E: Benefit-Cost Analysis Guidance
- Appendix F: Acronyms and Definitions

All planning partners will adopt the plan in its entirety.

4.4.3 Plan Use

Published 12/4/2015 08:44 by Daiko Abe

The Plan should be used to help County and participating City officials plan, design, and implement programs and projects that will help reduce the jurisdictions vulnerability to natural, technological, and man-made hazards. The Plan should also be used to facilitate inter- jurisdiction coordination and collaboration related to all hazard mitigation planning and implementation within the County and at the Regional level. Lastly, the Plan should be used to develop or provide guidance for local emergency response planning. If adopted, this Plan will achieve compliance with the Disaster Mitigation Act of 2000 (DMA 2000).

4.4.4 Plan Purpose

Published 12/9/2015 15:47 by Daiko Abe

The primary focus of the Plan is to evaluate the County's potential exposure to natural and manmade disasters and identify appropriate mitigation strategies.

The purposes of this Plan are to:

- Fulfill Federal and local mitigation planning responsibilities
- Promote pre- and post-disaster mitigation measures with short/long range strategies to minimize suffering, loss of life, impact on traditional culture, and damage to property and the environment
- Eliminate or minimize conditions that would have an undesirable impact on the people, culture, economy, environment, and well-being of the County at large.
- Enhance elected officials', departments', and the public's awareness of the threats to the community's way of life, and of what can be done to prevent or reduce the vulnerability and risk.

4.4.5 Scope

Published 12/4/2015 08:48 by Daiko Abe

Although DMA 2000 only requires local governments to address natural hazards, the County decided it was imperative to address all hazards, including technological and political hazards.

4.4.6 Legal Authority

Published 12/9/2015 12:40 by Daiko Abe

Federal legislation has historically provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest legislation to improve this planning process (Public Law 106-390). The new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, DMA 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

Section 322 of DMA 2000 specifically addresses mitigation planning at the state and local levels. It identifies new requirements that allow HMGP funds to be used for planning activities, and increases the amount of HMGP funds available to states that have developed a comprehensive, enhanced mitigation plan prior to a disaster. States and communities must have an approved mitigation plan in place prior to receiving post-disaster HMGP funds. Local and tribal mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to and the capabilities of the individual communities.

FEMA prepared an Interim Final Rule, published in the Federal Register on February 26, 2002 (44 CFR Parts 201 and 206), which establishes planning and funding criteria for states and local communities. For disasters declared after November 1, 2004 a local government must have a Local Hazard Mitigation Plan (LHMP) approved per section 201.6, in order to receive Federal HMGP project grants.

4.4.7 The Planning Area: Participating Jurisdictions and Organizations

Published 4/6/2017 11:52 by Leah Redding

The Milwaukee County Hazard Mitigation Plan is a multi-jurisdictional plan that encompasses all incorporated and unincorporated jurisdictions within the County.

All participating jurisdictions in Milwaukee County were actively involved in the planning process.

- The steering committee included representation from the different jurisdictions in the County.
- Invitations and meeting notices were sent to representatives from participating jurisdictions and associated groups.
- Jurisdictional representatives were given the opportunity to comment real-time with the plan development process via the online planning system
- Additional follow-up contacts were made with local jurisdictions and their representatives, as needed. In September 2015, a request to review mitigation actions/projects was issued to the various jurisdictions and their representatives.

The planning area was defined to consist of all of Milwaukee County. All partners to this plan have jurisdictional authority within this planning area. Adopting resolutions for all of the jurisdictions are in Appendix A: Notice of Endorsement & Adoption.

Participating Jurisdictions			
No	**Jurisdiction**	**Involvement**	**Authority to Regulate Development**
01	Milwaukee County: Department of Administration, Department of Transportation, General Mitchell International Airport, Parks Department	Mitigation Steering Committee Leadership; Mitigation Actions/Projects	Yes
02	Bayside Village	Mitigation Actions/Projects	Yes
03	Brown Deer Village	Steering Committee Member; Mitigation Actions/Projects	Yes
04	Cudahy City	Steering Committee Member; Mitigation Actions/Projects	Yes
05	Fox Point Village	Steering Committee Member; Mitigation Actions/Projects	Yes
06	Franklin City	Steering Committee Member; Mitigation Actions/Projects	Yes
07	Glendale City	Steering Committee Member; Mitigation Actions/Projects	Yes
08	Greendale Village	Mitigation Steering Committee Leadership; Mitigation Actions/Projects	Yes
09	Greenfield City	Steering Committee Member; Mitigation Actions/Projects	Yes
10	Hales Corners Village	Mitigation Actions/Projects	Yes
11	Milwaukee City	Steering Committee Member	Yes
12	Oak Creek City	Steering Committee Member; Mitigation Actions/Projects	Yes
13	River Hills Village	Steering Committee Member; Mitigation Actions/Projects	Yes
14	Shorewood Village	Mitigation Actions/Projects	Yes
15	South Milwaukee City	Mitigation Steering Committee Leadership; Mitigation Actions/Projects	Yes
16	St. Francis City	Mitigation Actions/Projects	Yes
17	Wauwatosa City	Steering Committee Member; Mitigation Actions/Projects	Yes
18	West Allis City	Steering Committee Member; Mitigation Actions/Projects	Yes
19	West Milwaukee Village	Mitigation Steering Committee; Mitigation Actions/Projects	Yes
20	Whitefish Bay Village	Steering Committee Member; Mitigation Actions/Projects	Yes
21	MMSD	Steering Committee Member	Yes

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard; Element A: Planning Process
  - A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
    - A1.3. List of participating jurisdictions
    - A1.5. How each jurisdiction was involved
  - A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate

development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)

- A2.1. List of stakeholders: local and regional agencies that take part in hazard mitigation activities
- A2.2. List of stakeholders: agencies that have the authority to regulate development
- A2.3. List of stakeholders: neighboring communities
- A2.5. How each stakeholder was involved

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Prerequisites
  - 2. Multi-Jurisdictional Plan Adoption; Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
    - 2.A. Does the new or updated plan indicate the specific jurisdictions represented in the plan?
  - 3. Multi-Jurisdictional Planning Participation; Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
    - 3.A. Does the new or updated plan describe how each jurisdiction participated in the plan's development?
    - 3.B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
  - 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
    - 4.D. Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?

4.4.8 The Steering Committee

Published 4/6/2017 11:45 by Leah Redding

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. The Milwaukee County Steering Committee was formed to oversee all phases of the plan. The members of this committee included key members from the participating jurisdictions, planning partner staff and other stakeholders from within the planning area. The table below lists the committee members and other representatives who attended meetings.

Hazard Mitigation Steering Committee Membership & Other Participating Reps							
No	**Jurisdiction**	**Organization**	**Name**	**Title**	**Steering Committee and Plan Involvement**	**Membership Start Date**	**Membership End Date**
01	Bayside	PD	Scott McConnell	Chief	• Engaged via online planning system	21-Oct-16	
02	Brown Deer	DPW FD	Matthew Maederer Michael Kass	Director Chief	• Engaged via online planning system and meetings	21-Oct-16	
03	Cudahy	FD	Daniel Mayer Rob Schmidt	Chief Battalion Chief	• Engaged via online planning system and meetings	21-Oct-16	
04	Fox Point	DPW FD	Christopher Freedy Scott Brandmeier	Chief Director	• Engaged via online planning system and meetings	21-Oct-16	
05	Franklin	FD	Adam Remington	Chief	• Engaged via online planning system and meetings	21-Oct-16	
06	Glendale	Inspection Services/ Floodplain admin.	Collin Johnson	Director	• Engaged via online planning system and meetings	21-Oct-16	
07	Greendale	DPW FD	Robbie McFaul Tim Saidler	Director Chief	• Engaged via online planning system and meetings	21-Oct-16	
08	Greenfield	FD DPW DPW	Jon Cohn John Laskoski Jeffrey Katz	Chief Assistant-superintendent	• Engaged via online planning system and meetings	21-Oct-16	
09	Hales Corners	FD	Eric Cera Paul Brantman	Chief	• Engaged via online planning system and meetings	21-Oct-16	
10	Oak Creek	FD	Tom Rosandich	Chief	• Engaged via online planning system and meetings	21-Oct-16	

11	River Hills	DPW	Kurt Frederickson	Director	• Engaged via online planning system and meetings	21-Oct-16	
12	Shorewood	PD	Peter Nimmer	Chief	• Engaged via online planning system	21-Oct-16	
13	South Milwaukee	HD FD	Jackie Ove Joe Knitter	Director Chief	• Engaged via online planning system and meetings	21-Oct-16	
14	St. Francis	FD DPW	Frank Lockwood Melinda Dejewski	Chief Director	• Engaged via online planning system and meetings	21-Oct-16	
15	Wauwatosa	FD DPW	Robert Ugaste Bill Wehrley	Chief Director	• Engaged via online planning system and meetings	21-Oct-16	
16	West Allis	FD City FD DPW HD	Steve Bane Rebecca Grill Jay Scharfenberg Chris St. Clair Dan Koralewski	Chief City Administrator Assistant Chief Director	• Engaged via online planning system and meetings	21-Oct-16	
17	West Milwaukee	PD	Dennis Nasci	Chief	• Engaged via online planning system and meetings	21-Oct-16	
18	Whitefish Bay	DPW	John Edlebeck	Director	• Engaged via online planning system and meetings	21-Oct-16	
21	Milwaukee County	-DAS Risk Management -DAS Facilities Management -DAS Facilities Management -Deputy Director of Ops -GMIA -GMIA -Parks	-Ken Kuehn -Jeremy Theis -Karl Stave -Tom Statsny -Kyle Mirehouse -Erika Payne -John Nelson	- Director Architect Deputy Director of Ops EM Coordinator Program Safety Manager Safety/training Manager	• Engaged via online planning system and meetings	21-Oct-16	
22	Milwaukee County	Office of Emergency Management	• Leah Redding • Carl Stenbol • Christine Westrich	• EM Coordinator • EM Division Manager • OEM Director	• Lead on 2016 plan update • Helped to coordinate meetings and edit material • Reviewed plan	21-Oct-16	

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard; Element A: Planning Process
  - A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
    - A1.2. List of individuals involved
    - A1.4. List of representatives from each jurisdiction (person's position/title and agency)
  - A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)
    - A2.1. List of stakeholders: local and regional agencies that take part in hazard mitigation activities
    - A2.4. List of representatives for each stakeholder involved (person's position/title and agency or organization)
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
  - 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
    - 4.B. Does the new or updated plan indicate who was involved in the current planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)
    - 4.D. Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?

4.4.9 Organization/Agency Coordination and Participation

Published 11/22/2016 14:33 by Leah Redding

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)). This task was accomplished by the planning team as follows:

Steering Committee Involvement — Agency representatives were invited to participate on the Steering Committee.

Key Stakeholder Interviews -- The stakeholder interviews obtained input from many local stakeholders with insight into hazards and potential projects. See The Steering Committee for a list of stakeholders interviewed. Agency representatives (see list of agencies below) were also contacted and interviewed/consulted regarding specific flooding, planning and zoning, transportation, and community-related questions.

Agency Notification — Agencies and organizations throughout the County were invited to participate in the plan development process from the beginning and were kept apprised of plan development milestones.

The following agencies/organizations were informed of key planning meetings. Agency/organization representatives were also invited to participate via the online planning system and were given the opportunity to review, comment and suggest revisions to the plan.

- Milwaukee County Office of Emergency Management
- Milwaukee County Department of Administration
  - Risk Management
  - Facilities Management
  - Land Information Office
- Milwaukee County Parks
- Milwaukee County Department of Transportation
  - Highway Maintenance
  - Fleet Management and Transit Services
- General Mitchell International Airport
- Milwaukee Metropolitan Sewerage District
- Bayside
  - Police Department
- Brown Deer
  - Police Department
  - Department of Public Works
- Cudahy
  - Fire Department
- Fox Point
  - Police Department
  - Department of Public Works
- Franklin
  - Fire Department
- Glendale
  - Department of Administration
  - Inspection Services
- Greendale
  - Fire Department
  - Department of Public Works
- Greenfield
  - Fire Department
  - Department of Public Works
- Hales Corners

    - Police Department
- Oak Creek
    - Fire Department
- River Hills
    - Village Government
    - Department of Public Works
- Shorewood
    - Police Department
- South Milwaukee
    - Health Department
- St. Francis
    - Fire Department
- Wauwatosa
    - Fire Department
- West Allis
    - Fire Department
    - Public Health
    - City Government
- West Milwaukee
    - Police Department
- Whitefish Bay
    - Village Government
    - Department of Public Works

Pre-Adoption Review

Key agencies and stakeholders were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan on the web site and Online Planning System. Each agency was sent an e-mail message (or invite to the Online Planning System) informing them that draft portions of the plan were available for review.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard; Element A: Planning Process
    - A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)
        - A2.1. List of stakeholders: local and regional agencies that take part in hazard mitigation activities

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
    - 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
        - 4.D. Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?

4.4.10 Public Involvement

Published 4/6/2017 11:48 by Leah Redding

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The strategy for involving the public in this plan emphasized the following elements:

- Attempt to reach as many planning area citizens as possible using multiple media.
- Identify and involve planning area stakeholders.

Standard

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process

- A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
  - A1.5. How each jurisdiction was involved
  - A1.A Recommended documentation: narrative description, meeting agendas and sign-in sheets, meeting minutes, newspaper articles, copies of letters or surveys distributed.
- A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)
  - A2.5. How each stakeholder was involved
- A3. Does the Plan document how the public was involved in the planning process during the drafting stage? 44 CFR 201.6(b)(1) and (c)(1)
  - A3.1. How the public was given the opportunity to be involved (must be prior to final approval/adoption)
  - A3.2. How public feedback was incorporated into the Plan

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Prerequisites

- 3. Multi-Jurisdictional Planning Participation; Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
  - 3.A. Does the new or updated plan describe how each jurisdiction participated in the plan's development?

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.

-
  - ***4.C. Does the new or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)***
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
  - ***3. For multi-jurisditctional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.***
    - ***3.A. Does the new or updated plan describe how each jurisdiction participated in the plan's development?***
    - ***3.B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?***
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.
  - 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
    - 4.C. Does the new or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Plan Maintenance Process
  - 18. Monitoring, Evaluating, and Updating the Plan; Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
    - 18.C. Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?
    - 18.B. Does the new or updated plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e. the responsible department)?
    - 18.A. Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department?

- 19. Incorporation into Existing Planning Mechanisms; Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.
  - 19.A. Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
  - 19.B. Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
  - 19.C. Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
- 20. Continued Public Involvement; Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
  - 20.A. Does the new or updated plan explain how continued public participation will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)

4.4.10.1 Stakeholders and the Steering Committee

Published 3/27/2017 08:25 by Leah Redding

Stakeholders are the individuals, agencies and jurisdictions that have a vested interest in the recommendations of the hazard mitigation plan, including planning partners. The effort to include stakeholders in this process included stakeholder participation on the Milwaukee County Steering Committee. Stakeholders were encouraged to attend and participate in all committee meetings.

The Steering Committee agreed to meet two times or as needed throughout the course of the plan's development. Meetings were facilitated at each Steering Committee meeting, which addressed a set of objectives based on the work plan established for the plan.

The Steering Committee met twice in November, and certain jurisdictions set up individual online meetings with OEM. Meeting agendas, notes and attendance logs can be found in Appendix B of this document. All Steering Committee meeting times and locations were put into the planning system work group and sent via e-mail with follow-up phone calls as needed.

The planning team made a presentation at the first Steering Committee meeting on October 21st, 2016 to introduce the mitigation planning process. The Steering Committee, planning partners and public all were encouraged to participate in the plan update process. Key meeting objectives were as follows:

- Provide an overview of the Disaster Mitigation Act.
- Describe the reasons for a plan.
- Outline the work plan.
- Outline planning partner expectations.
- Seek commitment to the planning partnership.
- Affirm expectations for the update

Standard

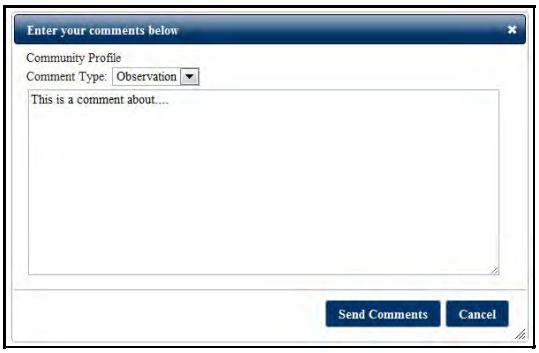
Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process

- A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
    - A1.1. Schedule or timeframe of activities that made up the Plan's development

4.4.10.2 Online Planning System and Workgroup Management Tool

Published 4/10/2017 11:56 by Leah Redding

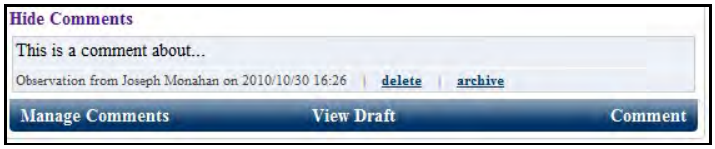
Online Planning System and Workgroup Management Tool



Comments can be used to encourage collaboration for plan maintenance. The **Comments** tool allows the user to make comments on any page within the manual and mark the comment as an observation or feedback. Comments for pages will be visible to all administrators and users who have editing privileges for the specific page.

To make a comment, click on the **Comment** link on the bottom of content page and a pop-up box will appear. Use the drop-down box to designate whether the comment is a **Feedback** or an **Observation.** After entering the comment, click the **Send Comments** button to submit.

The comment will appear after the page refreshes (if user is allowed to view comments). An email notification will be sent to users who are able to receive comment notification. To view the comment, click the **Show Comments** link at the bottom of the manual page.



The following are important points to remember about comments on shared pages:

- Comments on the **Shared From** (originating or home) site:
  - All comments will be displayed whether made from the Shared From or Shared To site
  - The homepage (dashboard) will include all comments on pages belonging to the site, whether they were added by the Shared From or Shared To site
  - The **Comments List** (in **System Administration-CEMP Knowledge Base-CEMP Comments**) will include all comments on pages belonging to this site, whether they were added by the Shared From or Shared To site. This page will also display comments for all pages that belong to this site.
- Comments on the **Shared To** (receiving) site:
  - The CEMP page will only display comments made on this site
  - The homepage (dashboard) will include any comments made on this site, whether they were added by the Shared From or Shared To site. This page will also display comments for all pages that belong to this site
  - The **Comments List** (in **System Administration-CEMP Knowledge Base-CEMP Comments**) will include all comments on pages belonging to this site, whether they were added by the Shared From or Shared To site. This page will also display comments for all pages that belong to this site.

Milwaukee County Emergency Management Preparedness Program - Mitigation Steering Committee Feedback and Observation Record				
Comment Page	**Comment**	**Type**	**Contributor**	**Date/Time**
Mitigation Actions Matrix - Jurisdiction and Type	The table describing action prioritization criteria was included in all of the municipal sections and I just copied it into this page at the top.	Observation	Leah Redding	4/3/2017 8:27

Plan Integration	I think that this will be okay, but in a perfect world it would be nice to see a little more description of the process by which other planning mechanisms integrate this data (per C6.1). No changes required, just a comment :-)	Observation	Margaret Zieke	3/31/2017 17:09
Mitigation Actions Matrix - Jurisdiction and Type	Hi Leah, for item C5.5 expected timeframe, I am not seeing the expected timeframe for all of the mitigation items. We have the status, year reviewed/update, and sometimes a end date in the status but I don't see an expected timeframe for all of these items. for item c5.1 I do not see any criteria laid out for action prioritization. Could you please point out where that would be?	Observation	Margaret Zieke	3/31/2017 16:00
Flooding and Dam Failure Hazard Profile	Noted-- I will change the wording to 1% chance AEP flood on these sections.	Observation	Leah Redding	3/24/2017 17:03
General Community Introduction	Typos have been corrected.	Observation	Leah Redding	3/24/2017 16:54
Fire Service	Good point- I am planning on listing all, just waiting on more accurate information on specific numbers for municipal departments. I should have this by Tuesday.	Observation	Leah Redding	3/24/2017 16:21
Population	Whoops- it should be 65 and older. I have added that in where it was missing.	Observation	Leah Redding	3/24/2107 16:09
Meetings	Understood-- I will add in the links to the "meetings" section, which includes info on attendees and agenda items.	Observation	Leah Redding	3/24/2017 16:03
Political Hazards	If we're not going to have this hazard in the current update, I would recommend leaving it out.	Observation	Margaret Zieke	3/24/2017 14:57
Vulnerability	I also really like what you've done with this section. You've tailored it to be very informative, but still Milwaukee-specific. Awesome	Observation	Margaret Zieke	3/24/2017
Flooding and Dam Failure Hazard Profile	Leah, I really like this section. You've done a great job with incorporating all of the information from different municipalities, historical flood data, and scientific data regarding flooding and flood risk. Plus, the maps are just great. The only suggestion I would make for improvement would be to amend the sentence about the 100-year flood. It has been our experience that when we describe the flood risk as the water level expected once in a hundred years, it makes people think that if a 100-year flood event happened recently, then it won't happen again for another hundred years. Food for thought.	Observation	Margaret Zieke	3/24/2017 14:42
Hazard Summary	"Wisconsin Emergency Management (WEM) completed and regularly updates the State Hazard Mitigation Plan, which was last revised in 2011." Could you please change that date to 2016? the plan was updated while this plan was being written :-)	Observation	Margaret Zieke	3/24/2017 14:00
Public Safety Support	"Approximately 1,600 personnel, staff the" is in red text for some reason. Can we please change that to black? I am curious why the law enforcement departs were listed out with links, but the fire departments were not. For consistency, can we list them out? Additionally, did you mean to say that there are only 25 firefighters on duty each day?	Observation	Margaret Zieke	3/24/2017 13:45

Population	Changing Family Structures section: recommend changing word "kids" to "children" for consistency with the rest of the section Age section: recommend adding a "plus" or "older" after ages. Currently it reads like "The percentage of people age 65 was approximately 13% in 2000". This is repeated a couple times in this section. Are 13% of individuals in Milwaukee County age 65, or aged 65 or older?	Observation	Margaret Zieke	3/24/2017 13:39
General Community Introduction	"Milwaukee came to prominence Manufacturing was very influential in the development and urbanization process in Milwaukee County." Please rephrase this, it reads like the sentence is missing something. Thanks.	Observation	Margaret Zieke	3/24/2017 13:33
Steering Committee Meeting Management	Recommend changing 2nd sentence to read "Members of the Steering continue to have access to this work-group in order to review, comment, and approve the ongoing activities of the committee." This lays out that the plan is a living document and that the steering committee is dedicated to continuing to update it.	Observation	Margaret Zieke	3/24/2017 13:21
Web site/ social media	For consistency, you might want to capitalize "Hazard Mitigation" after the OEM Website link Facebook section: I would recommend changing the sentence to "Reminder statuses were sent out the day before as well as the day of the event" in order to clarify what the sentence is referencing.	Observation	Margaret Zieke	3/24/2017 13:15
The Updated Plan and the Key Differences	Noted-- I will delete that part.	Observation	Leah Redding	3/24/2017 10:24
The Updated Plan and the Key Differences	Hi folks, Recommend either adding more to the line regarding political hazards or taking it out. Feel fragmented.	Observation	Margaret Zieke	3/24/2017 9:48
WEM Mitigation Standard 2015	A.1.1 "Promulgation and Adoption" links to the "Plan Development & Planning Process" section.	Observation	Margaret Zieke	3/24/2017 9:42
Promulgation and Adoption	I would recommend rephrasing your placeholder message. maybe something along the lines of "this page will be updated when WEM and FEMA approval is reached" or something like that.	Observation	Margaret Zieke	3/24/2017 9:39
Fog: Location and Extent	Right you are- I will take down this information for now, as I cannot seem to find the direct source.	Observation	Leah Redding	2/20/2017 14:16
Fog: Location and Extent	Note: The link to the Journal Sentinel does not appear to be operational at this time.	Observation	Katie Sommers	2/20/2017 13:30
Fox Point Hazard Analysis	All other hazards look appropriately classified. I did not change the color of the one I entered.	Observation	Scott Brandmeier	1/06/2017 13:54
South Milwaukee: Mitigation Goals and Objectives	I have reviewed these goals and find they are still relevant to the mitigation projects.	Observation	Jackie Ove	12/16/2016 9:45
South Milwaukee Hazard Analysis	I agree with the Hazard Analysis.	Observation	Jackie Ove	12/16/2016 9:42

Hales Corners Hazard Analysis	The hazard analysis was reviewed and appears to be accurate.	Observation	Paul Brantman	12/09/2016 7:37 pm
Whitefish Bay	John Edlebeck - here is the section I mentioned in the email this morning - thank you for your assistance	Observation	John Rogan	12/08/2016 8:54
Greendale Hazard Analysis	Everything looks accurate.	Observation	Tim Saidler	11/23/2016 11:03
Greenfield Hazard Analysis	Everything looks accurate.	Observation	Jeffrey Katz	11/23/2016 10:53
Risk Assessment-Hazard Summary	The Milwaukee County general hazard summary is now copied into the "Hazard Analysis" section for each municipality. Please look over your section and comment on (or edit) specific hazards that impact your municipality differently than the broader county rating. If everything looks accurate as is, send a comment saying so in your hazard analysis section.	Observation	Leah Redding	11/23/2016 10:35
West Allis Mitigation Projects	For Number Three, If more money was available, we would continue previously design and new projects towards these goals.	Observation	Chris St. Clair	11/11/2016 10:29
West Allis Mitigation Projects	Project Numbers One and Two continue to be on going.	Observation	Chris St. Clair	11/11/2016 10:27
Mitigation Plan Review and Update	Just a reminder to everyone to have a representative sign up for a meeting time on the 11th. Please send me an email or send a comment on here saying whether or not you can make it.	Observation	Leah Redding	11/04/2016 1:45
Brown Deer-Mitigation Projects	Mitigation project 01 is complete.	Observation	Matthew Maederer	10/28/2016 10:42
Bayside	Leah - per our discussion on Friday. Each jurisdiction and organization has a defined section with a designated security role enabling the jurisdiction/organization to review, edit, and publish their section and their section alone. In addition, each jurisdiction/organization is able to review and make comments on all sections and will receive comments from every section.	Observation	John Rogan	10/22/2016 16:40
2016 Mitigation Plan Update-Initial meeting (under group tab)	Milwaukee County Mitigation Plan Steering Committee - please review the agenda for tomorrow's meeting - time and location is in the agenda. The link in this email will take you to the planning system workgroup. In addition and if possible, please go the planning system Home and review your jurisdictional specific section and the 2011 plan.	Observation	John Rogan	10/20/2016 10:07
2016 Mitigation Plan Update-Initial meeting (under group tab)	Leah and Carl - here is a draft agenda for the meeting on Friday., Leah we can review the agenda and email this morning.	Observation	John Rogan	10/20/2016 10:07

2011-Appendix D Critical Facilities	Completed appendix D critical facilities. Please review.	Observation	Leah Redding	10/04/2016 10:22

4.4.10.3 Meetings

Published 3/24/2017 16:06 by John Rogan

Two steering committee meetings, multiple individual online meetings, and one public meeting were held during the update process.

More information is provided in the MC Steering Committee under the Group Tab:

- Initial Planning Meeting: October 21st, 2016
- Second meeting with representatives: November 11th 2016
- Public Meeting: January 26th, 2017
    - Copies of the Executive Summary were made available at the public meeting.

Milwaukee County Steering Committee Meetings:

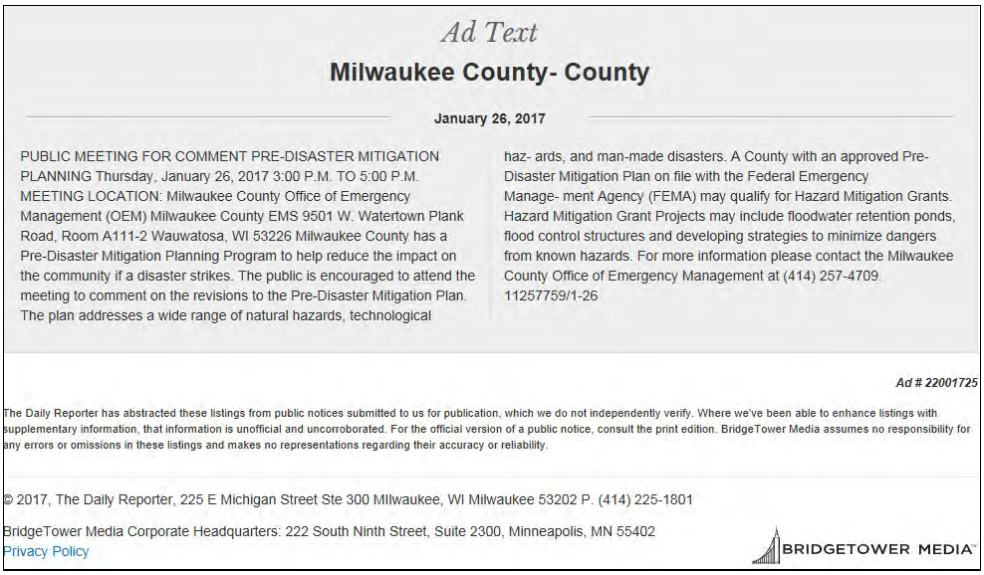
- 2016 Mitigation Plan Update - Initial Meeting 21-Oct-16 - Knowledge Management System (KMS) Milwaukee County Mitigation Steering Committee Workgroup
- 2016 Mitigation Plan Update - Mitigation Plan Review and Update 11-Nov-16 - KMS Milwaukee County Mitigation Steering Committee Workgroup

4.4.10.4 Press Releases and Meeting Notices

Published 1/31/2017 08:35 by Leah Redding

A press release and multiple meeting notices were issued to encourage greater public participation and input into the updated Pre-Disaster Hazard Mitigation Plan.

- http://publicnotices.dailyreporter.com/search/detail.aspx?detail=10964029



Ad Text

Milwaukee County- County

January 26, 2017

PUBLIC MEETING FOR COMMENT PRE-DISASTER MITIGATION PLANNING Thursday, January 26, 2017 3:00 P.M. TO 5:00 P.M. MEETING LOCATION: Milwaukee County Office of Emergency Management (OEM) Milwaukee County EMS 9501 W. Watertown Plank Road, Room A111-2 Wauwatosa, WI 53226 Milwaukee County has a Pre-Disaster Mitigation Planning Program to help reduce the impact on the community if a disaster strikes. The public is encouraged to attend the meeting to comment on the revisions to the Pre-Disaster Mitigation Plan. The plan addresses a wide range of natural hazards, technological haz- ards, and man-made disasters. A County with an approved Pre-Disaster Mitigation Plan on file with the Federal Emergency Manage- ment Agency (FEMA) may qualify for Hazard Mitigation Grants. Hazard Mitigation Grant Projects may include floodwater retention ponds, flood control structures and developing strategies to minimize dangers from known hazards. For more information please contact the Milwaukee County Office of Emergency Management at (414) 257-4709. 11257759/1-26

Ad # 22001725

The Daily Reporter has abstracted these listings from public notices submitted to us for publication, which we do not independently verify. Where we've been able to enhance listings with supplementary information, that information is unofficial and uncorroborated. For the official version of a public notice, consult the print edition. BridgeTower Media assumes no responsibility for any errors or omissions in these listings and makes no representations regarding their accuracy or reliability.

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BRIDGETOWER MEDIA

The public meeting information was also posted on the Milwaukee County website and as an event on Milwaukee County OEM's Facebook page:

- http://county.milwaukee.gov/OEM/EmergencyManagement/HazardMitigation.htm

Office of Emergency Management
Emergency Management
CEMP
Hazard Mitigation
LEPC
Resources
911 Communications
EMS
OASIS

Office of Emergency Management (OEM)
Emergency Management Division

The Milwaukee County Pre-Disaster Mitigation Plan profiles significant hazards to the community and identifies mitigation projects that can reduce their future impacts. The plan promotes sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.

Hazard Mitigation Plan

The updated 2016 Milwaukee Pre-Disaster Mitigation Plan is in the approval process. Join us for our public meeting on Thursday January 26th to review the plan and answer questions:

PUBLIC MEETING FOR COMMENT

Thursday, January 26, 2017,
3:00 P.M. TO 5:00 P.M.

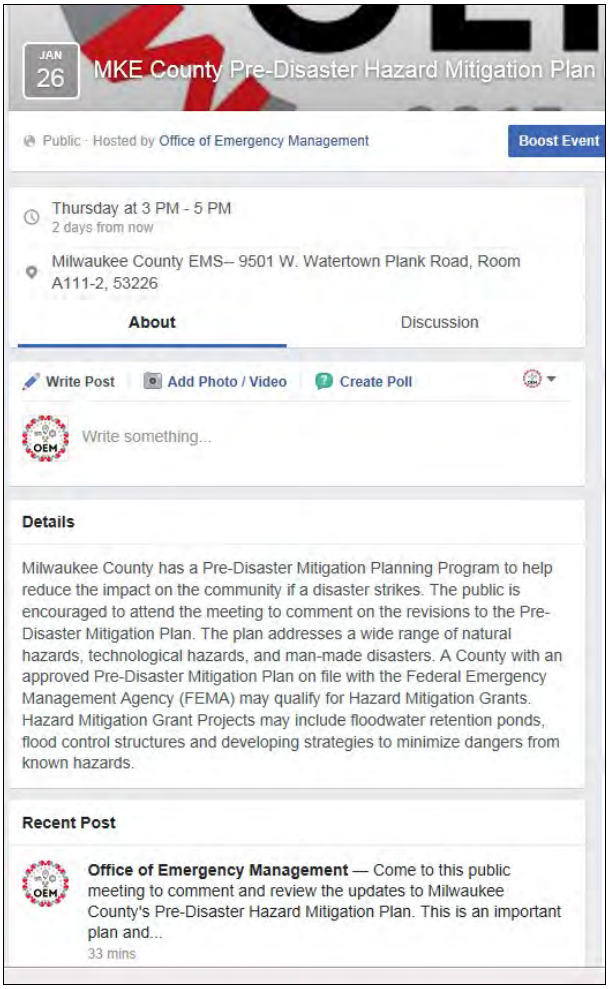
MEETING LOCATION:

Milwaukee County Office of Emergency Management (OEM)
Milwaukee County EMS
9501 W. Watertown Plank Road, Room A111-2
Wauwatosa, WI 53226

Milwaukee County has a Pre-Disaster Mitigation Planning Program to help reduce the impact on the community if a disaster strikes. The public is encouraged to attend the meeting to comment on the revisions to the Pre-Disaster Mitigation Plan. The plan addresses a wide range of natural hazards, technological hazards, and man-made disasters. A County with an approved Pre-Disaster Mitigation Plan on file with the Federal Emergency Management Agency (FEMA) may qualify for Hazard Mitigation Grants. Hazard Mitigation Grant Projects may include floodwater retention ponds, flood control structures and developing strategies to minimize dangers from known hazards.

For more information please contact the Milwaukee County Office of Emergency Management at (414) 257-4709

- https://www.facebook.com/events/974998919300706/


JAN
26
MKE County Pre-Disaster Hazard Mitigation Plan
Public · Hosted by Office of Emergency Management
Boost Event
Thursday at 3 PM - 5 PM
2 days from now
Milwaukee County EMS-- 9501 W. Watertown Plank Road, Room A111-2, 53226
About
Discussion
Write Post
Add Photo / Video
Create Poll
Write something...
Details
Milwaukee County has a Pre-Disaster Mitigation Planning Program to help reduce the impact on the community if a disaster strikes. The public is encouraged to attend the meeting to comment on the revisions to the Pre-Disaster Mitigation Plan. The plan addresses a wide range of natural hazards, technological hazards, and man-made disasters. A County with an approved Pre-Disaster Mitigation Plan on file with the Federal Emergency Management Agency (FEMA) may qualify for Hazard Mitigation Grants. Hazard Mitigation Grant Projects may include floodwater retention ponds, flood control structures and developing strategies to minimize dangers from known hazards.
Recent Post
Office of Emergency Management — Come to this public meeting to comment and review the updates to Milwaukee County's Pre-Disaster Hazard Mitigation Plan. This is an important plan and...
33 mins

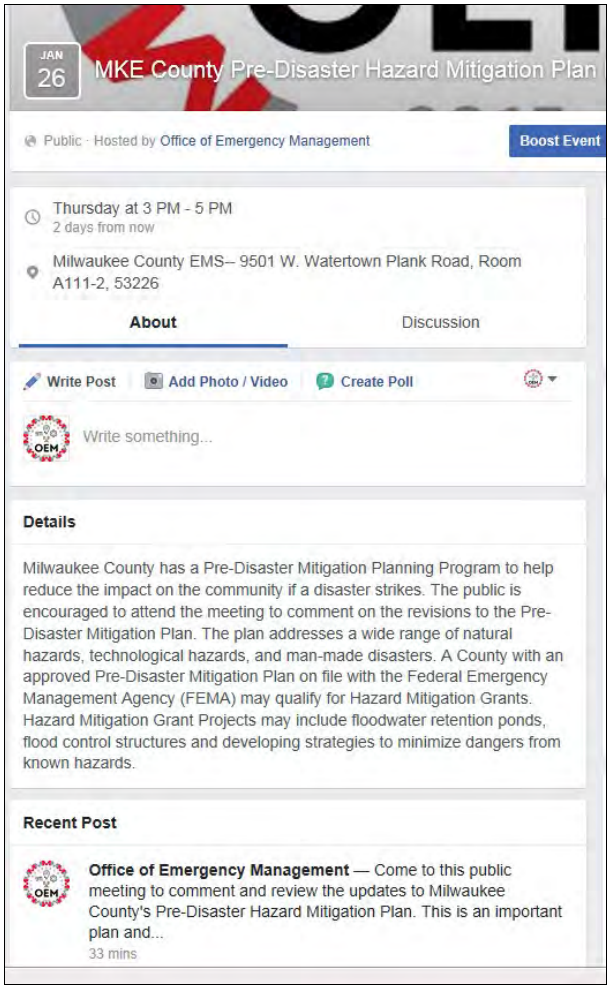
4.4.10.5 Web site/ social media

Published 3/27/2017 08:26 by Leah Redding

The Milwaukee County website and the Milwaukee County OEM Facebook were utilized to make the public meeting information for the updated Hazard Mitigation Plan available to key stakeholders. Once approved, the 2016 plan will also be shared on both on these platforms as a PDF link.

- OEM Website- Hazard Mitigation
  - The information about the public meeting was posted in advance on the Milwaukee County OEM website under the Emergency Management tab, and under the "Hazard Mitigation" sub-tab. The information about the public meeting was placed under the link to the 2011 plan (which will remain until the 2016 plan is approved).
  - 

- Facebook event page
  - Milwaukee County OEM pushed out the public meeting information via a Facebook event. Reminder statuses were sent out the day before and the day of the public meeting.
  - The Executive Summary was posted via Facebook days prior to the meeting.


JAN
26
MKE County Pre-Disaster Hazard Mitigation Plan
Public · Hosted by Office of Emergency Management
Boost Event
Thursday at 3 PM - 5 PM
2 days from now
Milwaukee County EMS-- 9501 W. Watertown Plank Road, Room A111-2, 53226
About
Discussion
Write Post
Add Photo / Video
Create Poll
Write something...
Details
Milwaukee County has a Pre-Disaster Mitigation Planning Program to help reduce the impact on the community if a disaster strikes. The public is encouraged to attend the meeting to comment on the revisions to the Pre-Disaster Mitigation Plan. The plan addresses a wide range of natural hazards, technological hazards, and man-made disasters. A County with an approved Pre-Disaster Mitigation Plan on file with the Federal Emergency Management Agency (FEMA) may qualify for Hazard Mitigation Grants. Hazard Mitigation Grant Projects may include floodwater retention ponds, flood control structures and developing strategies to minimize dangers from known hazards.
Recent Post
Office of Emergency Management — Come to this public meeting to comment and review the updates to Milwaukee County's Pre-Disaster Hazard Mitigation Plan. This is an important plan and...
33 mins

4.4.11 Review of Existing Programs and Plans

Published 4/6/2017 12:08 by Leah Redding

Local comprehensive plans, ordinances, and other pertinent planning documents were reviewed and discussed with the steering committee when available and pertinent. During stakeholder interviews and meetings, participants were asked to identify and consider related plans and ordinances. The results of these discussions were integrated into the appropriate assessment section or recommended strategies which were reviewed by the steering committee, communities, and other stakeholders. A few examples of other planning efforts considered and integrated into this plan include the State Hazard Mitigation Plan and recent studies conducted by the County and its respective departments.

Plan Name	How the Document was Used
2016 Wisconsin Hazard Mitigation Plan	Risk assessment data
2016 National Climatic Data Center- Storm Events Data Base	Historical data for natural hazards
2011 Milwaukee County Hazard Mitigation Plan	Served as the primary framework for the 2016 update
2006 Milwaukee County Land and Water Resources Management Plan	Good demographic, environmental data and mapping

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports, and technical information (44 CFR, Section 201.6(b)(3)). This Plan provides a review of the laws and ordinances in effect within the planning area that can affect hazard mitigation initiatives.

Additionally, there have been plans and ordinances completed by individual Milwaukee County departments or municipalities that are directly and/or indirectly related to the County's overall mitigation efforts. Some of these initiatives were used as reference materials for this plan, and include the following:

Milwaukee County Code of Ordinances

https://www.municode.com/library/wi/milwaukee_county/codes/code_of_ordinances?nodeId=MICOCOGEORVOI_CH1RUCOBOSU

- Chapter 49 - System of Parks and Parkways
- Chapter 44 - Public Works
- Appendix A - Basic Zoning Ordinance
- Mapping provided by the MC Land Information Office

City of Bayside

- Bayside Mitigation Projects
- Storm water Management Plan. Prepared by Bonestoo, Rosene, Anderlik & Associates
- Village of Bayside Comprehensive Plan. Prepared by Kapur & Associates

City of Brown Deer

- Brown Deer Mitigation Projects
- The Village of Brown Deer Comprehensive Plan 2030. Prepared by URS Corporation. 2009.
- Storm water Management Plan. Prepared by Earth-Tech, Environmental Consultants

City of Cudahy

- Cudahy Mitigation Projects
- City of Cudahy 2020 Comprehensive Plan. 2009.
- City of Cudahy Ordinance. Prepared by Common Council.

Village of Fox Point

- Fox Point Mitigation Projects
- The Village of Fox Point 2035 Comprehensive Plan. Graef Anhalt Schloemer and Associates. 2010.
- The Village of Fox Point Flood Damage Prevention Village Code. Prepared by Village Board.
- Storm water Management Plan. Prepared by Earth Tech. April, 1999.

City of Franklin

- Franklin Mitigation Projects
- City of Franklin 2025 Comprehensive Master Plan. Prepared by Graef Anhalt Schloemer and Associates, R.A. Smith National and Cedarburg Science. 2009.

- City of Franklin Ordianance. Prepared by Common Council

City of Glendale

- Glendale Mitigation Projects
- Storm water Management Plan. Prepared by Bonestoo, Rosene, Anderlik & Associates.
- City of Glendale Code of Ordinance. Prepared by Common Council. 2012.

City of Greendale

- Greendale Mitigation Projects

City of Greenfield

- Greenfield Mitigation Projects
- City of Greenfield Comprehensive Plan. 2008.
- City of Greenfield Comprehensive Land Use Plan. City Plan Commission. 2005.

Village of Hales Corners

- Hales Corners Mitigation Projects
- Village of Hales Corners Comprehensive Plan 2025. 2011.
- Village of Hales Corners Notice of Public Hearings. Common Council. 2011.

City of Milwaukee

- Flood Mitigation Plan for the City of Milwaukee. SEWRPC. 2002.

City of Oak Creek

- Oak Creek Mitigation Projects
- Flood Mitigation Plan for the City of Oak Creek- Preliminary Draft. July. SEWRPC. 2003
- The City of Oak Creek Comprehensive Plan. 2000.

Village of River Hills

- River Hills Hazard Mitigation Projects
- The Village of River Hills Comprehensive Plan. 2009.
- Village of River Hills Zoning and Ordinance. Village Board.

Village of Shorewood

- Shorewood Mitigation Projects
- The Village of Shorewood Comprehensive Plan 2030. Ericka Lang. 2011.
- Capacity assurance, Management, Operations and Maintenance. Superior Engineering. 2011.

City of South Milwaukee

- South Milwaukee Mitigation Projects
- City of South Milwaukee Comprehensive Plan 2020. Prepared by HNTB. 2003.
- City of South Milwaukee Ordinance. Common Council.

City of St. Francis

- St. Francis Mitigation Projects
- City of St. Francis Comprehensive Plan. Graef Anhalt Schloemer and Associates. 2003.
- City of St. Francis Ordinance. Common Council.

City of Wauwatosa

- Wauwatosa Mitigation Projects
- City of Wauwatosa Comprehensive Plan 2008-2030. Vandewalle and Associates. 2008.
- Flood Mitigation Plan for the City of Wauwatosa. August. SEWRPC. 2001.
- City of Wauwatosa Code of Ordinances. Common Council.

City of West Allis

- West Allis Mitigation Projects

- City of West Allis Comprehensive Plan 2030. Graef Anhalt Schloemer and Associates. 2011.

Village of West Milwaukee

- West Milwaukee Mitigation Projects
- Comprehensive Plan for Village of West Milwaukee. R.A. Smith National. 2009

Village of Whitefish Bay

- Whitefish Bay Mitigation Projects
- Village of Whitefish Bay Comprehensive “Smart Growth” Plan. Matthew Schuenke and Bryan Law. 2009.
- Storm water Management Plan. Bonestoo, Rosene, Anderlik & Associates.

FEMA

- State of Wisconsin Repetitive Loss Report. Federal Emergency Management Agency Region V. 2010
- Multi Hazard Identification and Risk Assessment. A corner stone of the National Mitigation Strategy. Federal Emergency Management Agency. 1997

NOAA

- Satellite and Information Service, National Climatic Data Center, 2016. Comprehensive Data List of All Hazard Events in Milwaukee County.
- National Weather Service (NWS). Historic Weather Events. Milwaukee, Wisconsin.
- NWS Milwaukee/Sullivan WFO, 2016.

Wisconsin State Climatology Office

- Climate of Wisconsin. http://www.aos.wisc.edu/.

U.S. Bureau of the Census

- General Demographic Characteristics. 2015 estimates.
- General Demographic Characteristics. 2010 census.

Standard

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process

- A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? 44 CFR 201.6(b)(3).
  - A4.1. List of existing plans, studies, reports, and technical information that were reviewed
  - A4.2. How relevant information was incorporated into the Plan

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy

- C1. Does the Plan document each jurisdiction’s existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing policies and programs? 44 CFR 201.6(c)(3)
  - C.1.1. Description of each jurisdiction’s existing authorities, policies, programs, and resources available to accomplish hazard mitigation
- C2. Does the Plan address each jurisdiction’s participation in the National Flood Insurance Program (NFIP) and continued compliance with NFIP requirements as appropriate? 44 CFR 201.6(c)(3)(ii)
  - C2.2. Description of floodplain management programs/activities that contribute to continued compliance for each NFIP-participating jurisdiction

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.

- 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
  - 4.E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?

4.5 Community Profile

Published 1/31/2017 11:33 by Leah Redding

IV. Community Profile

The Community Profile is an important component of the Hazard Mitigation Plan, and should be utilized to provide valuable intelligence and situational awareness. The Community Profile is an overview of the political governance, economy, geography, climate, population, community assets, future development and trends, and commercial and industrial make-up of Milwaukee County.

The Community Profile provides Milwaukee County with a solid foundation for developing a common operational picture for all programmatic, planning, and operational needs.

Standards:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
  - B1.3 Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element D Plan Review, Evaluation, and Implementation (UPDATES ONLY)
  - D1. Was the Plan revised to reflect changes in development? 44 CFR 201.6(d)(3)
  - D1.1. Changes in development in hazard prone areas that increased or decreased the vulnerability of each jurisdiction
  - D1.2. If no changes in development impacted the jurisdiction's vulnerability, validate the information in the previous plan

4.5.1 Physical and Natural Characteristics of Milwaukee County

Published 10/17/2016 10:07 by Leah Redding

Physical Characteristics of Milwaukee County

This section describes the geology, topography, climate, hydrology, soil, wetlands, vegetation and land use considerations for Milwaukee County.

4.5.1.1 General Community Introduction

Published 3/24/2017 16:52 by Leah Redding

General Community Introduction

Milwaukee County is the most populous county in the state, containing about 948,930 people over 241 square miles of land. With the City of Milwaukee at it center and Lake Michigan bordering it to the East, Milwaukee County is a vibrant and diverse urban hub, the Midwest's "best kept secret." Tourists and residents are drawn to Milwaukee for its beer, festivals, music, its Great Lake and rivers, its award-winning Parks System, for the various activities its climate allows, and for its cultural diversity.

Manufacturing was very influential in the development and urbanization process in Milwaukee County. By the mid 19th century Milwaukee had become a modern manufacturing center, with a booming lumber and flour milling industry and an unmatched ability in the state to create consumer goods with raw materials from the land. Milwaukee surpassed other cities in manufacturing because it had the advantages of an expanding urban market, which brought with it a continuous flow of immigrant labor, materials and customers easily accessible through its growing transportation system. This urban market allowed for the production of a variety of industrial goods, from machinery to toys, increasing Milwaukee County's footprint on the industrial market. Milwaukee's growth and the construction of the highway system brought about the incorporation of municipalities like Hales Corners, Brown Deer, Franklin, and Greenfield in the 1950s.

Even after the tide of globalization and the decline of industries in many Rust Belt areas, manufacturing remains prominent and important to the Milwaukee County economy. Although Milwaukee is no longer home to four major brewing companies (Miller Brewing Company being the only major brewery left), the growing craft brewery industry has brought many microbrews to the area, allowing Milwaukee to maintain it's image as "The Beer Capital of the World".
Additionally, Milwaukee still dominates the Wisconsin economy in the manufacturing of tools, engines, and heavy machinery.

Areas which fell victim to manufacturing decline, such as the Menomonee Valley in the City of Milwaukee and the "Burleigh Street Triangle" of Wauwatosa, have since began to repurpose their blighted, empty warehouses and lots into bars, shops, and green spaces. They have harnessed the back-to-the-city movement, helping to revitalize Milwaukee County's urban areas after suburbanization of the mid-late 20th century shrank the population and resulted in urban decay. Driving through Milwaukee County today, you will see a mix of skyscrapers, century-old architectural beauties, and slow, rolling hills left behind by the glaciers of Wisconsin's past. Nothing is more fitting to describe this than Milwaukee's 1968 slogan: "Milwaukee- Old World Charm, New World Vigor".

(Source: The Wisconsin Historical Society: http://www.wisconsinhistory.org/turningpoints/tp-044/?action=more_essay)

(Source: The Milwaukee Public Library, "Milwaukee Slogans": http://www.mpl.org/blog/now/milwaukee-slogans)

4.5.1.2 Plan Area

Published 12/20/2016 13:38 by Leah Redding

Plan Area

Milwaukee County is located in southeast Wisconsin and has a land area of about 154,879 acres or 242 square miles (U.S. Bureau of the Census, 2001). The County is unique to Wisconsin, as 19 jurisdictions within the County encompass the total land area of the County. In Wisconsin, there are three types of sub-county, full-service local government units: towns, which are unincorporated, and villages and cities, which are incorporated. Milwaukee County has no unincorporated municipalities: it contains the Cities of Cudahy, Franklin, Glendale, Greenfield, Oak Creek, South Milwaukee, St. Francis, Wauwatosa, and West Allis; the Villages of Bayside, Brown Deer, Fox Point, Greendale, Hales Corners, River Hills, Shorewood, West Milwaukee and Whitefish Bay. (*Map 1-1* is a map of Milwaukee County municipal borders)

Milwaukee County is bounded by Lake Michigan on the east, Racine County to the south, Waukesha County to the west, and Ozaukee and Washington Counties to the north. The Menomonee, Milwaukee, Root, Kinnickinnic Rivers, and Oak Creek are the major rivers that flow through Milwaukee County and into Lake Michigan.

Milwaukee County lies within the Eastern Ridges and Lowlands geographical province. Topographic features are distinct, but they are low. Alternate weak and resistant rock layers are carved by streams and weather into a belted plain. This plain has parallel strips of upland and lowland corresponding to the more important resistant and weak strata. The uplands are called cuestas: a ridge which has a steep escarpment on one side and a long gentle slope of the other. The topography of the Eastern Ridges and Lowlands is controlled by cuestas. The Niagara Cuesta runs through Milwaukee County. The upland on the back slope of the Niagara cuesta is a region of very moderate relief, with glacial deposits forming the greatest irregularities. The erosion of the largest streams, like the Milwaukee River, results in a maximum relief of only 100 to 120 feet by cutting into the glacial drift and the rock. The map below shows Milwaukee County and it's municipalities.

(Source: http://www.wisconline.com, "The Eastern Ridges and Lowlands of Wisconsin)

(The City of Milwaukee is outlined in blue and not included in this plan)

4.5.1.3 Geology

Published 10/27/2016 13:05 by Leah Redding

Geology

Bedrock topography was shaped by pre-glacial and glacial erosion of the exposed bedrock, directly influencing the geologic composition and topography of Milwaukee County. Because of this, sloping ground moraine consisting of heterogeneous material, deposited beneath the ice of glaciers and at the forward margin of ice sheets, covers most of the County. The lower bedrock formation of Milwaukee County consists of Silurian and Devonian dolomite (a rock-forming mineral), and the top bedrock layer is Silurian dolomite; mainly Niagara dolomite underlain by an impervious layer of Maquoketa Shale. Erosion has removed the Niagara dolomite in certain pre-Pleistocene valleys in the southwestern portion of the County.

The movement of the glacial ice sheets caused a wide range of glacial deposits over the bedrock. The largest glacial deposits in Milwaukee County are 200 to 400 feet thick, and are located mostly in the Southern part of the County. The north-central portion and western boundary of the County is where bedrock ranging from 0 to 100 feet can be found.

(Milwaukee County: Land and Water Resource Management Plan 2012-2021, page 28. SEWRPC, Milwaukee County DOT, MC DPW, MC Parks.)

4.5.1.4 Topography

Published 1/31/2017 09:18 by Leah Redding

Topography

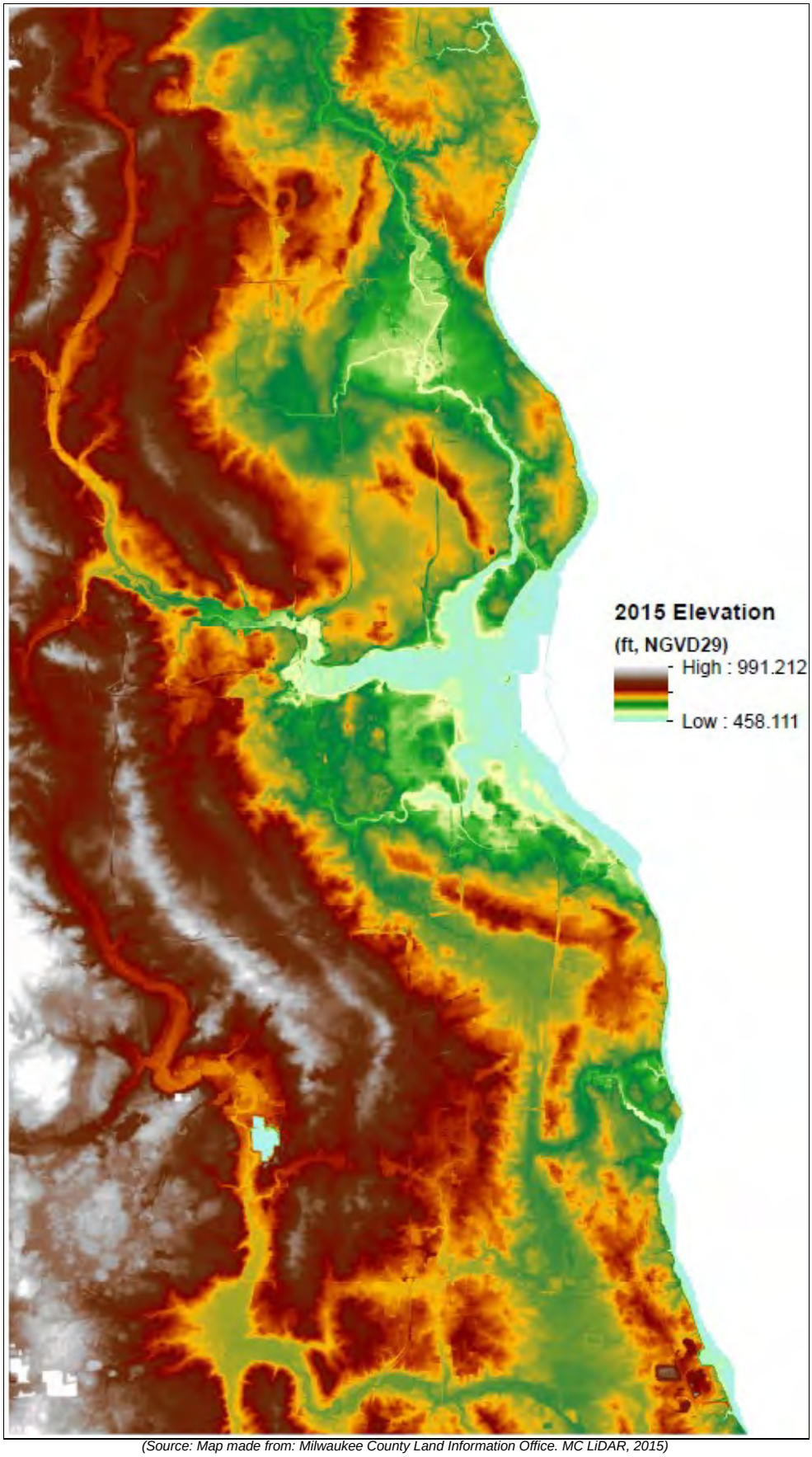
Wisconsin lies in the upper Midwest between Lake Superior, the upper peninsula of Michigan, Lake Michigan and the Mississippi and Saint Croix Rivers. Its greatest length is 320 miles and greatest width 295 miles for a total area 56,066 square miles. Glaciation has largely determined the topography and soils of the state, except for the 13,360 square miles of driftless area in southwestern Wisconsin. The various glaciations created rolling terrain with nearly 9,000 lakes and several areas of marshes and swamps. Elevations range from about 600 feet above sea level along the Lake Superior and Lake Michigan shores and in the Mississippi floodplain in southwestern Wisconsin to nearly 1,950 feet at Rib and Strawberry Hills.

The Northern Highlands, a plateau extending across northern Wisconsin, is an area of about 15,000 square miles with elevations from 1,000 to 1,800 feet. This area has many lakes and is the origin of most of the major streams in the state. The slope down to the narrow Lake Superior plain is quite steep. A comparatively flat, crescent-shaped lowland lies immediately south of the Northern Highlands and embodies nearly one-forth of Wisconsin. The eastern ridges and lowlands to the southeast of the Central Plains are the most densely populated and have the highest concentration of industry and farms. The uplands of southwestern Wisconsin west of the ridges and lowlands and south of the Central Plains make up about one-fourth of the state. This is the roughest section of the state, rising 200 to 350 feet above the Central Plains and 100 to 200 feet above the Eastern Ridges and Lowlands. The Mississippi River bluffs rise 230 to 650 feet. (http://www.uwex.edu/sco/state.html)

Four major stages of glaciation, the last of which was the Wisconsin stage, ending approximately 10,000 years ago in the state, have largely determined the physiography, topography, and soils of Milwaukee County. The topography in Milwaukee County varies from the eastern half with it's long, rolling glacial plains, to the steep hills of the Western half. The County's adjacency to Lake Michigan, one of the five Great Lakes, has also influenced the County's topography: the North and South Lake Michigan shorelines of the County have a steep escarpment. Additionally, the sub-continental divide, separating the Great Lakes-St. Lawrence River Basin and the Mississippi River Basin, crosses through the City of Franklin, in the far Southwest of the County. Topographic elevation in Milwaukee County ranges from approximately 580 feet above National Geodetic Vertical Datum, 1929 adjustment (NGVD 29) at the mouth of the Milwaukee River, to approximately 850 NGVD 29 in the City of Greenfield.

(Milwaukee County: Land and Water Resource Management Plan. SEWRPC, Milwaukee County DOT, MC DPW, MC Parks.)

The map below shows the elevation of Milwaukee County by foot.



(Source: Map made from: Milwaukee County Land Information Office. MC LiDAR, 2015)

4.5.1.5 Climate

Published 12/8/2016 11:08 by Leah Redding

Climate

The Wisconsin climate is typically continental with some modification by Lakes Michigan and Superior. Winters are generally cold and snowy and summers are warm. About two-thirds of the annual precipitation falls during the growing season; this is normally adequate for vegetation although there are occasional droughts. The climate favors dairy farming and the primary crops are corn, small grains, hay and vegetables. Storm tracks generally move from west to east and southwest to northeast.

The average annual temperature varies from 36 degrees F in the north to about 56 degrees F in the south with statewide extreme records of 114 degrees F (Wisconsin Dells, 7/13/1936) and minus 55 degrees F (Couderay, 2/2/1996 & 2/4/1996). During more than one-half of the winters, temperatures fall to minus 40 degrees F or lower and almost every winter temperatures of minus 30 degrees F or colder are reported from northern stations. Summer temperatures above 90 degrees F average two to four days in northern counties and about 14 days in southern districts, including Milwaukee County. During marked cool outbreaks in summer months, the central lowlands occasionally report freezing temperatures.

The freeze-free season ranges from around 80 days per year in the upper northeast and north-central lowlands to about 180 days in the Milwaukee area. The pronounced moderating effect of Lake Michigan is well-illustrated by the fact that the growing season of 140 to 150 days along the east-central coastal area is of the same duration as in the southwestern Wisconsin valleys. The short growing season in the central portion of the state is attributed to a number of factors, among them an inward cold air drainage and the low heat capacities of the peat and sandy soils. The average date of last spring freeze ranges from early May along the Lake Michigan coastal area and southern counties to early June in the northernmost counties. The first autumn freezes occur in late August and early September in the northern and central lowlands and in mid-October along the Lake Michigan coastline, however a July freeze is not entirely unusual in the north and central Wisconsin lowlands.

The long-term mean annual precipitation ranges from 30 to 34 inches over most of the Western Uplands and Northern Highlands, then diminishes to about 28 inches along most of the Wisconsin Central Plain and Lake Superior Coastal area. The higher average annual precipitation coincides generally with the highest elevations, particularly the windward slopes of the Western Uplands and Northern Highlands. Wisconsin has had a 10% increase in average annual precipitation in the past 60 years, and Milwaukee's average annual precipitation has increased about 6% (WEM, hazard mitigation). Thunderstorms average about 30 per year in northern Wisconsin to about 40 per year in southern counties and occur mostly in the summer. Occasional hail, wind and lightning damage are also reported.
(Source: Wisconsin Initiative on Climate Change Impacts: How is Wisconsin's Climate Changing?" 2009.)

The average seasonal snowfall varies from about 30 inches at Beloit to well over 100 inches in northern Iron County along the steep western slope of the Gogebic Range. Greater average snowfall is recorded over the Western Uplands and Eastern Ridges than in the adjacent lowlands. The mean dates of first snowfall of consequence (an inch or more) vary from early November in northern localities to early December in southern Wisconsin counties. Average annual duration of snow cover ranges from 85 days in southernmost Wisconsin to more than 140 days along Lake Superior. The snow cover acts as protective insulation for grasses, autumn seeded grains, alfalfa and other vegetation.

Milwaukee County is located within the region generally classified as continental with some modification for the Great Lakes. The weather can be quite variable with large day-to-day temperature variations, particularly during the fall and the spring.The yearly average for precipitation is 34.4 inches, with over 68 percent of the precipitation falling from March through September. The average annual snowfall is 47 inches. Winter temperatures can vary between 13 to 28 degrees Fahrenheit. The average annual temperature for summer, June – August, is 71 degrees Fahrenheit. (Wisconsin State Climatology Office)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average High (degrees F)	29	33	42	54	65	75	80	79	71	59	46	33
Average Low (degrees F)	16	19	28	37	47	57	64	63	55	43	32	20
Average Precipitation (inches)	1.76	1.65	2.3	3.56	3.4	3.9	3.67	3.97	3.2	2.65	2.71	2.04
Average Snowfall (inches)	14.7	9.8	7	2	0.1	0	0	0	0	0.3	2.4	10.6

(Wisconsin State Climatology Office-Monthly normal: 1981-2010: http://www.aos.wisc.edu/~sco/clim-history/sta-data/mke/MKE-Monthly/GHCND_USW00014839_2010-1-1.pdf*)*

4.5.1.6 Hydrology

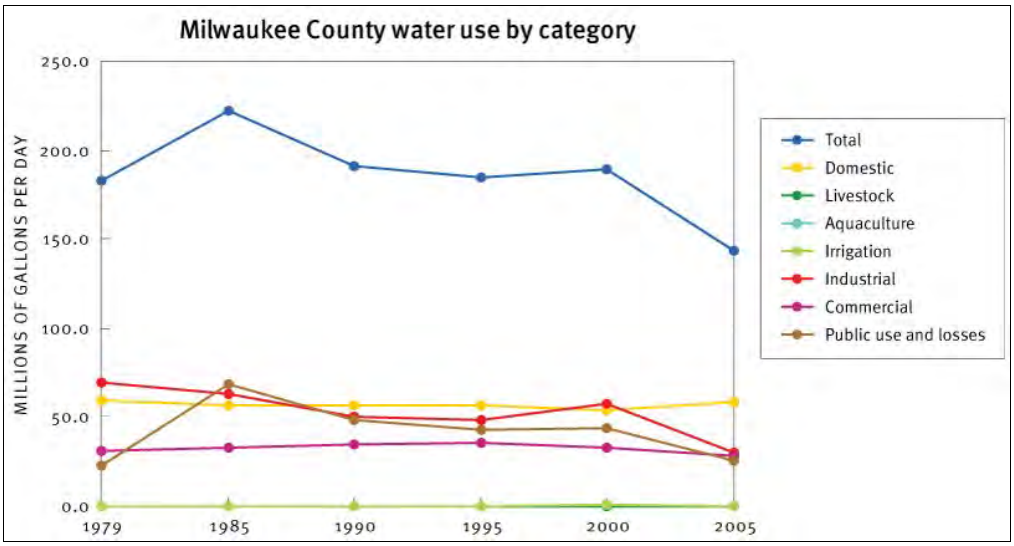
Published 1/31/2017 13:06 by Leah Redding

Hydrology

The land in Wisconsin drains into Lake Superior, Lake Michigan and the Mississippi River. The Mississippi and St. Croix Rivers form most of the western boundary. About one-half of the northwestern portion of the state is drained through the Chippewa River, while the remainder of this region drains directly into the Mississippi or St. Croix Rivers and into Lake Superior. The Wisconsin River has its source at a small lake nearly 1,600 feet above mean sea level on the Upper Michigan boundary and drains most of central Wisconsin. Most of its tributaries also spring from the many lakes in the north. Except for the Rock River, a Mississippi River tributary which flows through northern Illinois, eastern Wisconsin, drains into Lake Michigan. The sub-continental divide traverses the county in a north-south direction in the eastern tier of communities, separating the county between the Mississippi River and the Great Lakes-St. Lawrence River drainage systems.

Most of the streams and lakes in the state are ice-covered from late November to late March. Snow covers the ground in practically all the winter months except in extreme southern areas. Flooding is most frequent and most serious in April due to the melting of snow and spring rains. During this period, flood conditions are often aggravated by ice jams which back up the flood waters. Excessive rains of the thunderstorm type sometimes produce tributary flooding or flash flooding along the smaller streams and creeks (http://www.uwex.edu/sco/state.html).

Most water in Milwaukee County is surface water designated for public uses. Any agricultural uses come from groundwater. The following table shows how many million gallons of water are used per day in Southeastern Wisconsin and how the water is used.



(Source: USGS: Protecting Wisconsin's Groundwater through Comprehensive Planning, Executive Summary. http://wi.water.usgs.gov/gwcomp/find/milwaukee/)

Groundwater

Groundwater reservoirs are recharged by direct precipitation. Spring is a prime time for recharge because evapotranspiration is low and melting snow and rainfall infiltrate and percolate the water table on unfrozen ground. Fall is another prime time for high recharge. During the summer, groundwater levels drop because precipitation is lower causing losses to evaporation and transpiration to exceed precipitation. In addition, groundwater is lost to surface waters by discharge in the form of springs (DeVaul, 1967.) The winter period normally lacks infiltration because of frozen ground.

Groundwater in Milwaukee County helps to sustain wetlands and provides the perennial base flow of streams. Because of the proximity of Milwaukee County to Lake Michigan, only about 5% of the county's water use comes from groundwater. Despite this small percentage, about $213 million has been spent on cleaning up petroleum from leaking underground storage tanks.

- There are three ground-water-level collection sites in Milwaukee County: two take periodic measurements, one takes continuous measurements.
  - Continuous measurement site: Franklin= rated above normal water-level; 76-90th percentile
  - Periodic measurement sites:
    - Glendale= rated at normal water-level; 25-75th percentile

- Oak Creek= Not ranked (typically means there has not been at least 10 years of water-level measurements in measurement month)

(Source: USGS: Protecting Wisconsin's Groundwater through Comprehensive Planning, Executive Summary. http://wi.water.usgs.gov/gwcomp/find/milwaukee/)

Groundwater occurs mostly within the Silurian Dolomite Aquifer under Milwaukee County and a narrow strip along Lake Michigan is Devonian dolomite. Silurian Dolomite is the uppermost bedrock aquifer in the Southeastern Region, and is a primary source of domestic supplies for surrounding counties. This aquifer is only found in Eastern Wisconsin and has dual permeability. Three of its units are thin and coarse-grained and carry 68-90% of the groundwater discharge to Lake Michigan. Recharge to groundwater is derived almost entirely from precipitation. Much of the groundwater in shallow aquifers originates from precipitation that has fallen and infiltrated within a radius of about 20 or more miles from where it is found.

(Source: Groundwater Resources of Southeastern Wisconsin, 2002. SEWRPC & WI Geological and Natural History Survey.)

Surface Water

Surface water resources constitute a valuable part of the natural resource base of Milwaukee County. Surface waters provide recreational activities and an attractive setting for properly planned residential development. Because surface water quality is highly susceptible to deterioration from pollutant runoff, both urban and rural land uses must be carefully managed to achieve a balance between level and extent of use and the maintenance of water quality.

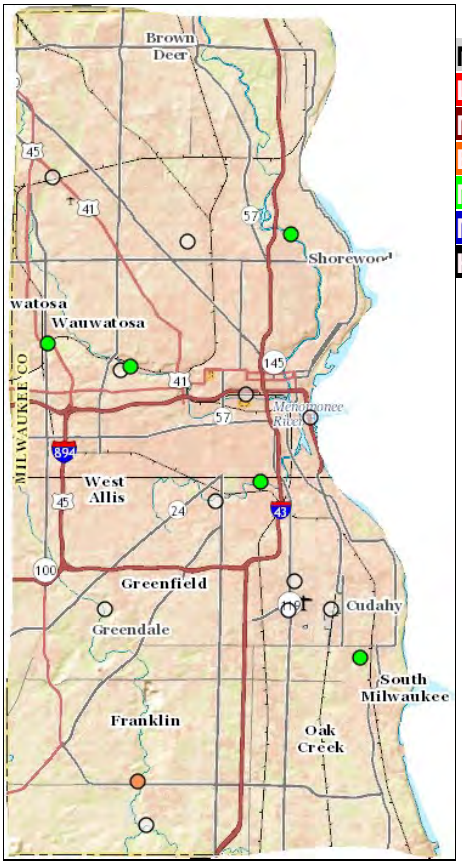
Major inland lakes are defined as those with a surface area of 50 acres or larger; a size capable of supporting reasonable recreational use with minimal degradation of the resource. Besides of course Lake Michigan to the East, Milwaukee County contains no major lakes, but has about 41 smaller lakes, ponds, and lagoons, most with surface areas of less then 10 acres. *(Milwaukee County: Land and Water Resource Management Plan. SEWRPC, Milwaukee County DOT, MC DPW, MC Parks.)*

For flood control and water quality planning purposes, the Southeastern Wisconsin Regional Planning Commission has divided the Region into 11 major watersheds, five of which directly effect Milwaukee County and its Lake Michigan Shoreline. The sub-continental divide separates the Great Lakes-St. Lawrence River Basin and the Mississippi River Basin, crossing through the far Southwest of the County, in the City of Franklin. Two of the major watersheds, the Menomonee River and Root River watersheds, lie east of the sub-continental divide and are part of the Great Lakes-St. Lawrence River drainage system. The Fox River Watershed lies west of the sub-continental divide and is a part of the Mississippi River drainage area.

The following map is of the Watersheds and Surface Water Resources of the Region. The unlabeled watersheds in it are: upper section of purple= Menomonee River Watershed, upper green= Milwaukee River Watershed, lower green= Root River Watershed, orange next to the lake= Lake Michigan Watershed.

(Source: Groundwater Resources of Southeastern Wisconsin, 2002. SEWRPC & WI Geological and Natural History Survey.)

There are 17 surface water-level collection sites in Milwaukee County:



Not Ranked
Low
Much below Normal (<10%)
Below Normal (10%-24%)
Normal (25%-75%)
Much Above Normal (>90%)
High

(Source: USGS: Protecting Wisconsin's Groundwater through Comprehensive Planning, Executive Summary. https://www.usgs.gov/centers/water-dashboard/surface?state=wi)

4.5.1.7 Soil Types

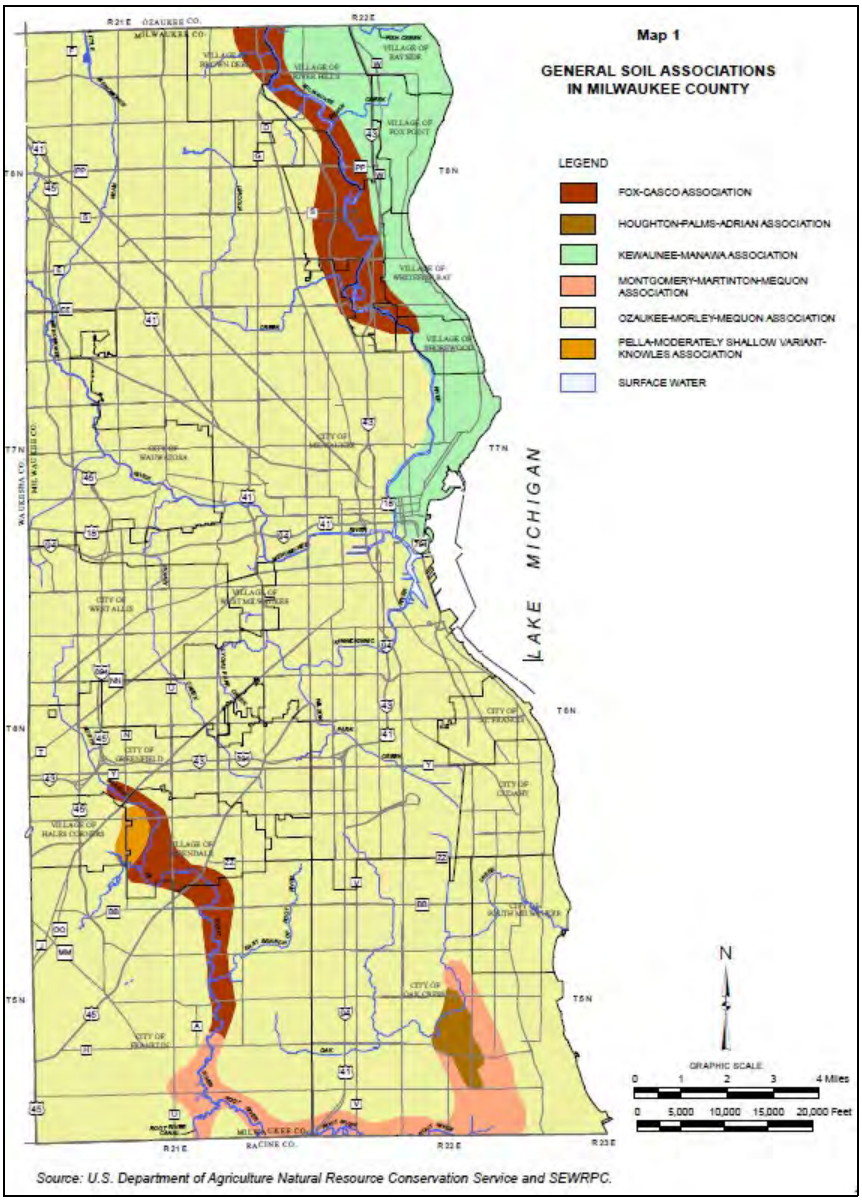
Published 1/31/2017 09:22 by Leah Redding

Soil Types

Soils vary dramatically across the landscape. Much of Milwaukee County is covered by soils well suited for agricultural use (class II soils). Of this area, cultivated lands are the predominant type of agricultural use (72% of agricultural land).

Topographical features of the land, especially the slope, directly affect soil erosion rates and govern the physical and chemical properties of a certain soil. This is a large factor in the soil makeup in an urban county like Milwaukee. Highly erodible lands (HEL) in the County are areas with slopes greater than 6 percent. HELs make urban development, as well as agriculture, difficult to manage. Land surface slopes within Milwaukee County range from less than 1% to over 20%, with about half of the land surface slope ranging from 0 to 6%.

A soil association is defined as a landscape with a distinctive proportional pattern of soils, typically comprised of one or more major soil types and at least one minor soil type, as identified by the S. Department of Agriculture, Natural Resources Conservation Service, and named after the major soils. *Six soil associations are found in Milwaukee County: Fox-Casco, Houghton-Palms-Adrian, Kewaunee-Manawa, Montgomery-Martinton-Mequon, Ozaukee-Morley-Mequon, and Pella-Moderately Shallow Variant-Knowles:*



(Information and map on this page from: *A Land and Water Resource Management Plan for Milwaukee County: 2012-2021.* SEWRPC, Milwaukee County DOT, DPW, and Park Department.)

4.5.1.8 Wetlands

Published 1/31/2017 11:43 by Leah Redding

Wetlands

Because wetlands provide many benefits to the environment, several municipal, state and federal ordinances/regulations protect wetland areas. The basic concept associated with these laws is that wetland areas on any property cannot be disturbed without a permit. Wetlands store flood waters and filter water from precipitation before it enters lakes and streams. Some wetlands also recharge local groundwater aquifers. By slowing water movement, wetlands reduce the likelihood that heavy rainfall or spring snowmelt will cause erosion and flooding. Wetlands retain eroded soil and hold nutrients that would otherwise promote excessive weed growth and algae blooms in lakes and streams. These nutrients, when held in the wetlands, produce a heavy growth of vegetation that provides nesting sites, food and cover for waterfowl, small mammals and many other types of wildlife. Wetlands also provide recreational opportunities for humans (wildlife observation, hiking, hunting, etc).

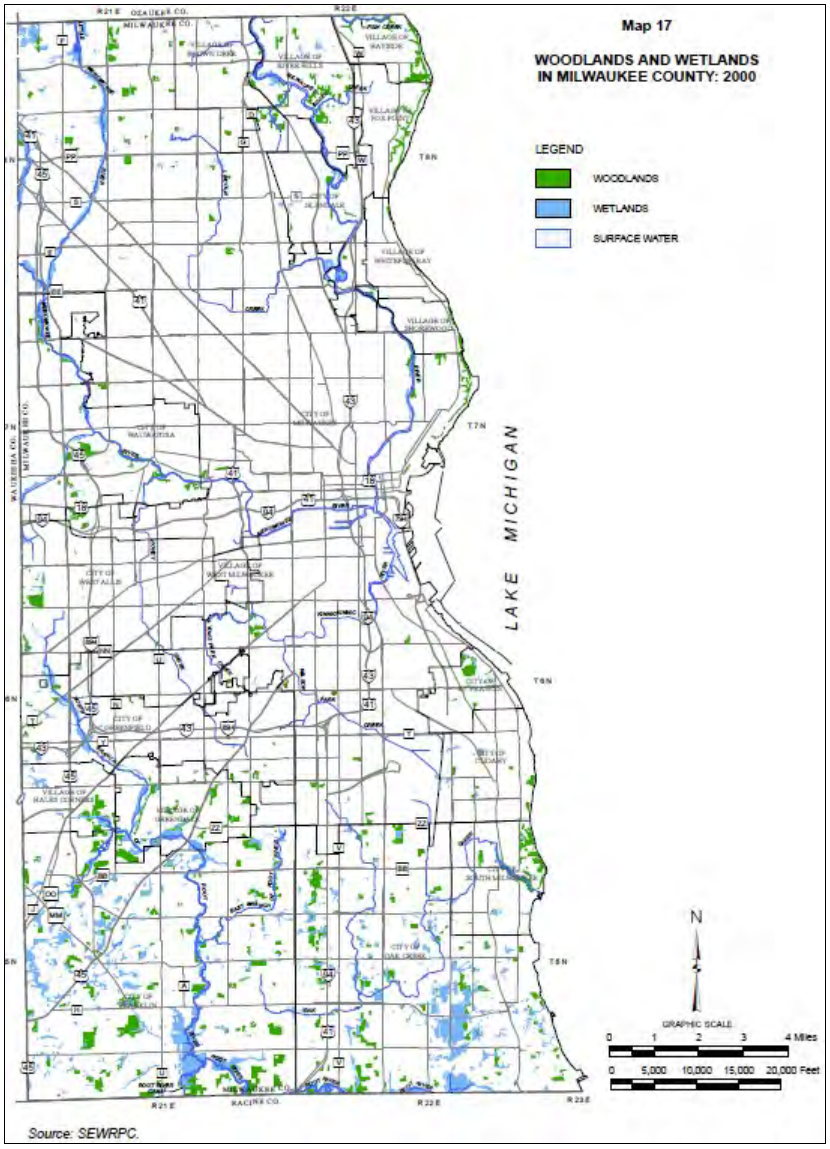
There are three basic factors in determining whether or not a property is a wetland:

- The presence of water at, near or above the surface (hydrology).
- Water present long enough to sustain aquatic plant life (hydrophilic vegetation).
- Soils indicative of wet conditions (hydric soils).

Wetlands perform an important set of natural functions, which make them particularly valuable resources lending to overall environmental health and diversity. Some wetlands provide seasonal groundwater recharge or discharge. Those wetlands that provide groundwater discharge often provide base flow to surface waters. Wetlands contribute to the maintenance of good water quality, except during unusual periods of high runoff following prolonged drought, by serving as traps, which retain nutrients and sediments, thereby preventing them from reaching streams and lakes. They act to retain water during dry periods and hold it during flooding events, thus keeping the water table high and relatively stable. They provide essential breeding, nesting, resting, and feeding grounds and predator escape cover for many forms of fish and wildlife. These attributes have the net effect of improving general environmental health; providing recreational, research and educational opportunities; maintaining opportunities for hunting and fishing and adding to the aesthetics of an area.

Wetlands pose severe limitations for urban development. In general, these limitations are related to the high water table and the high compressibility and instability, low bearing capacity and high shrink-swell potential of wetland soils. These limitations may result in flooding, wet basements, unstable foundations, failing pavements and failing sewer and water lines. Moreover, there are significant and costly onsite preparation and maintenance costs associated with the development of wetland soils, particularly in connection with roads, foundations and public utilities.

According to the Wisconsin Department of Natural Resources, Milwaukee County has approximately 8.2 square miles (5,279 acres) of wetlands, making up approximately 3.4% of the Count's total area, shown below in Map 17. This is about 0.1% of the total wetland acreage in Wisconsin. Most of these Milwaukee wetlands are classified as: potholes, fresh meadows, shallow marshes, deep marshes, shrub swamps, timber swamps, and bogs. (Info and map on this page from: *A Land and Water Resource Management Plan for Milwaukee: 2012-2021, page 81-82. SEWRPC*).

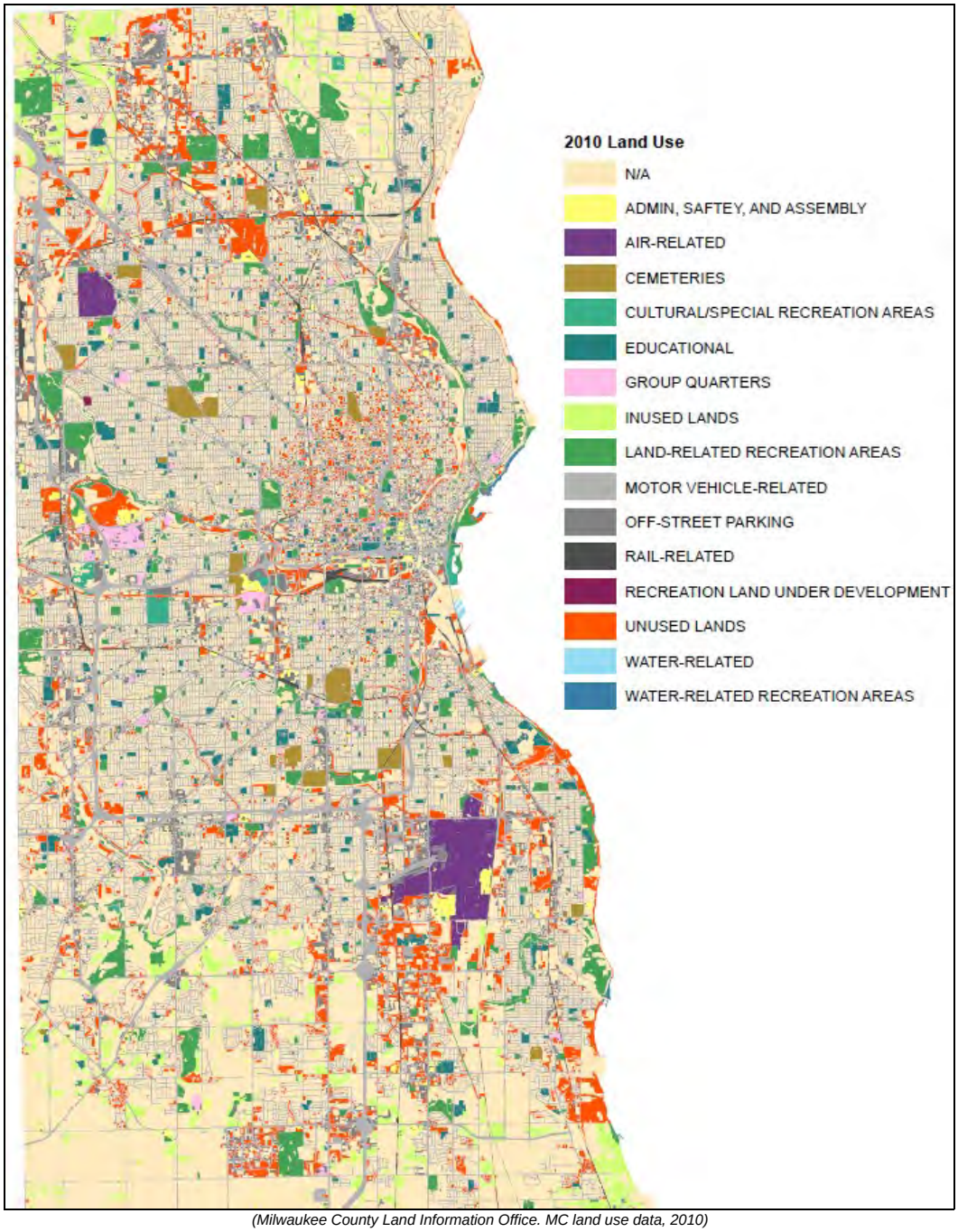

Map 17
WOODLANDS AND WETLANDS
IN MILWAUKEE COUNTY: 2000
LEGEND
WOODLANDS
WETLANDS
SURFACE WATER
LAKE MICHIGAN
N
GRAPHIC SCALE
0 1 2 3 4 Miles
0 5,000 10,000 15,000 20,000 Feet
Source: SEWRPC.

4.5.1.9 Land Use

Published 1/31/2017 11:48 by Leah Redding

Land Use

Land use in Milwaukee County is primarily residential, followed by open lands, transportation, and agricultural. Croplands primarily produce fruits and vegetables and there is some limited dairy production.



(Milwaukee County Land Information Office. MC land use data, 2010)

According to the Milwaukee Land and Water Resource Management Plan, in 2011, land use was divided as follows:

Urban: 115,057 acres or 74% of Milwaukee County

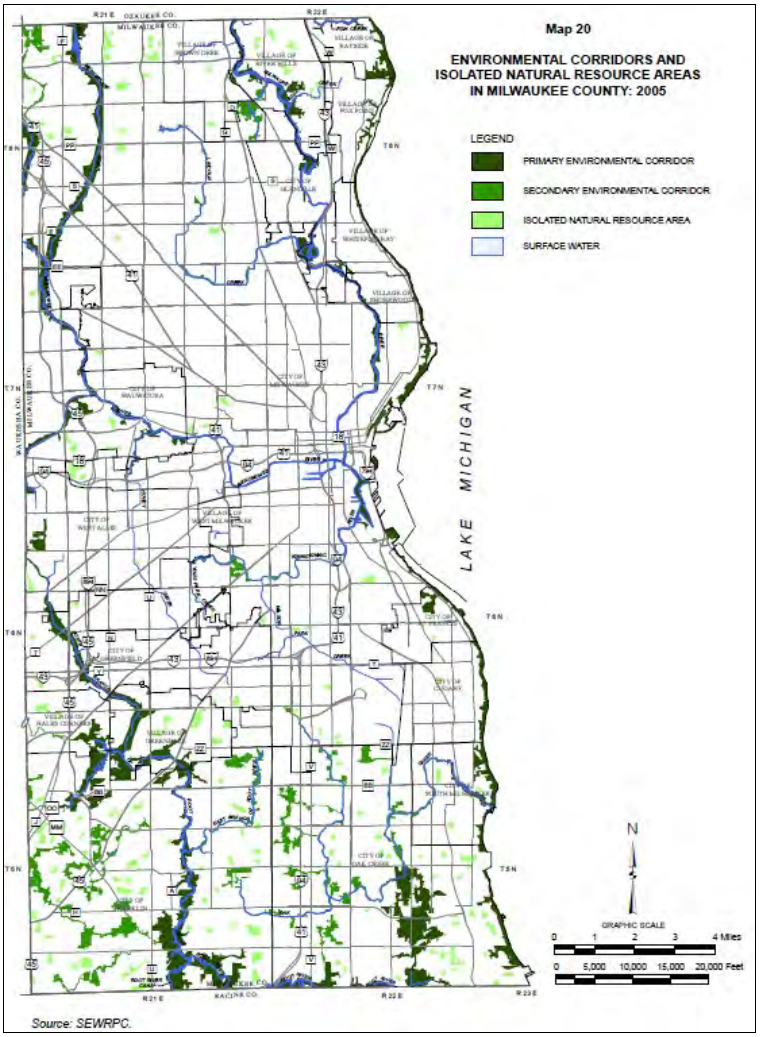
- Residential - 50,834 acres; 44% (33% of MC land)

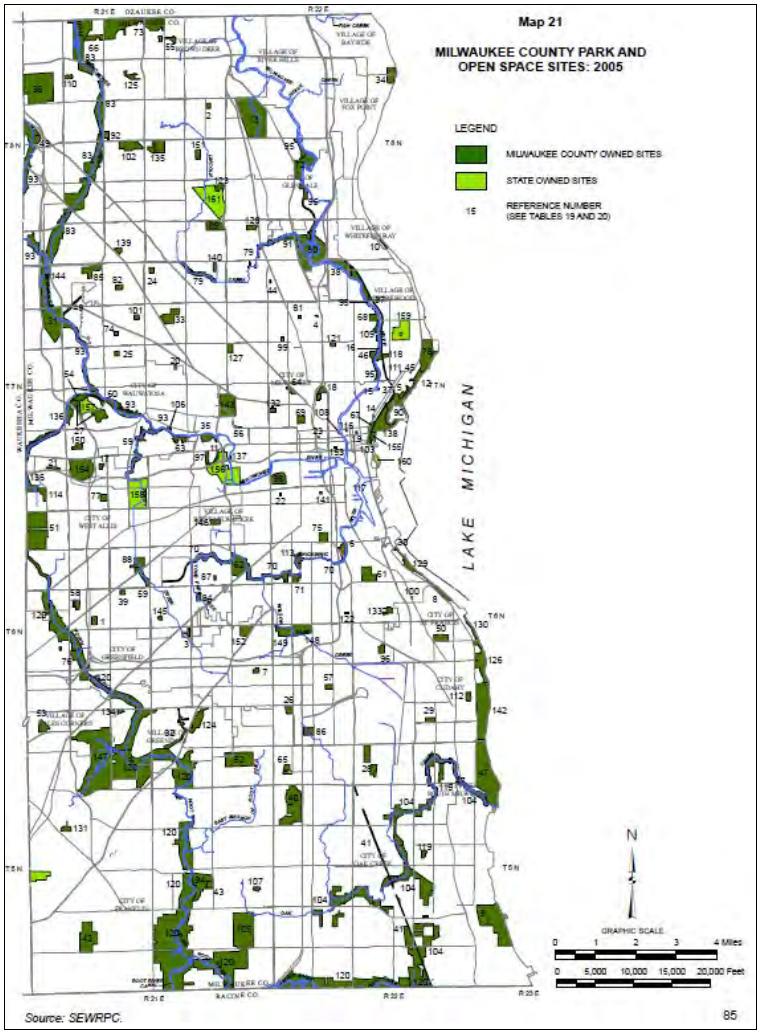
- Transportation/utilities/communications – 33,549 acres; 29% (22% of MC land)
- Commercial- 7,100 acres; 6% (5% of MC land)
- Industrial- 7,604 acres; 7% (5% of MC land)
- Government/Institutional – 8,222 acres; 7% (5% of MC land)
- Recreational – 7,748 acres; 7% (5% of MC land)

Non-Urban: 40,285 acres or 26% of Milwaukee County

- Natural resources areas- 11,142 acres; 28% (7% of MC land)
  - Surface Water – 1,298 acres; 3% (1% of MC land)
  - Wetlands – 5,279 acres; 13% (3% of MC land)
  - Woodlands – 4,565 acres; 11% (3% of MC land)
    - (MC-owned park and open space sites= 9.7% of MC land)
- Agricultural – 12,921 acres; 32% (8% of MC land)
  - Mostly in cities of Franklin and Oak Creek
- Quarries/extractive lands/landfills/open lands- 16,222 acres; 40% (10% of MC land)

(SEWRPC, 2005. Map 20: Environmental corridors & Natural areas. Map 21= MC Parks & Open Spaces)





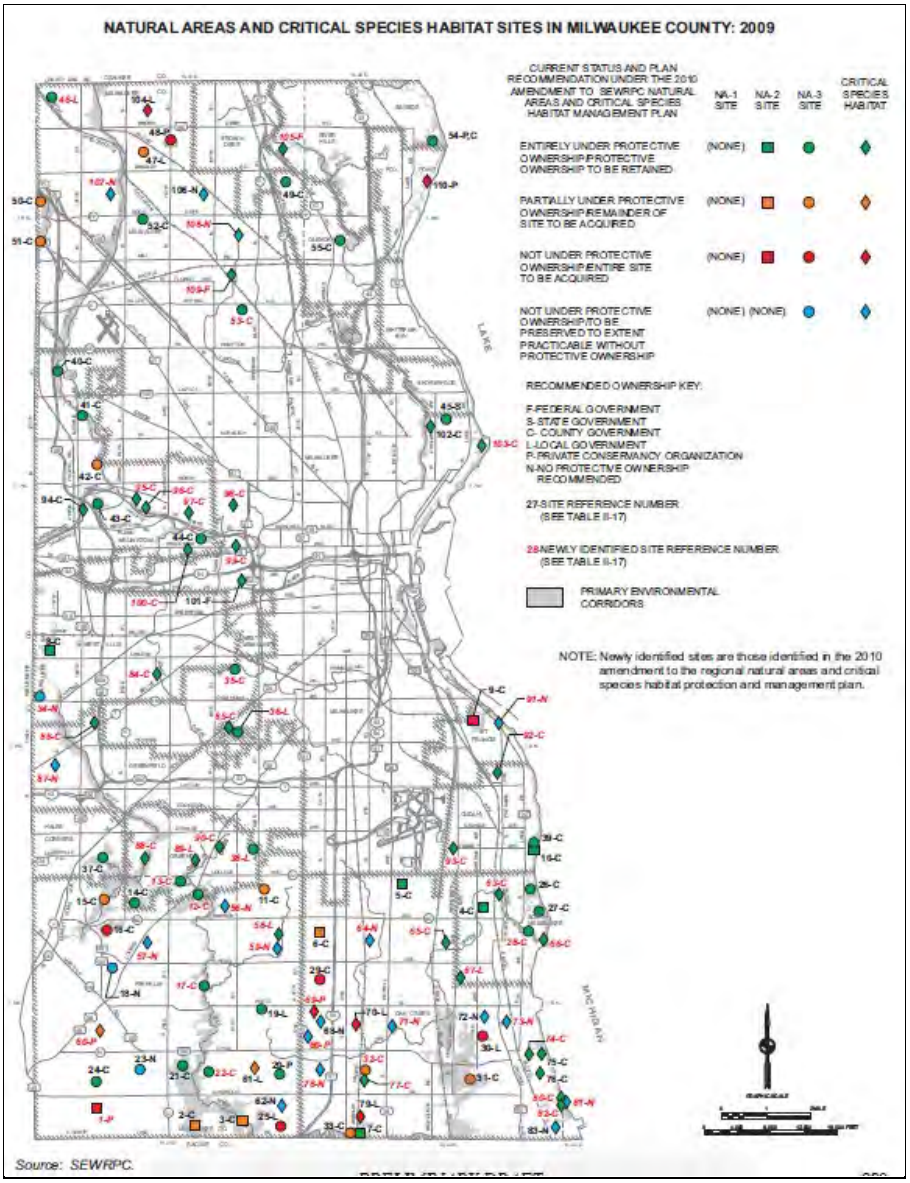
A comprehensive inventory of natural areas within the county was conducted by the Southeastern Wisconsin Regional Planning Commission in 2005 as part of the natural areas and critical species habitat protection and management plan being prepared by the commission. Natural areas are tracts of land or water that are mostly unmodified by humans activity, so that native animal and plant communities from pre-European settlement remain intact. The inventory systematically

identified all remaining high quality natural areas and critical species habitat then existing within the region.

Natural areas were classified based upon the natural area classification system developed by the Wisconsin Department of Natural Resources. Three classification categories are used: NA-1, natural areas of statewide or greater significance, which contain nearly complete and relatively undisturbed plant and animal communities which are believed to resemble closely those of pre-European settlement times; NA-2, natural areas of countywide or regional significance, which contain native biotic communities judged to be of lower than NA-1 significance, either because of evidence of a limited amount of human disturbance or because of limited size; and NA-3, natural areas of local significance, which have been substantially altered by human activities but which provide refuge for native plant and animal species that no longer exist in the surrounding area because of land uses, etc. A total of 55 known natural areas, encompassing about 2,891 acres (4.5 miles) or about 1.9 percent of the county, were identified by the Regional Planning Commission in Milwaukee County in 2009. Of the 55 identified sites, zero were classified as NA-1 sites, 10 were classified as NA-2 sites and encompass about 766 acres, and 45 were classified as NA-3 sites.

The inventory also identified a total of 55 critical species habitat sites within Milwaukee County, encompassing about 796 acres or 0.5% of Milwaukee County. Additionally, several critical aquatic habitat areas were identified within the County (areas with rare aquatic life or bisecting terrestrial natural areas). These areas are located: portion of the mainstem of the Menomonee River that's upstream from the confluence of Underwood Creek, the portion of the mainstem of the Milwaukee River upstream from Walnut Street, the mainstem of Root River downstream from Ryan Road, Fish Creek; Root River Canal; Tess Corners Creek, and Whitnall Park Creek.

(SEWRPC, 2009. Natural Areas & Critical Species Habitat Sites)



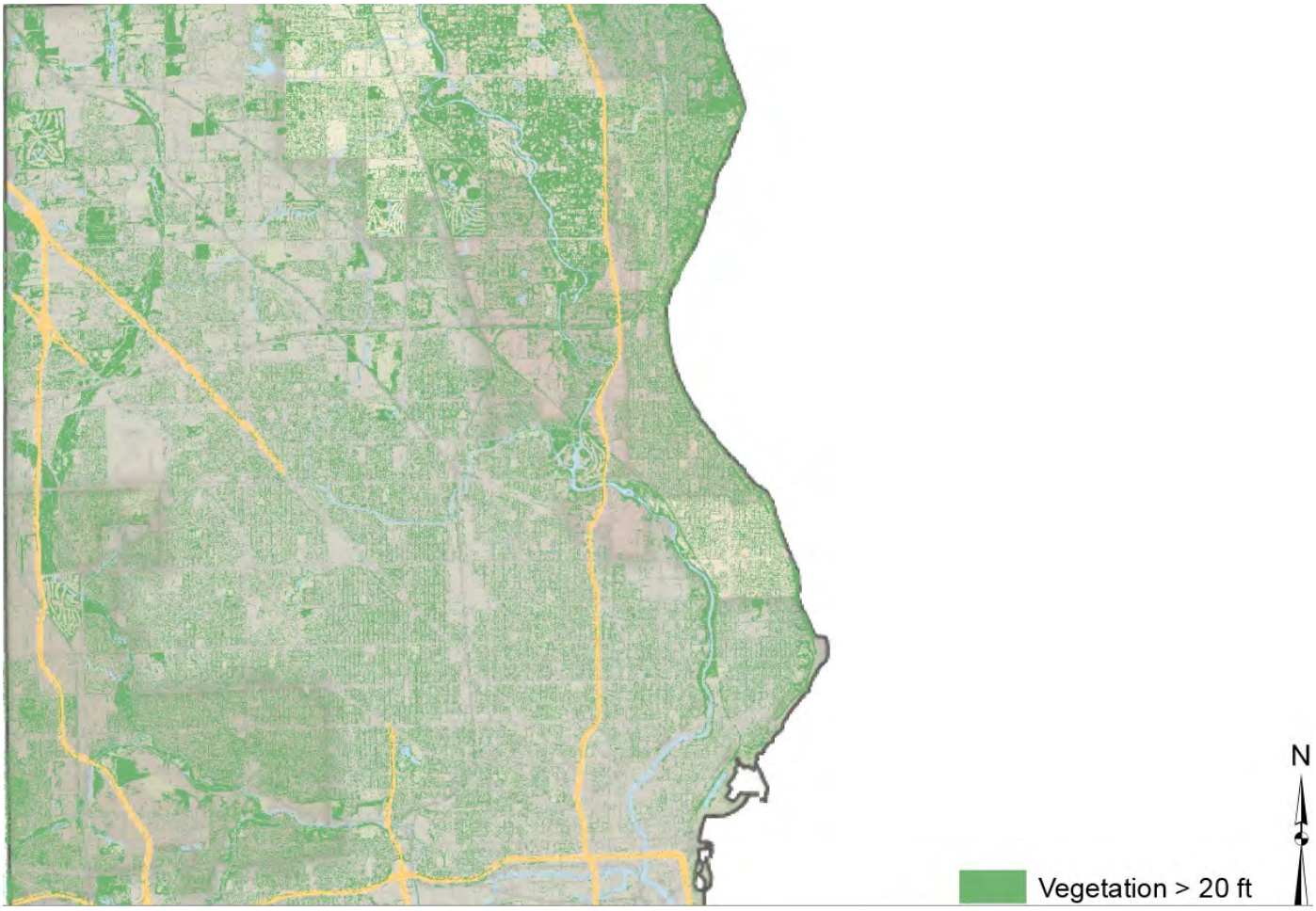
(The above information and maps are from SEWRPC's *Land and Water Resource Management Plan for Milwaukee: 2012-2021*. Pages 70-100)

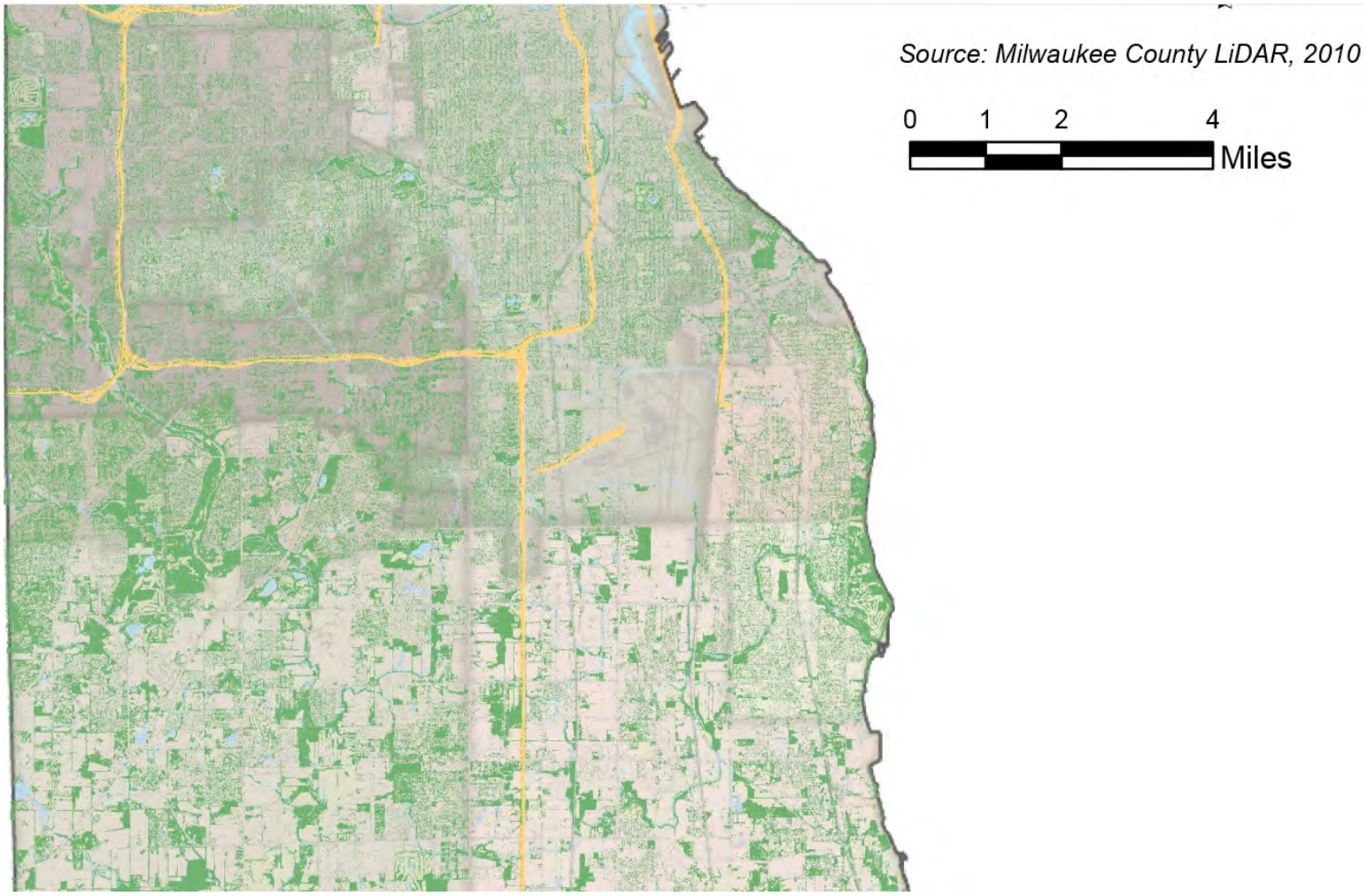
4.5.1.10 Vegetation

Published 1/31/2017 12:04 by Leah Redding

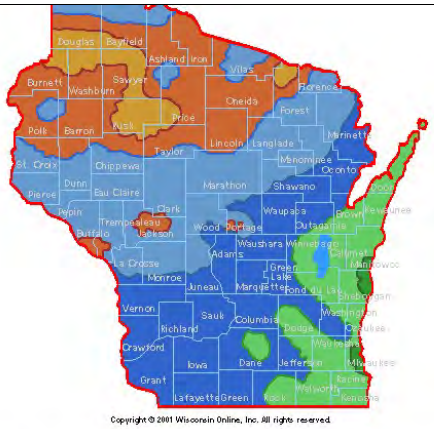
Vegetation

Sugar Maple, basswood, and elm are common throughout the County. In the Southwest corner, there are small areas of oak savanna. In the North-Central part of the County, there is a small area of conifer swamp.





The USDA map below shows minimum temperatures in each area and the corresponding woody plants that can grow there.



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USDA Hardiness Zones and Average Annual Minimum Temperatures

Zone	Average Annual Minimum Temperature	Representative Woody Plants
3a	-35° to -40° F	*Aronia melanocarpa* (Black chokeberry) *Cornus alternifolia* (Pagoda dogwood) *Juniperus communis* (Common juniper) *Malus baccata* (Siberian crabapple) *Spirea alba* (Meadowsweet) *Spirea tomentosa* (Hardhack) *Thuja occidentalis* (American arborvitae) *Viburnum lentago* (Nannyberry)
3b	-30° to -35°F	
4a	-25° to -30° F	*Acer saccharum* (Sugar maple) *Hydrangea paniculata* (Panicle hydrangea) *Juniperus chinensis* (Chinese juniper) *Ligustrum amurense* (Amur River privet) *Parthenocissus quinquefolia* (Virginia creeper) *Spiraea x vanhouttei* (Vanhoutte spirea)
4b	-20° to -25° F	
5a	-15° to -20° F	*Cornus florida* (Flowering dogwood) *Deutzia gracilis* (Slender deutzia) *Parthenocissus tricuspidata* (Boston ivy) *Taxus cuspidata* (Japanese yew)
5b	-10° to -15° F	

(Source: USDA data. Plant hardiness zones for Wisconsin. 2001: http://www.wisconline.com/almanac/gardening/hardiness.html)

4.5.2 Demographics and Infrastructure

Published 10/26/2016 09:56 by Leah Redding

Milwaukee County contains the Cities of Cudahy, Franklin, Glendale, Greenfield, Oak Creek, South Milwaukee, St. Francis, Wauwatosa, and West Allis. It contains the Villages of Bayside, Brown Deer, Fox Point, Greendale, Hales Corners, River Hills, Shorewood, West Milwaukee and Whitefish Bay.

4.5.2.1 Human Settlement Patterns

Published 12/12/2016 12:26 by Leah Redding

Human Settlement Patterns

The first evidence of human settlement in the Mississippi River Region was approximately 11,000 years ago, following closely the withdrawal of the Wisconsin glacier. These earliest known “Paleo- Indians” were hunter-gatherers that traveled in small nomadic family groups. This Ice Age era was known geologically as the Pleistocene period.

Between 1670 and 1680, the first Europeans to visit this land were the French traders to establish trading and military posts in the name of France, and the Jesuits to bring Christianity to the native inhabitants. Because the French made no definite settlement of the territory they yielded their rights to the English in 1761, who claimed possession until after the Revolutionary War. By the Treaty of 1835, the Indian tribes gave up their homeland and were moved to the country west of the Mississippi.

Milwaukee County was home to nine different Native American tribes who lived by our rivers, at one point or another. The largest four were: the Potawatomi, the Chippewa, the Ottawa, and the Menominee. When settlers from the east arrived in the mid-1800's, they found large mounds in the shape of panthers, birds and turtles, along with oval and cone-shaped mounds. Most of the mounds have disappeared with time. There are only two visible mounds that remain in Milwaukee County today: one eat the Eastern end of Lake Park in the City of Milwaukee, and a very small mound in the State Fair Park grounds.

Milwaukee County was created in 1834 from Brown County, and Waukesha County was sectioned off from it in 1846.

(Source: The Making of Milwaukee Stories: http://www.themakingofmilwaukee.com/classroom/pdf/stories/Native-Americans.pdf)

4.5.2.2 Population

Published 3/24/2017 16:07 by Leah Redding

Population

According to the U.S. Census population estimates in 2015, Milwaukee County is home to 948,930 people. Using this number and the 2016 population estimate for Wisconsin, Milwaukee County makes up approximately 17% of Wisconsin's population, and is the most populous County. Similar to other Midwestern urban areas, Milwaukee County boomed during the height of industrialism, growth slowed in the sixties, and then decreased up until 2010. Current 2015 Census estimates suggest the population has increased approximately 0.9% since 2010. (SEWRPC, Land and Water Resource Management: 2012-2021. U.S. Census). In Milwaukee County, there are approximately 3,926 people per square mile in the county, and about 241 total square miles of land area.

According to the 2010 U.S. Census there are 381,446 households in Milwaukee County with an average of 2.44 people per household. The 2010 U.S. census numbers indicate that the median household income is $43,385 and that the per capita income is $24,622. Approximately 22% of the people live below the poverty line. The 2015 census estimates indicated that there are approximately 416,951 housing units within the county.

Race and Ethnicity: Compared to the rest of Wisconsin (88% white), Milwaukee is a racially diverse county. According to the 2015 U.S. Census estimates, the majority of people in Milwaukee County reported that they were white (65%), but there are substantial percentages of African American (27%) and Latino (14.5%) populations. People of Hispanic or Latino origin were counted as a subcategory of those reporting that they were white, as another race, or as two or more races. There are no Native American tribal lands located within Milwaukee County.

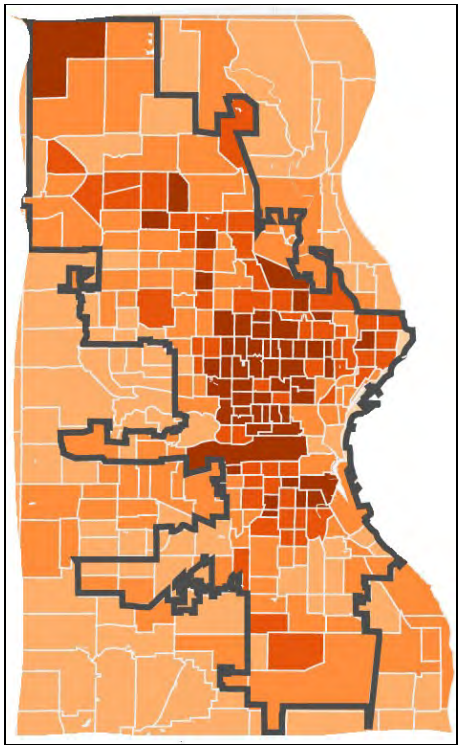
Changing Family Structures: According to the U.S. Census, 57.6% of households were family households in 2010, with an average of 2.4 people per household. The rate of Wisconsin households containing a married couple with children declined from 46% in 1960 to 28% in 1990, and continues to decline. This decline has been faster than the overall percentage of households with children. The percentage of households with children headed by a single mother has risen to about 20% in Milwaukee County.

(Source: https://www.purdue.edu/hhs/hdfs/fii/wp-content/uploads/2015/07/s_wifis02c02.pdf)

Home Ownership and Home Rent: According to the U.S. Census Bureau, 50.7% of housing units were owner-occupied in 2010.

Increasing Poverty: According to U.S. Census data, the percentage of people living below the poverty line has increased in Milwaukee County from 15.3% in 2000, to 22% in 2010. The City of Milwaukee has had the highest poverty rate of any community in the County, with approximately 29.4% of the population living in poverty according to the 2010 Census. The City of Milwaukee is not included in the Milwaukee County plan, however, and so the community with the highest rate of people living in poverty in the plan is Cudahy, at 16.3%.

The Map below displays percentages of residents living below the poverty line. Darker areas represent a higher percentage of people living in poverty. Milwaukee is outlined in grey.



(Source: The Journal Sentinel: Milwaukee's Deep Racial, Economic Divisions are Challenges to Rebirth. Rick Romell, 2013: http://archive.jsonline.com/business/a-time-to-build-milwaukees-deep-racial-economic-divisions-are-challenges-to-rebirth-203641121.html)

Age: The age distribution in Milwaukee County is fairly spread out. The median age in Milwaukee County, according to 2010-2104 American Community Survey (ACS), is 34 years old. This is almost equal with the median age in 2000, which was 33.7 years. The percentage of people ages 65 and older was approximately 13% in 2000, and decreased to 11.7% in 2010-2014 estimates. In 2000, 20% of Milwaukee County residents were between the ages of 45 and 64, which increased to 24.4% in 2010-2014 estimates. The largest age group percentages in 2000 according to the Census was people ages 25-44 at 30.3%, which decreased to 28.4% in 2010-2014 estimates. Additionally, ages 5-24 made up 29.7% of the population in 2000, decreasing slightly to 28.2% in the 2010-2014 ACS. The percentage of children under 5 in 2000 was 7.3%, and 7.1% in 2010-2014.

River Hills and Glendale have the largest percentage of people 60 and older living in their municipality, each at 30% in 2010. Franklin has seen the largest percent increase of senior residents: 189% increase in residents 70 and older.

(Source: Milwaukee County Department on Aging: The Face of Aging in Milwaukee County, Demographic Report, 2012. Third Edition. "Comparisons between 2000 and 2010 by Municipality in Milwaukee County: Older Population in 3 Age Categories.")

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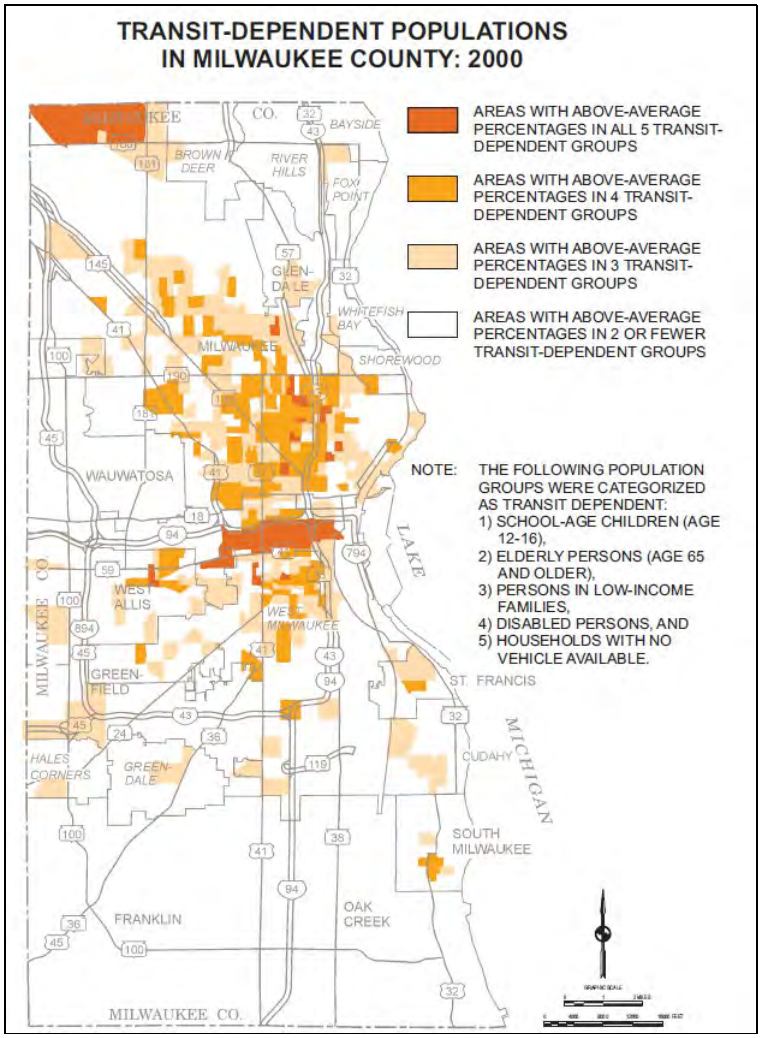
Homeless: Milwaukee County has the highest rate of homelessness in Wisconsin, according to the Wisconsin Division of Housing's 2012 annual report. In 2012, there were 2,783 people in Wisconsin who were chronically homeless (homeless for a year of more). According to this same report, Milwaukee County in 2013 had a total of 6,685 people served by emergency shelters, transitional housing programs, and safe havens (not including permanently housed clients). Many of these people shift in and out of the homeless population.

(Source: Wisconsin Department of Administration, Division of Housing. 2012 Annual Report: The State of Homelessness in Wisconsin)

Transit-Dependent Population: Transit-dependent population characteristics include: seniors (ages 75 and older), people in low-income households, disabled individuals and households with no vehicles. The following map below illustrates the location of functional access needs populations in Milwaukee County that are most likely to be dependent upon transit. Corresponding with poverty levels, people dependent on transit are concentrated in the City of Milwaukee, with isolated areas in South Milwaukee and West Allis.



(Source: Milwaukee County Transit System Development Plan: 2007-2011. SEWRPC)

4.5.2.3 Transportation Network

Published 1/31/2017 13:11 by Leah Redding

Transportation Network

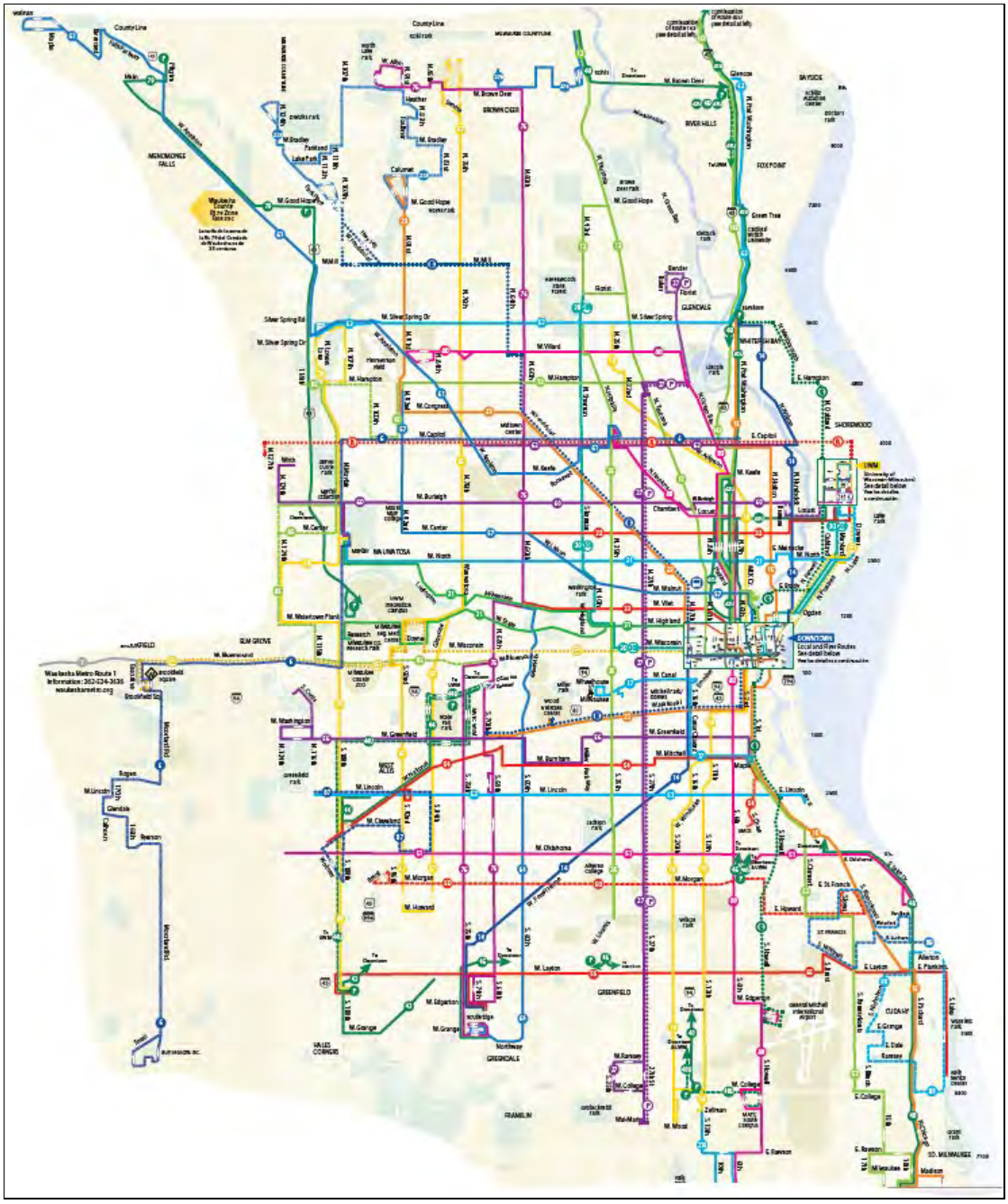
Milwaukee County has five State Trunk Highways (16, 119, 145, 341, 794), two U.S. Highways (41, 45), and four Interstate highways (43, 94, 794, 894).

This street and highway system within the county serves several important functions; including providing movement of vehicular traffic; providing access for vehicular traffic to abutting land uses; providing for the movement of pedestrians and bicycles and serving as a location for utilities and storm water drainage facilities. The freeway system in Milwaukee County carries about 33% of all travel made on an average weekday by Milwaukee County and Southeastern Wisconsin residents.

(Source: Wisconsin Highways & Byways of the Badger State: Milwaukee Freeways. Chris Bessert. 2016.)

In addition to their functional classification, arterial streets and highways are also classified by the unit of government that has the responsibility, or jurisdiction, over the facility. The Wisconsin Department of Transportation (WisDOT) has jurisdiction over the state trunk highway system, Milwaukee County has jurisdiction over the county trunk highway system and each local government unit has jurisdiction over local arterial streets within their community. The state trunk highway system, which includes interstate highways, U.S.–numbered highways and state highways, generally carry the highest traffic volumes, provide the highest traffic speeds, have the highest degree of access control and serve land uses of statewide or regional significance. State trunk highways serve the longest trips, principally carrying traffic traveling through Milwaukee County and between Milwaukee County and surrounding counties. County trunk highways should form an integrated system together with the state trunk highways and principally serve traffic between communities in the county and land uses of countywide importance. Local arterial streets and highways would serve the shortest trips, serve locally-oriented land uses, carry the lightest traffic volumes on the arterial system, carry traffic at lower speeds, have the least access control and predominately serve traffic within a community. (Draft Comprehensive Development Plan)

The Milwaukee County Transit System, operated through the Milwaukee County DOT, covers 241 square miles with an average of approximately 151,000 riders a day. Of these riders, 49% are between 18 and 44 years old, 48% are African American, 41% are white, 87% have a high school education, and 26% have a household income of more than 28,000. About 42% of adult riders use the bus to commute to work. MCTS operates 415 buses that travel for a total of around 17.1 million miles on average per year. Below is a map of Milwaukee County bus routes.



(Source: MCTS System Map: http://www.ridemcts.com/routes-schedules/system-map)

4.5.2.4 Land Use and Development Trends

Published 1/31/2017 13:13 by Leah Redding

Land Use and Development Trends

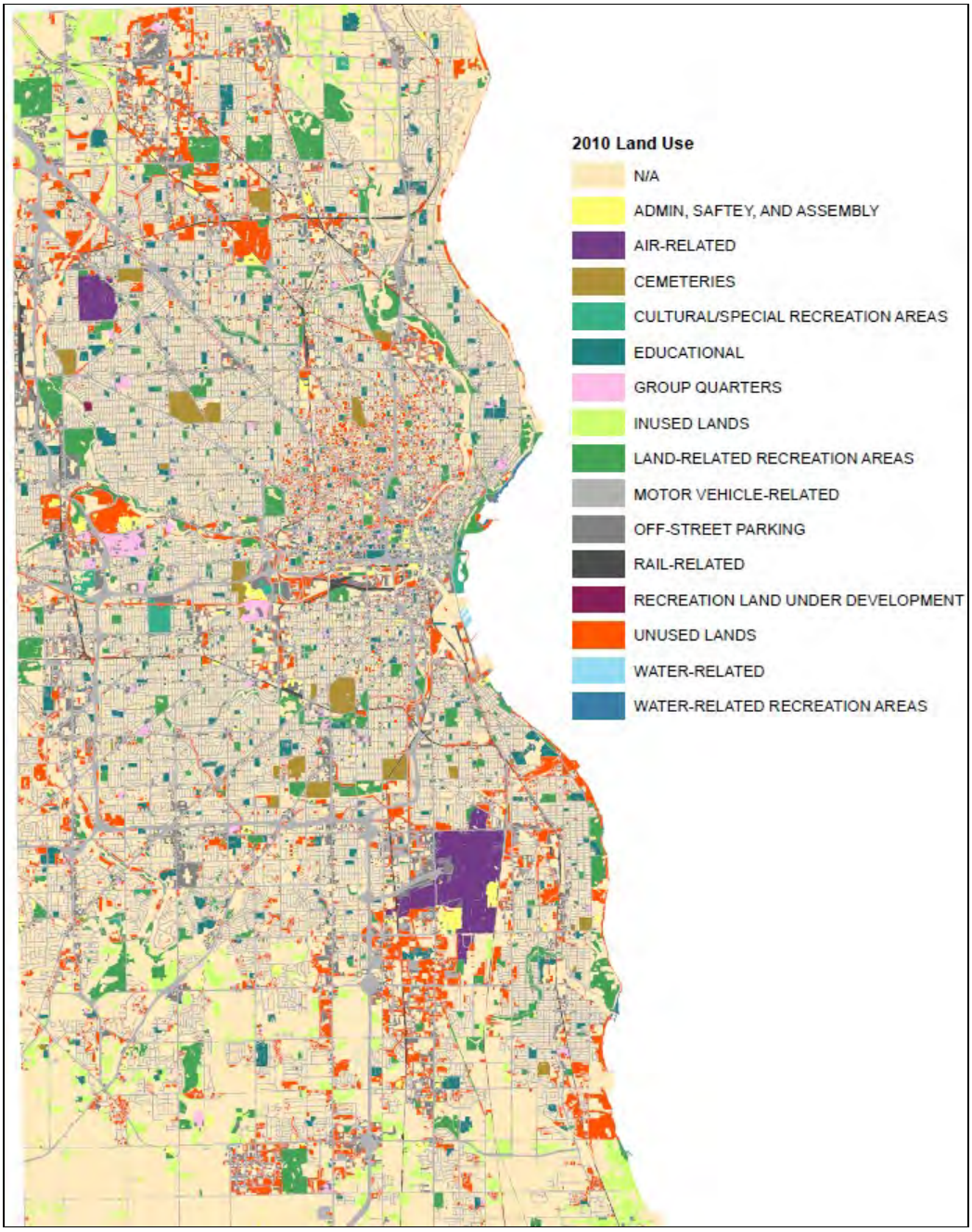
Milwaukee County is the highest-populated county in the Southeast, as well as in the state. The county's central business district, located in the City of Milwaukee downtown, has become an economic engine and transportation hub, with bus, train, plane, and soon a street car option. The city provides a "disproportionate property tax base relative to its small geographic area", drawing commuters in to downtown to work from neighboring suburbs. The majority of Milwaukee County land is zoned for residential uses, and the industrial and retail fields continue to play a major role in the economy. Because of the dense, urban nature of Milwaukee County, new development is no longer viable for many of its communities. However, River Hills, Franklin, and Oak Creek still have large areas of undeveloped land (see specific municipal sections for land use descriptions).

(*Source: Milwaukee Citywide Policy Plan: Land Use 2010*).

The Milwaukee Metropolitan Association of Commerce reported on economic trends in Milwaukee County as of November 2016:

- Historically low unemployment levels: 4% seasonally unadjusted rate for September (the lowest in 16 years)
- Nonfarm employment: 0.5% increase since 2015
- Six of ten major industry sectors registered September job growth since 2015 levels: Trade/transportation/utilities, Construction & Natural Resources, Manufacturing, Other services, leisure/hospitality, and education & health services
    - Trade, transportation, & utilities sector: 3.5% increase since 2015; strongest job increase among growing major industry sectors (above)
- Four of ten major industry sectors with September declines: Financial Activities, Government, Information, Professional & business services
    - Financial Activities Sector: 4.8% decline since last year (largest major sector decline)
- New-car registrations in September: 17.6% decline since 2015

(Source: Metropolitan Milwaukee Association of Commerce (MMAC): September 2016 Economic Trends. http://www.mmac.org/economic-trends.html)



(Source of map: County GIS Dep't- MC Data)

4.5.2.5 Archaeological and Historical Resources

Published 12/7/2016 08:59 by Leah Redding

Historic structures, sites, and districts are sometimes targeted for hazard mitigation strategies due to their unique, often irreplaceable, social value.

Archaeological and Historical Resources

The Wisconsin Historical Society has a listing of archaeological sites that have been identified in Milwaukee County; this list is available to governmental agencies upon request. The National Register of Historic Places also includes a listing of 269 locations in Milwaukee County (the 74 listed here are in communities other than the City of Milwaukee). As mitigation projects are considered, the county is committed to ensuring that archaeological and historical sites are preserved.

Historic Site Name	Address	Municipality
Brown Deer School	4800 W. Green Brook Dr.	Brown Deer
Cudahy Chicago and Northwestern Railway Depot	4647 South Kinnickinnic Avenue	Cudahy
Adelman, Albert and Edith , House	7111 North Barnett Lane	Fox Point
Nohl, Mary L., Art Environment	7328 North Beach Road	Fox Point
Meyer, Starke, House	7896 N. Club Circle	Fox Point
Milwaukee Shipwreck (Steam Screw)	Lake Michigan, 3 miles east of Fox Point	Hartland
Painesville Chapel	2740 W. Ryan Rd.	Franklin
Root River Parkway	Between West Layton Ave. and South 76th Street	Franklin
Town Hall	5909 N. Milwaukee River Pkwy.	Glendale
Elderwood	6789 N. Elm Tree Rd.	Glendale
Milwaukee River Parkway	Between Good Hope Road and West Capitol Drive	Glendale
Curtin, Jeremiah, House	8685 W. Grange Ave.	Greendale
Trimborn Farm	8801 W. Grange Ave.	Greendale
Greendale Historic District	Between West Grange and Catalpa Street	Greendale
Hunt, W. Ben, Cabin	5885 South 116th Street	Hales Corners
Lumberman Shipwreck	4 miles east of Bender Park, Lake Michigan	Oak Creek
Range Line Road Bridge	Range Line Road over the Milwaukee River	River Hills
Appomattox Shipwreck	150 yards off Atwater Beach	Shorewood
Cords, Erwin, House	1913 E. Olive St.	Shorewood
Bossert, Thomas, House	2614 E. Menlo Blvd.	Shorewood
Meyer, Henry A., House	3559 N. Summit Ave.	Shorewood
Hatch, Seneca W. & Bertha, House	3821 N. Prospect Ave.	Shorewood
Shorewood Village Hall	3930 N. Murray Ave.	Shorewood
Morgan, George E., House	4448 N. Maryland Ave.	Shorewood
Church, Benjamin, House	Parkway Dr., Estabrook Park	Shorewood
South Milwaukee Post Office	2210 Tenth Ave.	South Milwaukee
Lawson Airplane Hangar / Continental Faience and Tile Company	909 Menomonee Avenue	South Milwaukee
Oak Creek Parkway	Grant Park at Hawthorne Avenue and Rawson Avenue	South Milwaukee
South Milwaukee Passenger Station	Milwaukee Ave.	South Milwaukee
Old St. Peter's Church	3257 S. Lake Dr.	St. Francis
Henni Hall	3257 S. Lake Dr.	St. Francis
Church Street Historic District	1448--1630 Church St. and 7758 W. Menomonee River Pkwy.	Wauwatosa
Hart, Thomas B., House	1609 Church St.	Wauwatosa
Wauwatosa Woman's Club Clubhouse	1626 Wauwatosa Ave.	Wauwatosa
Wauwatosa Avenue Residential Historic District	1809-1845 Wauwatosa Avenue (odd only), 1907-2242 Wauwatosa Avenue, 7606 and 7624 Stickney Avenue	Wauwatosa
Norton, Pearl C., House	2021 Church St.	Wauwatosa
Damon, Lowell, House	2107 N. Wauwatosa Ave.	Wauwatosa
Hopkins, Willis, House	325 Glenview	Wauwatosa
Davis, H. R., House	6839 Cedar St.	Wauwatosa
George, Warren B., House	7105 Grand Pkwy.	Wauwatosa
Wauwatosa Arcade Building	7210--26 W. North Ave.	Wauwatosa
Kneeland--Walker House	7406 Hillcrest Dr.	Wauwatosa
Fiebing, J. H., House	7707 Stickney	Wauwatosa
Sunnyhill Home	8000 W. Milwaukee Ave.	Wauwatosa
Day, Dr. Fisk Holbrook, House	8000 W. Milwaukee Ave.	Wauwatosa

Annunciation Greek Orthodox Church	9400 W. Congress St.	Wauwatosa
Milwaukee County Home for Dependent Children--Administriation Building	9508 Watertown Plank Rd.	Wauwatosa
Milwaukee County Home for Dependent Children School	9658 Watertown Plank Rd.	Wauwatosa
Milwaukee County School of Agriculture and Domestic Economy Historic District	9722 Watertown Plank Rd.	Wauwatosa
Washington Highlands Historic District	Bounded by N. 68th St., W. Lloyd St., N. 60th St., and Milwaukee Ave.	Wauwatosa
Honey Creek Parkway	Located between State Highway 181 at Interstate 94 and North 72nd Street	Wauwatosa
McMicken, Alexander Herschel and Pauline G., House	1508 South 80th Street	West Allis
Wadhams Gas Station	1647 South 76th Street	West Allis
Kegel's Inn	5901-5905 West National Avenue	West Allis
Juneau Highlands Residential Historic District	6600-6734 W Grant St, 2109-2180 S Livingston Terrace, 6608-6656 W Revere Pl (even only), 6627-29 W Revere Pl	West Allis
West Allis Post Office	7440 West Greenfield Avenue	West Allis
Koelsch Funeral Home	7622 West Greenfield Avenue	West Allis
Greenfield School	8405 West National Avenue	West Allis
Kinnickinnic River Parkway	Located between South 72nd Street and South 16th Street in Milwaukee and West Allis	West Allis
Sperling, Frederick, House	1016 E. Lexington Blvd.	Whitefish Bay
Jenkins, Halbert D., House	1028 E. Lexington Blvd.	Whitefish Bay
Whitefish Bay National Guard Armory	1225 East Henry Clay Street	Whitefish Bay
Van Altena, William, House	1916 E. Glendale	Whitefish Bay
Arndt, Rufus, House	4524 N. Cramer St.	Whitefish Bay
Hardie, Harrison, House	4540 N. Cramer St.	Whitefish Bay
Gabel, George, House	4600 N. Murray Ave.	Whitefish Bay
Van Devan, G. B., House	4601 N. Murray Ave.	Whitefish Bay
Uihlein, Herman, House	5270 N. Lake Dr.	Whitefish Bay
Barfield-Staples House	5461--5463 Danbury Rd.	Whitefish Bay
Ullius, Fred W., Jr., House	5775 N. Santa Monica Blvd.	Whitefish Bay
Hatch, Horace W., House	739 E. Beaumont	Whitefish Bay
McEwens, John F., House	829 E. Lake Forest	Whitefish Bay
Williams, Frank J., House	912 E. Lexington Blvd.	Whitefish Bay
Grant, Paul S., House	984 E. Circle Dr.	Whitefish Bay

(Source: Wisconsin Historical Society: http://www.wisconsinhistory.org/hp/register/)

All of these sites have been reported to the State Historical Society of Wisconsin and are protected sites. If there is concern that a mitigation project will impact one of these or any other identified or suspected archeological site, the county will work with the proper authorities to ensure that all applicable laws and regulations are followed.

The above list is not inclusive of all sites of historic and cultural significance.

4.5.3 Community Capabilities

Published 9/26/2016 08:42 by John Rogan

Even in communities where the potential risks from hazards are acknowledged, and support for disaster-related policies are high, a jurisdiction's preparedness, response, and recovery abilities may still be limited. One reason may be due to the lack of capacity and limited capabilities of that community. While the two terms, capacity and capability, are oftentimes used interchangeably in the disaster literature, it is useful to conceptually delineate the two terms. Capacity, in reference to disaster management planning, can be broadly defined as the amount of resources available to an organization to execute or carry out certain functions to promote the safety and well-being of a community. Although very similar to capacity, capability, with regards to disaster management, can be defined as the actual ability of an institution or individual to perform actions necessary to anticipate, prevent, prepare for, cope with, respond to, or recover from the impact of a hazard. The purpose of delineating the two concepts is simply to show that having capacity, or the essential resources in-hand, does not necessarily translate into being capable of executing those actions. Capacity simply expresses the potential to act accordingly based on the availability of resources, which can be both tangible and intangible. Capability, then, could be considered the sum total of the knowledge, support, and experience required to perform or accomplish a certain task. With respect to disaster management, it is important to have both capacity and capability.

This section discusses "Public Safety" related capabilities within Milwaukee County.

4.5.3.1 Public Safety Support

Published 9/10/2015 17:22 by Daiko Abe

This section provides Public Safety information regarding: Medical, Fire Service, Ambulance Service, Law Enforcement, and Special Teams

4.5.3.1.1 Medical

Published 2/3/2017 15:16 by Leah Redding

Medical

The Milwaukee County Office of Emergency Management, city and county emergency services responders, hospital emergency staff and various departments have developed medical and mass casualty plans. These plans will be used in the event of a disaster. Milwaukee County communities are served by a complete range of health facilities and health professionals.

Milwaukee County has 18 operating hospitals that provide care to county residents. The following hospitals are in Milwaukee County:

- Aurora Psychiatric Hospital
- Aurora St. Luke's Medical Center
- Aurora West Allis Memorial Hospital
- Clement J. Zablocki Veternas Affairs Medical Center
- Colombia St. Mary's- Milwaukee Campus
- Kindred Hospital
- Orthapedic Hospital of Wisconsin
- Sixteenth Street Community Health Center Milwaukee
- Wheaton Franciscan Healthcare- St. Joseph
- Aurora Sinai Medical Center
- Aurora St. Luke's South Shore
- Children's Hospital of Wisconsin
- Columbia St. Mary's- Colombia Campus
- Froedtert Hospital & Medical College Clinics
- Ministry Health Care
- Rogers Memorial Hospital Milwaukee- Campus
- Wheaton Franciscan Healthcare- St. Francis
- Wisconsin Heart Hospital

*Source: *Local Information- Wisconsin Hospitals. Wisconline-(http://www.wisconline.com/counties/WI_hospitals.html#milwaukee)*

These health care facilities will coordinate with responding agencies to ensure the best utilization of services and the least injury or loss of life from a disaster situation. It should also be noted that area hospitals have reciprocal verbal agreements for transferring critical patients during a disaster.

The Milwaukee County OEM 911 Communications Division serves as the Public Safety Answering Point for Milwaukee County. The Communications Center dispatches Sheriff Deputies, Park Rangers, District Attorney Investigators, Law Enforcement Officers, Medical Examiner Investigators, and the Highway Department. Additionally, the center is responsible for dispatch of officers on extradition, civil process, and warrants.

Most Milwaukee County municipalities have their own active PSAP's:

- West Milwaukee Police
- Fox Point Police
- South Milwaukee Police Department
- Brown Deer Police
- Oak Creek Police
- Franklin Police Department
- Wauwatosa Police Department
- St. Francis Police
- Bayside Village Police Department
- Glendale Police Department

- Hales Corners Police
- North Shore Public Safety Communications
- Cudahy Police
- Greendale Police & Fire
- Milwaukee Police Department
- Greenfield Police Department
- West Allis Police Department
- West Allis Police & Fire

* Source: *Wisconsin Public Safety Answering Points. (http://viewresource.mabaswisconsin.org/mabaspsap.php)*

4.5.3.1.2 Fire Service

Published 3/27/2017 09:21 by Leah Redding

Fire Service

There are 19 municipalities and an area of 241 square miles served by 13 fire departments in Milwaukee County. The City of Milwaukee alone has 36 fire stations, 36 engine companies, 12 paramedic units, 5 Battalion Chiefs, with 25- firefighters on duty each day.

Milwaukee County Airport Fire: 1 Fire Station
Northshore Fire: 5 Fire Stations
Cudahy: 2 Fire Stations
Franklin: 3 Fire Stations
Greendale: 1 Fire Station
Greenfield: 2 Fire Stations
Hales Corners: 1 Fire Stations
Milwaukee: 36 Fire Stations
Oak Creek: 1 Fire Station
South Milwaukee: 1 Fire Station
St. Francis: 1 Station
Wauwatosa: 3 Fire Stations
West Allis: 3 Fire Stations

(Source: MFD Special Teams. http://city.milwaukee.gov/SpecialTeams.htm#.WM_c-FXyu00)

4.5.3.1.3 Ambulance Service

Published 3/27/2017 13:01 by Leah Redding

Ambulance Service

Milwaukee County's EMS services are delivered by over 500 plus Paramedics and over 1,000 EMTs and AEMTs, over 241 square miles. Milwaukee County OEM's EMS Division manages the coordinated municipality system through contractual agreements with nine of Milwaukee County's nineteen municipalities to provide Advanced Life Support (ALS), paramedic level, emergency medical services and three municipalities to provide basic life support (BLS) emergency medical services. Milwaukee County EMS provides administration, medical control, education, health information management, medical supplies, quality assurance, medical communications and dispatch guidelines for the municipal fire department ALS and BLS agencies.

Paramedic Units:

Franklin: 3
Greendale: 1
Greenfield: 2
North Shore: 3
Milwaukee: 13
Oak Creek: 3
South Milwaukee: 1
Wauwatosa: 3
West Allis: 3

Special Events Units: 7 (Milwaukee: 4, West Allis: 3)

(Source: MC OEM- EMS Division. http://county.milwaukee.gov/OEM/EMS/About.htm)

4.5.3.1.4 Law Enforcement

Published 2/13/2017 11:59 by Leah Redding

Law Enforcement

The sheriff is the chief law enforcement officer in the county and is responsible for the protection of life and property within the boundaries of Milwaukee County. The Sheriff's Office provides law enforcement for the expressway, security for the GMIA (county airport), for the County Courthouse, the Criminal Justice Facility, the Safety Building, the Children's Detention Center in Wauwatosa, the House of Correction in Franklin, and the Huber community access program.

Today the department is comprised of more than 250 sworn officers and provides direct police services to around 948,930 residents. *(http://county.milwaukee.gov/OfficeoftheSheriff7719.htm)*

A large number of local law enforcement departments are also responsible for protecting and serving the citizens of the many municipalities within the county. Some are large, municipal departments with full-time officers, many with special trainings such as Dive, Investigations and Tactical/SWAT and functions such as bicycle units, school resource officers, neighborhood watch, gangs/special crimes, Drug Abuse Resistance Education (D.A.R.E.), Crime Stoppers, Neighborhood Watch etc. Other departments are smaller and may have part-time staffing but all proudly serve as law enforcement professionals. All Milwaukee County municipalities have departments and are listed below (click for more info):

- Village of Bayfield
- Village of Brown Deer
- City of Cudahy
- Village of Fox Point
- City of Franklin
- City of Glendale
- Village of Greendale
- City of Greenfield
- Village of Hales Corners
- City of Milwaukee
- City of Oak Creek
- Village of River Hills
- Village of Shorewood
- City of South Milwaukee
- Village of St. Francis
- City of Wauwatosa
- City of West Allis
- Village of West Milwaukee
- Village of Whitefish Bay

4.5.3.1.5 Special Teams

Published 3/20/2017 09:15 by Leah Redding

The City of Milwaukee has several special teams that respond to different types of emergencies in the area:

- Citizens and Organizations Active in Disasters (COAD) is an association of individuals and organizations in Waukesha County and Milwaukee County interested in disaster preparedness and response.
- The MFD **HAZMAT team** provides level "A" response capability to Milwaukee, Ozaukee, Waukesha, Washington and Jefferson counties. The Milwaukee Regional Response Team #4 team is one of only seven regional response teams in the State of Wisconsin, who sponsors them . The MFD HAZMAT team is recognized as a leader in responding to Weapons of Mass Destruction (WMD) terrorist events in the state.
- The **Dive Rescue team** covers all of Milwaukee County, including 10.2 miles of Lake Michigan shoreline, three rivers, three dams and many park lagoons. The Dive Team Rescue responds to all emergencies involving swift water and dam rescue, bridge rescue, (thin) ice rescue, ice diving and search and rescue operations. There are 45 members on the team, managed by one fire captain and two fire lieutenants.
- The **Heavy Urban Rescue Team** (HURT) is equipped and trained to perform technical rescue procedures in a safe and efficient manner in the following disciplines: High Angle Rope Rescue, Low Angle Rope Rescue, One-Point Suspension with Litter Tender, Structural Collapse Rescue, Confined Space Rescue and Trench Rescue. The team also rescues firefighters and civilians in the event of an entrapment at a fire scene. The team has 90 members managed by 2 captains and 4 lieutenants.

4.6 Risk Assessment

Published 4/6/2017 14:16 by Leah Redding

V. Risk Assessment

Milwaukee County recognizes that a community's All Hazard Risk Assessment is the fundamental building block of the four core functions of emergency management: prepare, respond, recover, and mitigate. In today's hazard environment, emergency management is the crux of solving the complex challenges that face our communities during an emergency or following a disaster. The disaster activity over the past several years has re-emphasized the importance for communities to invest in creating thorough strategies to develop comprehensive emergency plans and to test, train, and exercise all emergency operations.

The objective of the risk methodology is to devise a process to compare and evaluate which natural, technological, and political hazards are the greatest threats to the County and where mitigation actions should be focused to provide the best value to Milwaukee County. The All-Hazard Risk Assessment describes, analyzes, and assesses the risks facing Milwaukee County from three categories of hazards: Natural, Technological, and Political. Natural hazards are those events that are a result of our surrounding environment, such as wildfires, flooding, or hurricanes. Technological hazards are events that are a result of the failure of infrastructure and systems that we have become dependent on for daily activities, such as transportation networks or utilities. Political hazards are those events that are a result of local, national, or international societal interactions, such as terrorism or civil disturbances.

Each hazard category will elaborate upon and define the different types of hazards that are associated with each, identify historical events that have occurred locally and/or regionally, define the hazard profiles, parameters, and characteristics; assess possible vulnerabilities; determine probable scenarios; and model select hazards. The hazards investigated were identified through extensive research that utilized input from Milwaukee County, Federal Emergency Management Agency (FEMA), Department of Homeland Security (DHS), hazard experts, historical occurrences, Geographic Information System databases, and hazard specific data such as Flood Insurance Maps.

Scope of Analysis

The following is a list of the hazards investigated in this study.

Natural Hazard	Technological Hazards	Political Hazards
Drought & Dust Storms	Utility Failure	Civil Disturbances
Earthquakes	Hazard Materials Release	Labor Disputes
Flooding & Dam Failure	Rail Transportation Incident	Protests
Fog		Terrorism:
Forest & Wildfires		Explosive Devices (bombs)
Severe Temperatures		Airline Attacks
Hail		Chemical/Biological/Nuclear Attacks
Lightning		Hostage Taking
Thunderstorms		Infrastructure Attacks
Tornadoes & High Winds		Active Assailant Attacks
Winter Storms		Home Grown Violent Extremists

Note: Political Hazards were added as part of the 2021 update/review process

Many of the hazards in the Risk Assessment do not pose a significant risk because of their low-probability of occurring or minimal impact; however, these hazards are still addressed in this report. Hazards that were determined to not occur in Milwaukee County (e.g. hurricanes) were removed from the Risk Assessment. Several hazard types (e.g. hazardous materials release) transcend hazard categories (i.e., natural, technological, and political).

Milwaukee County does not yet have access to Hazus-MH. The Milwaukee County Land Information Office is working on obtaining this software, and Milwaukee County will use it when it becomes available.

Hazard Risk Determination

The determination of the risks associated with each hazard were not based on empirical values, but instead based on a function of the probability of the event occurring and its potential impact. This approach was necessary due to the complexities of a uniformed all-hazard approach and the numerous direct and indirect factors for a unique community like Milwaukee County. To remain consistent, a color-coded scale was utilized to provide a descriptive assessment or each risk. An example of the risk scale is provided. Each hazard risk assessment will go through a review process involving the Milwaukee County Steering Committee.

Standard

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.
  - 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
  - 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
    - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
    - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
    - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
    - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?
  - 7. Assessing Vulnerability: Overview; Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.
    - 7.B. Does the new or updated plan address the impact of each hazard on the jurisdiction?
  - 8. Assessing Vulnerability: Addressing Repetitive Loss Properties; Requirement §201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.
    - 8.A. Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?
  - 9. Assessing Vulnerability: Identifying Structures; Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area …
    - 9.A. Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
    - 9.B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?
  - 10. Assessing Vulnerability: Estimating Potential Losses; Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate … .
    - 10.A. Does the new or updated plan estimate potential dollar losses to vulnerable structures?
    - 10.B. Does the new or updated plan describe the methodology used to prepare the estimate?

- 11. Assessing Vulnerability: Analyzing Development Trends; Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
  - 11.A. Does the new or updated plan describe land uses and development trends
- 12. Multi-Jurisdictional Risk Assessment; Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
  - 12.A. Does the new or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?

4.6.1 Hazard Summary

Published 3/24/2017 16:56 by Leah Redding

Hazard Analysis

The following sections identify those hazards that have occurred or could occur in Milwaukee County. Each includes a description of a hazard and its frequency of occurrence. Also included is a section that describes the general vulnerabilities of the community and its infrastructure to each particular type of hazard.

Wisconsin Emergency Management (WEM) regularly updates the State Hazard Mitigation Plan, most recently revised this past year in 2016. This plan describes the hazards that have occurred or are most likely to occur within the state and includes the frequency of occurrence, potential impacts and suggested actions to mitigate the hazard. This plan is the basis for the development of all emergency management plans and is distributed upon revision to county emergency government directors and other stakeholder agencies.

The Milwaukee County Office of Emergency Management develops and annually updates a list of all hazards that have occurred or could occur within the county. This listing includes the definition, frequency of occurrence and actions to mitigate the hazard. In general, the threat of most hazards is consistent throughout the county. The only hazard where there were differences identified within the county was for flooding and for that hazard, specific locations are identified. The ratings for each of these hazards come from an in-depth survey done by expert medical and emergency management professionals who are a part of the Healthcare Emergency Readiness Coalition (HERC), Region 7. These ratings were then compared to ratings given by municipal and Milwaukee County emergency management professionals. The result is the hazard summary below as well as the hazard assessments in each municipal section, with changes made by steering committee members to better fit their community.

Due to the geographic location of Wisconsin and/or Milwaukee County, volcanoes, landslides, hurricanes, and tsunamis were not considered to be a risk and will not have mitigation strategies associated with them.

Wisconsin Emergency Management (WEM) Hazard Matrix						
No.	**Hazard**	**Location (if the risk is not equal for the entire jurisdiction)**	**Frequency/Probability (i.e. Future Probability)**	**Magnitude/Extent (i.e. Strength or Magnitude)**	**Vulnerability (i.e. Consequence and Impact)**	**Overall Risk Rating**
01	Droughts and Dust Storms	Droughts will primarily impact the natural sites of Milwaukee County.	**Medium**	**Low**	**Low**	**Low**
02	Earthquakes	Countywide	**Low**	**Low**	**Medium**	**Low**
03	Flooding and Dam Failure	Countywide	**High**	**Medium**	**High**	**High**
04	Fog	Countywide	**Medium**	**Low**	**Low**	**Low**
05	Forest and Wildfires	As illustrated on the plan's wildfire maps, the highest risk areas are the areas where wildland is in close proximity to urban settlements. Communities adjacent to and surrounded by wildlands (e.g. areas of grassland, woodlands, bushland, scrubland) are most at risk of wildfires.	**Low**	**Low**	**Low**	**Low**

06	Hail	Countywide	High	Low	Low	Medium
07	Lightning	Countywide	High	Medium	Medium	Medium
08	Severe Temperatures	Countywide	Medium	Medium	Medium	Medium
09	Thunderstorms	Countywide	High	Medium	Low	Medium
10	Tornadoes and High Winds	Countywide	Medium	Medium	Medium	Medium
11	Winter Storms	Countywide	Medium	Medium	Low	Medium
12	Hazardous Materials Release	Near transit hubs, rail, or large industrial facilities that store or produce hazardous materials	Medium	Medium	Medium	Medium
13	Utility Failure	The highest risks associated with power failures and utility failures are in communities with hospitals, nursing homes, care facilities, elderly housing facilities and other housing/care facilities occupied by vulnerable populations.	Medium	Medium	Medium	Medium
14	Rail Transportation Incident	Countywide; Specifically near major rail lines and routes.	Low	Medium	Medium	Medium

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.2. Rationale for any omitted natural hazards that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B.3.1 Potential impacts of each identified hazard for each participating jurisdiction
    - B.3.2 Vulnerability of each participating jurisdiction to the identified hazards
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.
  - 7. Assessing Vulnerability: Overview; Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.
    - 7.A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?

4.7 Drought and Dust Storms

Published 9/26/2016 08:48 by John Rogan

Drought and Dust Storms

Two types of drought occur in Wisconsin: agricultural and hydrologic. Agricultural drought is a dry period that reduces crop yields. Hydrologic drought is a dry period of sufficient length and intensity to affect lake and stream levels and the height of the groundwater table. These two types of drought may, but do not necessarily, occur together.

Dust storms result from a combination of high winds and dry, loose soil conditions. While high winds and periods of drought have each occurred in Milwaukee County, there has never been a recorded dust storm event. Since natural hazards that have occurred in the past are more likely to occur in the future, it is unlikely that a dust storm event will occur in Milwaukee County. This assertion is further bolstered by the fact that there is very little irrigation done within the county and that the soils in Milwaukee County are not prone to blowing. While there are concerns about topsoil erosion and some mitigation activities may be planned that would reduce the effects of these types of events, they will not be a major focus of this plan.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.
  - 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
  - 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
    - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
    - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
    - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
    - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.7.1 Drought and Dust Storms Hazard Profile

Published 9/26/2016 08:55 by John Rogan

Hazard Profile

A drought is characterized as an extended period of time with persistent dry weather conditions in a geographic area that typically has rain fall. In essence, droughts are water deficits that have harmful consequences for people, animals and plants. Droughts can also negatively impact the environment by depleting the moisture from soil ruining crop production; water levels can decrease in streams, rivers, lakes and reservoirs; and wildfires can result from extended or severe droughts. Other climatic factors such as high temperatures, high winds, and low humidity can significantly worsen a drought's severity. A drought can however be defined in several different ways depending on the geographical region and situation:

- Meteorological drought: When the normal level of precipitation has a significant measurable drop.
- Agricultural drought: When the level of soil moisture drops below the suitable range for agricultural growth.
- Hydrological drought: When the surface water and underground water supply falls below normal.
- Socioeconomic drought: When water shortages seriously interferes with human activity.
- What constitutes as a drought in one region may not qualify in another.

The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993. The SPI quantifies the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation anomalies on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect longer-term precipitation anomalies. For these reasons, the SPI is calculated for 3-, 6-, 12-, 24- and 48-month time scales.

The SPI calculation for any location is based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero. Positive SPI values indicate greater than median precipitation and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way and wet periods can also be monitored using the SPI.

The classification system shown in the SPI values table (below) defines drought intensities resulting from the SPI. The criteria for a drought event are also defined for any of the time scales. A drought event occurs any time the SPI is continuously negative and reaches an intensity of -1.0 or less. The event ends when the SPI becomes positive. Each drought event, therefore, has a duration defined by its beginning and end and an intensity for each month that the event continues. The positive sum of the SPI for all the months within a drought event can be termed the drought's "magnitude." Current SPI maps for the United States can be found at http://www.drought.unl.edu/monitor/spi.htm.

SPI Values	Description
2.0	Extremely Wet
1.55 - 1.99	Very Wet
1.0 - 1.49	Moderately Wet
-0.99 - 0.99	Near Normal
-1.0 to -1.49	Moderately Dry
-1.5 to -1.99	Severely Dry
-2.0 and less	Extremely Dry

Palmer Drought Index

The Palmer Index, developed by Wayne Palmer in the 1960s, uses temperature and rainfall information to formulate dryness. It has become the semi-official drought index. The index is effective in determining long term drought conditions of several months. The index sets normal conditions at 0 with drought conditions in negative values. The index can also be reversed showing the excess of precipitation where the normal conditions at 0 and positive values for amount of rainfall.

The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions.

The National Integrated Drought Information System (NIDIS) provides alerts when conditions are favorable for drought. The following table provides information on the different alerts for the National Weather Service:

Alert	Criteria	Palmer Drought Index
D0 Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1 Moderate Drought	Some damage to crops, pastures, streams, reservoirs, or wells low, some water shortages developing or imminent, and voluntary water-use restrictions requested.	-2.0 to -2.9
D2 Severe Drought	Crop or pasture losses are likely, water shortages common and water restrictions imposed.	-3.0 to -3.9
D3 Extreme Drought	Major crop and pasture losses with widespread water shortages or restrictions.	-4.0 to -4.9
D4 Exceptional Drought	Exceptional and widespread crop and pasture loss, shortages of water in reservoirs, streams, and wells creating water emergencies.	-5.0 or less

The Palmer Index is an older scale and is used more often by governmental organizations. It is effective in determining long-term drought (i.e., over several months) and is not as good with short- term forecasts (i.e., weeks.) It uses a zero as normal; drought is shown in terms of negative numbers and excess moisture is reflected by positive figures. The future incidence of drought is highly unpredictable and may also be localized, making it difficult to determine probability with any accuracy.

Drought conditions may vary from below-normal precipitation for a few weeks to a severe lack of normal precipitation for several months. Drought primarily affects agricultural areas because the amount and timing of rainfall has a significant impact on crop production. The severity of a drought cannot therefore be completely measured in terms of precipitation alone but must include crop yields.

Hazard Considerations

The following is a list of potential impacts and planning considerations for a drought event.

Area Impacted:

- Regional and Statewide

Duration of the event:

- Droughts can occur over a period of weeks, months and years.

Essential Service Disruption:

- Water shortages force government officials to order water restrictions

Special Needs:

- Agriculture (farming and ranching) community most affected.
- Rural populations

Direct Damage:

- Farming/Ranching business interruption due to agricultural losses
- Lower water levels in reservoirs, lakes, and ponds
- Government officials forced to spend millions in emergency or non-budgeted funds to ensure adequate ground water supplies for residents.

Economic Damage:

- Agricultural losses – fields, crops, pastures and livestock can be devastated for months and even years resulting in severe economic hardship in these industries.
- Loss to industries directly dependent on agricultural production (e.g., machinery and fertilizer manufacturers, food processors, dairies, fishery, timber etc.)
- Reduction of economic development
- Rural population loss

Environmental Damage:

- Migration and concentration of wildlife
- Effect on water quality (e.g., salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)
- Prolonged drought over a number of years could have long-term environmental impacts on the area, such as species endangerment and changes to agriculture.
- Increased risk of sinkhole formation.

Emergency Services:

- Inadequate water supply to effectively manage fire

Social Factors:

- Practicing water conservation that protects the environment while supplying residents with adequate amounts of drinking and irrigation water supplies
- Increased respiratory ailments and disease caused by wildlife concentrations
- Reduced quality of life and changes in lifestyle (population migrations, social values, disruption of cultural beliefs, etc.)

4.7.2 Location and Extent

Published 4/6/2017 12:45 by Leah Redding

Location and Extent

Droughts can be devastating for the host community. Direct impacts of a drought can include reduced crop, rangeland, and forest productivity; increased fire hazards; reduced water levels; increased livestock and wildlife mortality rates; damage to wildlife and fish habitat; increased problems with insects and diseases to forests and reduce growth. Indirect results can lead to financial hardships for farmers and increased prices for food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and businesses, migration, and disaster relief programs.

In addition to the impacts of a drought on farming and agriculture, a drought can be related to other hazards. Extreme weather can complicate droughts because high temperatures increase the amount of evapotranspiration that occurs in plants. Increased evapotranspiration results in higher water loss rates and increases plant damage. The probability of landscape plants loss and extreme crop losses can be increased during a drought if high temperatures are also experienced.

Dead and dry vegetation caused by droughts also provide fuel for wildfires. Drought-related wildfires should be monitored closely by the County to ensure the protection of commercial, industrial, agricultural, and residential regions. Milwaukee County is less susceptible to droughts because it is very urban and positioned on Lake Michigan. However, with the onset of Climate Change, all counties are vulnerable to severe drought.

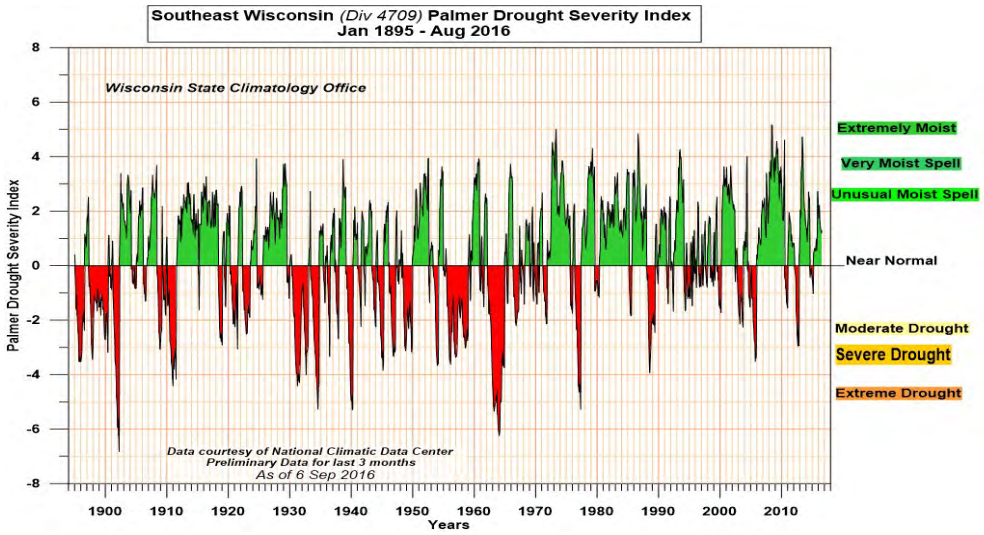
4.7.3 Frequency and Probability

Published 12/6/2016 12:37 by Leah Redding

Frequency Occurrence

Drought is a relatively common phenomenon in Wisconsin and has occurred statewide in 1895, 1910, 1939, 1948, 1958, 1976, 1988, 1992, 2003, 2005 and 2012. The 1976 drought received a Presidential Emergency Declaration with damage to 64 Wisconsin counties. Estimated losses of $624 million primarily affected the agricultural sector. Only 19% ($119,434,924) of this loss was compensated by any federal program.

The Palmer Index chart for the years between January 1895 and August 2016 in Southeastern Wisconsin, which includes Milwaukee County follows:



*Source: http://www.aos.wisc.edu/~sco/clim-watch/graphics/pdsi-ts-09-l.gif

The Governor declared a drought emergency for 42 counties in the state of Wisconsin in July 2012. This declaration, the first since August 2003, allowed farmers access to additional water for crop irrigation. The National Weather Service has 17 recorded drought events for Milwaukee County between August 1950 and August 2016.

County	Date	Death	Injury	Property Damage	Crop Damage
Milwaukee County	8/1/2002	0	0	0	$25,000
Milwaukee County	8/1/2003	0	0	0	0
Milwaukee County	9/1/2003	0	0	0	0
Milwaukee County	10/1/2003	0	0	0	0
Milwaukee County	11/1/2003	0	0	0	0
Milwaukee County	12/1/2003	0	0	0	0
Milwaukee County	7/1/2005	0	0	0	0
Milwaukee County	8/1/2005	0	0	0	0
Milwaukee County	9/1/2005	0	0	0	0
Milwaukee County	10/1/2005	0	0	0	0
Milwaukee County	11/1/2005	0	0	0	0
Milwaukee County	7/1/2007	0	0	0	0
Milwaukee County	6/26/2012	0	0	0	0
Milwaukee County	7/1/2012	0	0	0	0
Milwaukee County	8/1/2012	0	0	0	0
Milwaukee County	9/1/2012	0	0	0	0
Milwaukee County	10/1/2012	0	0	0	0

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.7.4 Vulnerability

Published 11/30/2016 09:23 by Leah Redding

Hazard Impacts

Drought generally impacts farm output by reducing crop yields and the health and product output (e.g., milk) of livestock. As a result, a drought will seriously impact the economy of the entire county. Dust storms impact farms in the long term by blowing away the top levels of soil, which are the richest. This could economically impact the county by reducing its long-term viability for farming. Drought is also a major risk factor for wildfire.

Drought can reduce the amount of surface water available for recreational activities (e.g., boating, fishing, water skiing) and for wildlife. This is important because, for example, low water levels can lead to an outbreak of disease (e.g., botulism) in migratory bird pools.

Prolonged drought can also impact the groundwater reserves. This can reduce the ability of water services and rural individuals on wells to draw adequate fresh water. This may especially impact rural homeowners who tend to have wells that are not drilled as deeply as municipal wells. In Milwaukee County, most people get their water from Lake Michigan, through public utilities. There could also be a safety risk during dust storms if they are severe enough to reduce the visibility of the roadways for drivers.

The impacts of many droughts are not felt in urban areas where their impacts are usually limited to the inconvenience of ordinances and regulations to conserve water. However, in rural communities droughts can be devastating. Losses from droughts are typically underestimated and inaccurate. Indirect losses form impacts such as farm foreclosures are not often accounted, and direct crop or livestock losses are typically difficult to evaluate due to fluctuations in the commodity markets.

Hazard Assessment		
Drought and Dust Storms		
Frequency/Probability (i.e. Future Probability)	▶	Medium
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Low
Vulnerability (i.e. Consequence and Impact)	▶	Low
Overall Risk Rating	▶	Low

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.8 Earthquakes

Published 12/6/2016 12:50 by Leah Redding

An earthquake is a shaking or sometimes violent trembling of the earth which results from the sudden shifting of rock beneath the earth's crust. This sudden shifting releases energy in the form of seismic waves (wave-like movement of the earth's surface).

Source: http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/earthquake_guide.pdf

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.
  - 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
  - 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
    - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
    - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
    - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
    - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.8.1 Earthquakes Hazard Profile

Published 4/22/2016 19:35 by a-reum han

Hazard Profile

Earthquakes (also known as 'seismic events') are sudden slippages or movements in a portion of the earth's crust accompanied by a series of vibrations. The ground shaking is caused by the sudden release of accumulated strain by an abrupt shift of rock along a fracture or fault in the earth, by volcanic or magmatic activity, or by other sudden stress changes in the earth's crust. The hypocenter of an earthquake is the location beneath the earth's surface where the rupture of the fault begins. The epicenter of an earthquake is the location directly above the hypocenter on the surface of the earth.

Earthquakes occur on faults. A fault is a fracture or zone of fractures between two blocks of rock. Faults allow the blocks to move relative to each other. This movement occurs rapidly during an earthquake. Faults may range in length from a few millimeters to thousands of kilometers. Most faults produce repeated displacements or repeated earthquakes over long time periods. During an earthquake, the rock on one side of the fault suddenly slips with respect to the other. The fault surface can be horizontal or vertical or some arbitrary angle in between. Geologists use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults.

Faults which move along the direction of the dip plane are dip-slip faults and described as either normal or reverse (thrust), depending on their motion. Faults which move horizontally are known as strike-slip faults and are classified as either right-lateral or left-lateral. Faults which show both dip-slip and strike-slip motion are known as oblique-slip faults. Normal faults are a dip-slip fault in which the block above the fault has moved downward relative to the block below. This type of faulting occurs in response to extension and is often observed in the Western United States Basin and Range Province and along oceanic ridge systems. Thrust fault is a dip-slip fault in which the upper block, above the fault plane, moves up and over the lower block. This type of faulting is common in areas of compression, such as regions where one plate is being sub-ducted under another as in Japan. When the dip angle is shallow, a reverse fault is often described as a thrust fault. Strike-slip fault is a fault on which the two blocks slide past one another. The San Andreas Fault is an example of a right lateral fault. A left-lateral strike-slip fault is one on which the displacement of the far block is to the left when viewed from either side. A right-lateral strike-slip fault is one on which the displacement of the far block is to the right when viewed from either side.

Aftershocks are earthquakes that follow the largest shock of an earthquake sequence. They are smaller than the main shock and within 1-2 rupture lengths distance from the main shock. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the main shock, the larger and more numerous the aftershocks, and the longer they will continue.

Earthquakes and seismic activity has a very rapid and unpredictable onset. Current technology cannot predict an earthquake and is limited to real-time seismic surveillance. The duration of an earthquake is related to its magnitude but not in a perfectly strict sense. There are three ways to think about the duration of an earthquake. The first is the length of time it takes for the fault to fully rupture. The second is the length of time shaking is felt at any given point. Earthquakes can last from seconds to minutes. The third way to think about duration is the aftershock period after the main seismic event. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the main shock, the larger and more numerous the aftershocks, and the longer they will continue.

Richter Scale

Earthquake strength has traditionally been measured using the Richter scale, developed by Charles Richter in 1935. The Richter scale went through numerous adjustments since its conception, and was eventually replaced by the "Moment Magnitude Scale" for earthquakes larger than 3.5; however, most still refer to both scales as the Richter scale. The Richter magnitude scale, used as an indicator of the force of an earthquake, measures the magnitude, intensity, and energy released by an earthquake with seismographs. Each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value. It is important to note that the Richter Magnitude Scale is not used to express damage.

Magnitude	Earthquake
< 2.0	Micro earthquakes, not felt.
2.0 - 2.9	Minor earthquakes, generally not felt, but are recorded.
3.0 - 3.9	Minor earthquakes, often felt, but rarely causes damage.
4.0 - 4.9	Light earthquakes, noticeable shaking of indoor items, rattling noises, and significant damage is unlikely.
5.0 - 5.9	Moderate earthquakes, can cause major damage to poorly constructed buildings over small regions, and possible slight damage to well-designed buildings.
6.0 - 6.9	Strong earthquakes, can be destructive in areas up to about 99 miles across in populated regions.
7.0 - 7.9	Major earthquakes, can cause serious damage over larger regions.
8.0 - 8.9	Great earthquakes, can cause serious damage in regions several hundred miles across.
9.0 - 9.9	Great earthquakes, devastating in areas several thousands of miles across.
10 <	Massive earthquakes, never recorded, widespread devastation across vast regions.

Source: United States Geological Survey

Modified Mercalli Intensity Scale

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. The Modified Mercalli (MM) Intensity Scale is the common intensity scale used in the United States. This scale is composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the non-scientist than the magnitude because intensity refers to the effects actually experienced at that place. The following is an abbreviated description of the 12 levels of Modified Mercalli Intensity:

Level of Intensity	Observed Earthquake Effects
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: United States Geological Survey

4.8.2 Location and Extent

Published 11/30/2016 09:54 by Leah Redding

Physical Characteristics

There are a few fault lines that run through Wisconsin. These include the Douglas Thrust Fault in the NW corner of the state, the Pine Fault found in Burnett and Polk Counties, the Lake Owens Thrust Fault that extends into western Ashland County, and the Dutchman Creek Fault near Green Bay. There are additional fault lines in southern Wisconsin from near Madison to the suburbs of Milwaukee and further south from New Diggings to Milton.

The nearest major active fault is the New Madrid Fault, stretching along the central Mississippi River Valley in Missouri. In recent years, considerable attention has focused on seismic activity in the New Madrid seismic zone that lies within the central Mississippi Valley, extending from northeast Arkansas through southeast Missouri, western Tennessee and western Kentucky to southern Illinois. Scientists at the Center for Earthquake Information have computed a set of probabilities that estimates the potential for different magnitude earthquakes to occur at the New Madrid Fault. Even an 8.3 magnitude earthquake at the New Madrid Fault, however, would cause only minor damage in the southeastern Wisconsin. At this time it is not possible to predict the exact date, duration or magnitude of an earthquake.

Severe earthquakes destroy power and telephone lines, gas, sewer, or water mains, which, in turn, may set off fires and/or hinder firefighting or rescue efforts. Earthquakes also may cause buildings and bridges to collapse. Most of Wisconsin's occurrences have not been severe, with only one registering 5.1 on the Richter Scale in Beloit, 1909.

The likelihood of an area to experience an earthquake is expressed as a Seismic Risk Zone Value. Seismic Risk Zones are numbered 0 to 4, with a 4 representing the highest likelihood of a serious earthquake. Milwaukee County is rated a 0 on the Seismic Risk Zone scale.

Six earthquakes have occurred in Milwaukee County since 1906 with the last one occurring in 1987. Three have ranged in the magnitude from 3.0 – 3.9 on the Richter scale and the other three have been in the 4.0-4.9 range. A magnitude 4.0 earthquake, centered just south of Milwaukee, shook Milwaukee County on May 6, 1947. Some residents that felt the quake ran into the streets thinking there was a major explosion, damage was limited to some broken windows and glassware that fell from shelves. (State of Wisconsin, 2002).

4.8.3 Frequency and Probability

Published 11/30/2016 09:52 by Leah Redding

Earthquakes that have affected Wisconsin from 1899 to 1987 are listed in the table that follows. The most severe earthquake in Wisconsin was the record earthquake of 1811, centered along the New Madrid Fault. An earthquake on May 6, 1947, apparently centered just south of Milwaukee near the shore of Lake Michigan, caused only minor damage. There were no reports of injuries. The tremor shook buildings and rattled windows in many communities in a 7770 square kilometer area of southeastern Wisconsin. The shock was felt in a 160 kilometer wide strip from Sheboygan to the Wisconsin - Illinois border and extended from the lakeshore to Waukesha, 40 kilometers inland.

Most earthquakes that do occur in Wisconsin are very low in intensity and can hardly be felt. These very minor earthquakes are fairly common, occurring every few years. Events of moderate magnitude have occurred in locations in Illinois and Michigan. Those and other stronger earthquakes centered in other parts of the country have been felt primarily in Southern Wisconsin. Six earthquakes have occurred in Milwaukee County since 1906 with the last one occurring in 1987. Three have ranged in the magnitude from 3.0 – 3.9 on the Richter scale and the other three have been in the 4.0-4.9 range. A magnitude 4.0 earthquake, centered just south of Milwaukee, shook Milwaukee County on May 6, 1947. Some residents that felt the quake ran into the streets thinking there was a major explosion, damage was limited to some broken windows and glassware that fell from shelves. *The following table shows earthquakes and shocks felt in Wisconsin (State of Wisconsin, 2002).*

Date	Location	Latitude North	Longitude West	Maximum Intensity	Magnitude
10/12/1899	Kenosha	42o 34’	87o 50’	II	3
3/13/1905	Marinette	45o 08’	87o 40’	V	3.8
4/22/1906	Shorewood	43o 03’	87o 55’	II	3
4/24/1906	Milwaukee	43o 03’	87o 55’	III	--
1/10/1907	Marinette	45o 08’	87o 40’	III	--
5/26/1909	Beloit	42o 30’	89o 00’	VII	5.1 (max)
10/7/1914	Madison	43o 05’	89o 23’	IV	3.8
5/31/1916	Madison	43o 05’	89o 21’	II	3
7/7/1922	Fond du Lac	43o 47’	88o 29’	V	3.6
10/18/1931	Madison	43o 05’	89o 23’	III	3.4
12/6/1933	Stoughton	42o 54’	89o 15’	IV	3.5
11/7/1938	Dubuque	42o 30’	90o 43’	II	3
11/7/1938	Dubuque	42o 30’	90o 43’	II	3
11/7/1938	Dubuque	42o 30’	90o 43’	II	3
2/9/1943	Thunder Mountain	45o 11’	88o 10’	III	3.2
5/6/1947	Milwaukee	43o 00’	87o 55’	V	4
1/15/1948	Lake Mendota	43o 09’	89o 41’	IV	3.8
7/18/1956	Oostburg	43o 37’	87o45’	IV	3.8
7/18/1956	Oostburg	43o 37’	87o45’	IV	3.8
10/13/1956	South Milwaukee	42o 55’	87o52’	IV	3.8
1/8/1957	Beaver Dam	42o 32’	98o48’	IV	3.6
2/28/1979	Bill Cross Rapids	45o 13’	89o46’	--	<1.0 MoLg
1/9/1981	Madison	43o 05’	87o55’	II	--
3/13/1981	Madison	43o 37’	87o45’	II	--
6/12/1981	Oxford	43o 52’	89o39’	IV-V	--
2/12/1987	Milwaukee	42o 95’	87o84’	IV-V	--
2/12/1987	Milwaukee	43o 19’	87o28’	IV-V	--
6/28/2004	Troy Grove, IL	41o 46’	88o91’	IV	4.2

The nearest major active fault is the New Madrid Fault, stretching along the central Mississippi River Valley in Missouri. In

recent years, considerable attention has focused on seismic activity in the New Madrid seismic zone that lies within the central Mississippi Valley, extending from northeast Arkansas through southeast Missouri, western Tennessee and western Kentucky to southern Illinois. Scientists at the Center for Earthquake Information have computed a set of probabilities that estimates the potential for different magnitude earthquakes to occur at the New Madrid Fault. Even an 8.3 magnitude earthquake at the New Madrid Fault, however, corner of would cause only minor damage in the southeastern Wisconsin. At this time it is not possible to predict the exact date, duration or magnitude of an earthquake.

The likelihood of an area to experience an earthquake is expressed as a Seismic Risk Zone Value. Seismic Risk Zones are numbered 0 to 4, with a 4 representing the highest likelihood of a serious earthquake. Milwaukee County is rated a 0 on the Seismic Risk Zone scale. Minor damage (e.g., cracked plaster, broken windows) from earthquakes has occurred in Wisconsin but most often the results have been only rattling windows and shaking ground. There is little risk except to structures that are badly constructed. Most of the felt earthquakes reported have been centered in other nearby states. The causes of these local quakes are poorly understood and are thought to have resulted from the still-occurring rebound of the earth's crust after the retreat of the last glacial ice. The likelihood of damage from an earthquake is also very low.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.8.4 Vulnerability

Published 4/22/2016 19:36 by a-reum han

Any impact in the community from earthquake would likely be due to a few broken windows and personal effects that fell in the earthquake. The damage to critical infrastructure and buildings would be negligible.

Hazard Assessment		
Earthquakes		
Frequency/Probability (i.e. Future Probability)	▶	Low
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Low
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Low

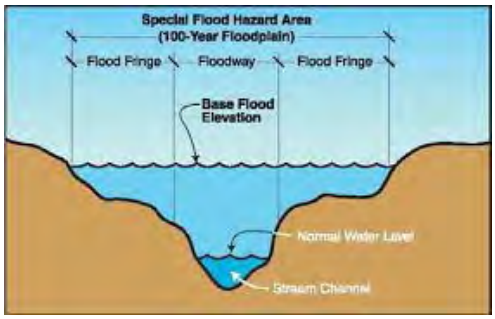
Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.9 Flooding and Dam Failure

Published 1/31/2017 13:19 by Leah Redding

Flooding is defined as a general condition of partial or complete inundation of normally dry land (i.e., the floodplains) caused by the overflow of inland waters or the unusual and rapid accumulation or runoff of surface waters from any source. Floodplains are the lowlands next to a body of water that are susceptible to recurring floods.



FEMA, August 2001

Floods are common in the United States, including Wisconsin, and are considered natural events that are hazardous only when adversely affecting people and property. Floods are common in the United States, including in Wisconsin, and are considered natural events that are hazardous only when adversely affecting people and property. Floods are the most frequently recorded destructive events and account for about 30% of the world's disasters each year, according to global statistics. There are many different factors that contribute to flooding. Flooding is an overflowing of water onto land that is normally dry. It can happen during heavy rains, when ocean waves come onshore, when snow melts too fast, or when dams or levees break. Flooding may happen with only a few inches of water, or with several feet of water. Flooding can affect many different communities covering several states during a single event.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B4. Does the Plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods? (Contact Wisconsin Emergency Management to obtain this information for your jurisdiction.) 44 CFR 201.6(c)(2)(ii)
    - B4.A. This information is subject to The Privacy Act of 1974, as amended. No information may be included in the Plan that identifies specific properties or property owners. Information describing general areas where claims have been paid can be made public. Please contact Wisconsin Emergency Management if you have questions.
    - B4.1. Estimate of the numbers of repetitive loss properties located in identified flood hazard areas
    - B4.2. Description of the types (residential, commercial, industrial, etc.) of repetitive loss properties identified above
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.
  - 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
  - 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
    - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
    - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
    - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
    - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.9.1 Flooding and Dam Failure Hazard Profile

Published 3/27/2017 08:42 by Leah Redding

Hazard Profile

Floods are the most frequently recorded destructive events and account for about 30% of the world's disasters each year, according to global statistics. There are many different factors that contribute to flooding. Flooding is an overflowing of water onto land that is normally dry. It can happen during heavy rains, when ocean waves come onshore, when snow melts too fast, or when dams or levees break. Flooding may happen with only a few inches of water, or with several feet of water. Flooding can affect many different communities covering several states during a single event.

Floods are a part of the earth's natural hydrologic cycle. The cycle circulates water throughout the environment, maintaining an overall balance between the water in the air, on the surface, and in the ground. Sometimes the hydrologic cycle gets out of balance, sending more water to an area than it can normally handle – inundating a floodplain. There are different types of floodplains and they are based on the type of flooding that forms them. During the 20th century, floods were the number one natural disaster in the United States in terms of the number of lives loss and property damage. Development has exacerbated this situation by creating impermeable surfaces that were once permeable - increasing the amount of storm water runoff while also decreasing the floodplain area.

A warmer atmosphere holds more water vapor and, therefore, can result in heavier and more long-lasting rainfall events. The expected global pattern is for arid areas to get drier and moist areas to get wetter. Where precipitation is enhanced, strong storms are expected to get stronger with the result that rainfall events with a given recurrence frequency, e.g. the 25-year storm, will happen more often. Detecting the influence of changing climate on flooding trends requires isolating the effects of increased rainfall intensity and frequency from the other factors that influence the areal extent and depth of floods, including land use, changes to drainage infrastructure, and changes in the extent of impervious surfaces.

The type of flooding that threatens a community is dependent on a variety of factors including terrain, geologic conditions, watershed characteristics, natural features, and human interaction. The characteristics of flooding events differ dramatically in a controlled engineered urban community from that of the more natural rural environment.

- **Urban flooding** is a result of a community's storm water infrastructure being exceeded by a storm or series of storms. An urban drainage system is comprised of altered natural channels and engineered ditches, storm sewers, retention ponds, and other facilities constructed to store runoff or carry it to a receiving stream or lake. Most storm water infrastructure systems are designed to handle the amount of water expected during a 10-year storm. Larger storms typically overload the storm water system producing shallow flooding.
- **Overbank Flooding** occurs when downstream channels receive more rain from their watershed than it can handle, or a channel is blocked by debris. Excess water overloads the channels and flows out onto the floodplain. Flood depths and duration are dependent on the watershed and riverine system. Generally, the larger the river, the deeper the flood and the longer the duration of the flood.
- **Ponding** is attributed to the high groundwater table and flat terrain. In flat areas, runoff collects in depressions and cannot drain out, creating a ponding effect. Ponding floodwaters do not move or flow away. Floodwaters will remain in the temporary ponds until they infiltrate the soil, evaporate, or are pumped out.
- **Lake Flooding** is a result of large bodies of water behaving more like small oceans – generating large waves that cause damage and shoreline erosion from severe storms.

1% Chance Annual Exceedance Probability (AEP) Flood

The 1% AEP Flood, or more commonly the "100-year flood", is defined as the flood water level that has a 1 in 100 chance of being equaled or exceeded in any 1 year. It has an average recurrence interval of 100 years. The DNR, working with local zoning offices, has designated flood plain areas as those places where there is the greatest potential for flooding.

A 100-year storm does not always result in a "100-year" flood. Flooding magnitude varies extensively depending on region, soil conditions, weather, and a large host of manmade factors such as dams and levees among others. Several factors can independently influence the cause-and-effect relation between rainfall and stream flow:

- **Extent of rainfall in the watershed:** When rainfall data are collected at a point within a stream basin, it is highly unlikely that this same amount of rainfall occurred uniformly throughout the entire basin. During intensely localized storms, rainfall amounts throughout the basin can differ greatly from the rainfall amount measured at the location of the rain gage. Some parts of the basin may even remain dry, supplying no additional runoff to the stream flow and lessening the impact of the storm.
- **Soil saturation before the storm:** Existing conditions prior to the storm can influence the amount of storm water runoff into the stream system. Dry soil allows greater infiltration of rainfall and reduces the amount of runoff entering the stream. Conversely, soil that is already wet from previous rains has a lower capacity for infiltration, allowing more runoff to enter the stream.
- **Relation between the size of the watershed and duration of the storm:** Another factor to consider is the relation between the duration of the storm and the size of the stream basin in which the storm occurs. For example, a 100-year storm of 30-minutes duration in a 1-square-mile basin will have a more significant effect on stream flow than the same storm in a 50-square-mile basin. Generally, streams with larger drainage areas require storms of longer duration for a significant increase in stream flow to occur. These and other factors determine whether or not a 100-year storm will produce a 100-year flood.

The 1% Chance AEP Flood level is statistically computed using past and existing data, and therefore as more data is collected, this level will change. For example, as a river basin is altered in a way that affects the flow of water in the river, scientists re-evaluate the frequency of flooding. Dams and urban development are examples of some man-made changes in a basin that affect floods.

The following table provides information on the different flooding alerts for the National Weather Service:

Alert	Criteria
Flood Watch	Atmospheric conditions over a large area, varying in size from multiple counties to multiple states, support the development of heavy rain and/or thunderstorms that are capable of producing flooding. A flood watch implies a longer period of relatively lighter rains, adding up to a large amount of rain. Longer-term flooding implies a slower or steadier rise in the water levels of creeks, streams and larger rivers. Roads can also become flooded, but it is usually more gradual, allowing motorists to monitor conditions more closely.
Flood Warning	A Flood Warning is issued by the National Weather Service when heavy rain has been occurring, and flooding is either occurring or will occur within a specified time, usually within 60 minutes.
Flash Flood Watch	Implies a shorter period of heavier rain. Generally, if flooding is expected within six hours of the onset of rain, a Flash Flood Watch is most appropriate. Flash flooding by definition suggests rapidly rising water, such as a surge of water heading rapidly downstream in a creek or small river. It could also be rapidly rising water on roadways, which can cause motorists to become stranded in vehicles, or even worse, washed into creeks and small rivers due to rapid runoff.
Flash Flood Warning	Atmospheric conditions over a large area, varying in size from multiple counties to multiple states, support the development of heavy rain and/or thunderstorms that are capable of producing flash flooding: A Flash Flood Warning is issued by the National Weather Service when heavy rain has been occurring, and flash flooding is either occurring or will occur within a specified time, usually within 60 minutes.
Urban and Small Stream Flooding	Flooding of small streams, streets and low-lying areas, such as railroad underpasses and urban storm drains is occurring.

Hazard Considerations

The following is a list of potential impacts and planning considerations for a flooding event.

Area Impacted:

- People, facilities, and infrastructure located within the floodplains are susceptible to flood impacts.
- Areas with poor drainage are more susceptible to short-term effects of flash flooding.

Duration of the event:

- Floods typically last for several days to a week, as waters rise and then recede. Typically ponding and overbank flooding can be predicted with some form of accuracy based on hydrologic conditions and weather predictions. Recovery from all flooding events would last several weeks to several months.

Essential Service Disruption:

- Disruption of essential government services (schools, operations, etc.)

Special Considerations:

- No Special Needs considered

Direct Damage:

- The cost of cleanup and structural damage repairs of personal property are often born by the tribal government responsible, resulting as a potential significant hardship for households without flood insurance coverage.
- Hazardous Material Release – Both transportation and fixed facilities have the potential to be located within a flooded area. If this occurs, flooding can cause the release of hazardous materials, as well as facilitate the spread of these materials.
- Mold can cause further damage to building materials and is considered a public health risk. The longer you allow mold to grow, the greater the risk and the harder the cleanup.
- Loss incurred from damages of public property owned and operated by Waukesha County could be extensive within the reservation. Section 406 (d) of the Stafford Act requires a limit of disaster assistance for insurable facilities that do not carry or carry inadequate flood insurance. Section 311 of the Stafford Act requires an applicant to purchase and maintain insurance where insurance is reasonably available, as a condition for receiving disaster assistance.
- The rapid waters that are typical of overbank flooding and dam/dike failure can cause significant damage to infrastructure such as roadways, utilities, etc. Damages to infrastructure from ponding and urban flooding will be less extensive.
- Injuries and deaths can result during flooding events.
- Flash flooding can cause traffic accidents and congestion, resulting in short-term impacts on transportation infrastructure.

Economic Damage:

- Flooding of agricultural fields and pastures can last for months and result in significant damage to the farming community. Emergency protective measures implemented to protect agricultural fields and pastures is not considered improved property and therefore not reimbursed under federal programs.

Emergency Services:

- Warning for a levee/dike failure may be less; however, due to the constant inspections, monitoring and maintenance of the Dam/Dike will enable the identification of problem areas prior to failure.
- Ponding and overbank flooding is typically gradual, allowing local government to implement emergency protective measures such as sandbagging, evacuation, etc.
- Flooding often leads to the closures of roads or other transportation routes when these routes are washed away or simply under water. This can interrupt transportation corridors and hamper emergency response vehicles.
- Disease/Epidemics – Flooding can produce ponding in areas, resulting in stagnant water. Stagnant water can be a breeding ground for diseases. Among other things, stagnant water is necessary for the breeding of mosquitoes. This in turn influences the prevalence of West Nile virus.
- First responders are often put at risk during flood events when they respond to calls for assistance. These risks can range from dangerous rescue operations to exposure to extreme weather.

Social Factors:

- The cost for flood insurance may be expensive and therefore can pose significant hardship for households without

flood insurance coverage.

4.9.2 Location and Extent

Published 11/30/2016 12:21 by Leah Redding

Physical Characteristics

Wisconsin is prone to experiencing flash floods, ice jam floods, local drainage floods, and high ground water floods. Flash floods are most notable as they occur with little to no warning. Flash floods occur within 6 hours of heavy rains, ice jams or dam failures. Major floods in Wisconsin have usually been confined either to specific streams or to locations that receive intense rainfall in a short period of time. Flash floods 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 dependent upon 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. Urban areas are increasingly subject to flash flooding due to the removal of vegetation, installation of impermeable surfaces, and construction of drainage systems.

Flooding on rivers usually occurs over 6 hours after an event. This event not only affects large rivers, but small streams and low areas outside of the flood plains.

Generally the amount of damage from flooding is a direct consequence of land use. If the ground is already saturated, stripped of vegetation or paved, the amount of run-off increases, adding to the flooding. There is also a concern regarding the loss of topsoil and erosion due to flooding. Milwaukee County is an urban area, which decreases the ability of natural systems to absorb rainfall because of the multitude of impervious surfaces and associated runoff.

Dams

Flooding may also occur due to a dam breach or overflow. Dams are barriers built across a waterway to store, control or divert water; a dam failure is a failure of the dam that causes downstream flooding. Failures may be caused by technological events (e.g., materials failure) or by natural events (e.g., landslide, earthquake) with flooding being the most common result.

According to the Wisconsin Department of Natural Resources (WDNR) Dam Safety Program there are approximately 3,800 dams in existence in the State of Wisconsin. Since the late 19th century, more than 700 dams have been built, then washed out or removed. Since 1967, approximately 100 dams have been removed. Almost 60% of the dams in Wisconsin are owned by a former company or private individual, 9% by the State of Wisconsin, 17% by a municipality such as a township or county government, and 14% by other ownership types.

The federal government has jurisdiction over most large dams in Wisconsin that produce hydroelectricity - approximately 5% or nearly 200 dams. The Wisconsin Department of Natural Resources regulates the rest of the dams. A dam with a structural height of over 6 feet and impounding 50 acre-feet or more, or having a structural height of 25 feet or more and impounding more than 15 acre-feet is classified as a large dam. There are approximately 1,160 large dams in the State of Wisconsin.

Milwaukee County has 19 dams included in the Wisconsin Department of Natural Resources (DNR) database:

Dam Official Name	Size	Latitude	Longitude	Owner Type	Waterway Name (Downstream City)
MILWAUKEE-"NORTH AVENUE" (REMOVED)	LARGE	43.057967	-87.894708	CITY	MILWAUKEE RIVER
ESTABROOK PARK	LARGE	43.102008	-87.912179	COUNTY	MILWAUKEE RIVER
NORTHRIDGE LAKES RESIDENTIAL DEVELOPMENT	LARGE	43.179687	-87.996507	PRIVATE	BEAVER CREEK
SOUTH MILWAUKEE MILL	SMALL	42.912389	-87.853335	COUNTY	OAK CREEK
KURTZE LAKE	SMALL	42.940931	-88.069075	PRIVATE	KURTZE LAKE OUTLET
KLETZSCH PARK	LARGE	43.133375	-87.928311	COUNTY	MILWAUKEE
FALK	SMALL	43.026045	-87.955001	PRIVATE	MENOMONEE RIVER
MILWAUKEE GENERAL HOSPITAL 1	SMALL	43.039172	-88.012352	COUNTY	(Stream enters storm sewer)-WAUWATOSA
MILWAUKEE GENERAL HOSPITAL 2	SMALL	43.039028	-88.022467	COUNTY	UNAMED TRIB TO HONEY CREEK
MILWAUKEE GENERAL HOSPITAL 3	SMALL	43.039154	-88.012353	COUNTY	(Stream enters storm sewer)-WAUWATOSA
HUMBOLDT			-87.900115		MILWAUKEE RIVER
DAM NEAR WEST ALLIS		43.001786	-88.014959		HONEY CREEK
MILWAUKEE SANITARIUM		43.049538	-88.011793	COUNTY	MENOMONEE RIVER
DAM IN TOWN OF GRANVILLE		43.144083	-88.060441	PRIVATE	MENOMONEE RIVER
MANSVILLE		43.042200	-87.969624	PRIVATE	MENOMONEE RIVER
PIERRON		43.142129	-87.922944	PRIVATE	MILWAUKEE RIVER
SILVER SPRINGS	LARGE	43.130222	-87.926835	PRIVATE	MILWAUKEE RIVER
MILWAUKEE COUNTY GROUNDS	LARGE	0.000	0.000	CITY	UNDERWOOD CREEK
PONDVIEW PARK	SMALL	42.968670	-87.955727	CITY	VILLA MANN CREEK
TUCKAWAY COUNTRY CLUB	SMALL	42.899745	-88.004020	PRIVATE	LEGEND CREEK

(Source: Dam Inspection, Wisconsin DNR. http://dnr.wi.gov/damsafety/damSearch.aspx)

None of these dams could handle the volume of water generated by a 100- or 500-year flood without overtopping. These dams are inspected by the Wisconsin Department of Natural Resources (DNR) and the largest are required to have an Emergency Action Plan (EAP) and failure analysis on them. There are no dams in other counties that pose a significant flooding risk to the citizens of Milwaukee County.

One potential effect of flooding is erosion. Erosion is defined as the removal of soil by the force of waves, currents and/or ice at a lakeshore or streambank or by the power of wind or water on open land. Erosion is a natural process that can be accelerated by natural disasters (e.g., flooding, heavy rains, strong winds, drought) or by human activity (e.g., removal of plants/trees, tilling.) Because of the many waterways in Milwaukee County, there is concern about ensuring the stabilization of the shorelines.

Watersheds

There are seven watersheds located wholly or partially in Milwaukee County, six of which are drain directly into Lake Michigan, and are a part of the Great Lakes-St. Lawrence River Drainage System. These watersheds include the Kinnickinnic River, Menomonee River, Milwaukee River, Oak Creek, and Root River, and the exception Fox River, covering a total of approximately 273 square miles. The seventh watershed includes communities that border Lake Michigan. *The maps in the Community Profile show the watershed boundaries and 100-year floodplains for the entire county*. The following sections provide additional detail on the watersheds within Milwaukee County. Most of the information presented has been compiled from the **DNR "State of the Basin"** report and the "Land and Water Resource Management Plan for Milwaukee County: 2012-2021".

Fox River Watershed
The portion of the Fox River Watershed that is within Milwaukee County covers only 1.3 square miles; 0.5% of the County. It is the only watershed in Milwaukee County that drains into the Mississippi River System, and not Lake Michigan.

Milwaukee River South Watershed
The Milwaukee River South Watershed covers 168 square miles, including parts of Ozaukee and Milwaukee Counties. This watershed wholly or partially includes Bayside, Brown Deer, Fox Point, Glendale, Milwaukee, River Hills, Shorewood, and Whitefish Bay. In the Milwaukee River South Watershed, the mainstream of the Milwaukee River enters West of Fredonia Village, traveling for 48 miles before hitting the Milwaukee Harbor. The land cover make-up of this watershed is: 33% urban, 25% agriculture, 21% grasslands, 12% forests, and 6% wetlands. The watershed's historical proximity to urban/industrial areas, combined with the modification of 15% of its streams have limited water quality and fish/plant habitat in many areas.

The Oak Creek Watershed
The Oak Creek watershed is located entirely within Milwaukee County, specifically in the municipalities of: Cudahy, Franklin, Milwaukee, Oak Creek, and South Milwaukee. The watershed covers 26 miles of land, 38% of which is urban, 32% is grassland, 14% is forest, 11% agriculture, and 3% wetland. Channelization and hydrological modifications of the past combined with urban runoff have seriously degraded water quality, causing 61% of the watershed to be listed on the State's Impaired Water body 303(d) list.

Kinnickinnic River Watershed
The Kinninckinnic River Watershed lies within the Southern portion of Milwaukee County, encompassing the entire city of St. Francis and portions of the cities of Milwaukee, Cudahy, West Milwaukee, West Allis, Greenfield, and South Milwaukee. This watershed covers 25 square miles, and is 78% urban, with grasslands covering 16% and forests covering 4%. The Kinninckinnic River Watershed is made up of many modified streams and seven park ponds.

Menomonee River Watershed
The Menomonee River Watershed covers 136 square miles in portions of Washington, Waukesha, and Milwaukee Counties. The Menomonee River originates in wetlands near the Village of Germantown in Washington County and runs southeasterly for 32 miles before meeting the Milwaukee and Kinnickinnic Rivers in the Milwaukee Harbor. Nearly all of the land area in the watershed is within incorporated municipalities: the cities of Greendale, Greenfield, Milwaukee, Wauwatosa, West Allis, and West Milwaukee lie wholly or partially within the Menomonee River watershed. This watershed is 42% urban, 22% grasslands, 17% agriculture, 8% forest, and 7% wetlands. Additionally, 96 miles of streams are found

within the watershed, along with several ponds. There are six dams within this watershed and flooding continues to be a major concern.

Root River Watershed

The Root River Watershed is located in portions of Waukesha, Racine, and Milwaukee counties and encompasses 197 square miles.The Root River watershed wholly or partially contains Greendale, Greenfield, Franklin, Hales Corners, Milwaukee, and Oak Creek. Water quality of the 117 miles of rivers and streams in the Root River Watershed ranges from severely degraded to good.

Lake Michigan Direct Drainage area Watershed

This seventh watershed covers areas next to Lake Michigan, which drain directly into the Lake through overland flow or small streams. It encompasses 7.8% of the County, or 18.9 square miles, including these municipalities: Bayside, Cudahy, Fox Point, Milwaukee, Oak Creek, St. Francis, Shorewood, and South Milwaukee

Floodplain Regulations

Floodplain regulations have been in place in the cities and villages of Milwaukee County for many years. The Department of Natural Resources requires that each municipality approve regulations that meet DNR guidelines. These regulations and guidelines result from the value of Wisconsin lakes and waterways and a desire to preserve them and to protect the people who reside near them. Unregulated development can lead to loss of lives and property during floods.

Chapter 614, Laws of Wisconsin 1965, requires counties to adopt regulations giving all lands within 300 feet of navigable rivers or streams protection from haphazard development. Under this legislation, Milwaukee County has adopted a zoning ordinance which gives a measure of protection to watersheds. The law protecting flood plains was created to meet the following objectives:

- Reduce the hazards to life and property from flooding
- Protect floodplain occupants from a flood which is or may be caused by their own land use, which is or may be undertaken without full realization of the danger.
- Protect the public from the burden of extraordinary financial expenditures for flood control and relief.

(Source: Land and Water Resource Management Plan for Milwaukee County: 2012-2021. SEWRPC, MCDOT, DAS, Parks. 2011)

4.9.3 Frequency and Probability

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Frequency Occurrence

Wisconsin has experienced several major floods during the last two decades. The 1973 and 1986 floods revealed that no flood plains or urban areas in Wisconsin can be considered safe from damages. Mill-dams have developed leaks on occasion but have not caused any flooding problems.

Milwaukee County has been included in 7 Presidential Disaster Declaration requests for flooding, the most recent of which are detailed below:

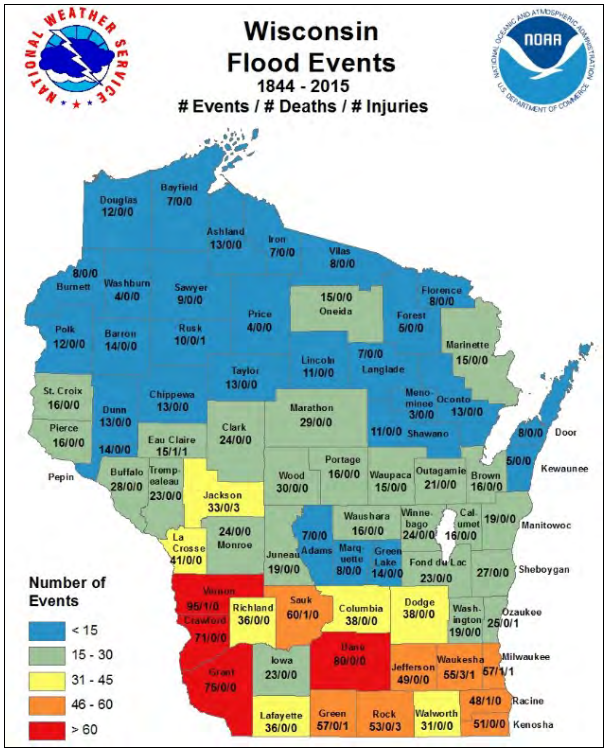
- FEMA-1180-DR-WI: On July 7, 1997, the President declared a Major Disaster as a result of flooding that occurred on June 21-23. The declaration was granted for both Public and Individual Assistance as well as Hazard Mitigation.
- In August 1998, the President declared a major disaster due to heavy rain, leaving $11 million in damages and 6 inches of rain.
- FEMA 1526-DR-WI: On June 18, 2004, the President declared a major disaster as a result of severe storms and flooding that began on May 19th. 4-7 inches of rain fell, costing over 1 million in damages. Milwaukee County was eligible for Individual Assistance.
- FEMA 1768-DR-WI: On June 14, 2008, the President declared a major disaster as a result of severe storms, tornadoes and flooding. Milwaukee County was eligible for both Public and Individual Assistance as well as Hazard Mitigation.
- In June 2009, the president declared a major disaster as a result of heavy rain which caused flash flooding countywide, especially in downtown Milwaukee and West Allis, causing over $7 million in damages. Between three and five inches fell in a 24 hour period. At least 1,227 homes sustained damages.

Following is a table with the 40 flood events recorded by the National Weather Service between January 1st 1950 and August 30th 2016:

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Milwaukee County	6/17/1996	Flood	0	0	75,000	0
Fox Point	6/21/1997	Flash Flood	0	0	78.7M	18,000
City of Milwaukee	8/05/1998	Flood	0	0	20,000	0
Wauwatosa	8/06/1998	Flash Flood	0	1	22.14M	0
City of Milwaukee	2/11/1999	Flood	0	0	1,000	0
Wauwatosa	4/03/1999	Flood	0	0	0	0
City of Milwaukee	4/23/1999	Flood	0	0	0	0
City of Milwaukee	5/16/1999	Flash Flood	0	0	25,000	0
Milwaukee County	6/13/1999	Flood	0	0	150,000	0
City of Milwaukee	6/28/1999	Flood	0	0	0	0
Milwaukee County	7/21/1999	Flash Flood	0	0	40,000	0
Franklin	5/12/2000	Flood	0	0	0	0
North portion of county	5/17/2000	Flash Flood	0	0	200,000	0
Fox Point	6/01/2000	Flash Flood	0	0	50,000	0
Milwaukee County	7/02/2000	Flood	0	0	150,000	0
South portion of county	7/02/2000	Flash Flood	0	0	6.820M	151,000
Milwaukee County	8/05/2000	Flood	0	0	0	0
Wauwatosa	9/11/2000	Flash Flood	0	0	100,000	0
West Allis	9/22/2000	Flood	0	0	0	0
Milwaukee County	2/09/2001	Flood	0	0	40,000	0
City of Milwaukee	8/09/2001	Flood	0	0	0	0
City of Milwaukee	8/22/2001	Flood	0	0	0	0
City of Milwaukee	6/03/2002	Flood	0	0	0	0
City of Milwaukee	6/10/2002	Flood	0	0	0	0
Milwaukee County	8/13/2002	Flood	0	0	0	0
Wauwatosa	9/11/2002	Flash Flood	0	0	10,000	0
Milwaukee County	6/01/2004	Flood	0	0	0	0
City of Milwaukee	9/25/2005	Flash Flood	0	0	50,000	0
West Allis	7/09/2006	Flash Flood	0	0	40,000	0
City of Milwaukee	7/09/2006	Flash Flood	0	0	50,000	0
Wauwatosa	9/12/2006	Flash Flood	0	0	100,000	0
Brown Deer	6/07/2008	Flash Flood	0	0	10,000	0
City of Milwaukee	6/07/2008	Flash Flood	0	0	10,000	
Brown Deer	6/08/2008	Flash Flood	0	0	77.97M	15,500
City of Milwaukee	6/19/2009	Flash Flood	0	0	5,000	0
West Allis	6/19/2009	Flash Flood	0	0	13.13M	0
GMIA	7/15/2010	Flash Flood	0	0	10,000	0
Franklin	6/21/2011	Flash Flood	0	0	500	0
Butler	5/12/2014	Flash Flood	0	0	0	0
West Milwaukee	8/30/2016	Flash Flood	0	0	50,000	0

(Source: NOAA Storm Events Database. 2016. https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29 Flood&beginDate_mm=08&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=08&endDate_dd=31&endDate_yyyy=2016&county=MILWAUKEE%3A79&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=55%2CWISCONSIN)

Below is a map of Flood Events in Wisconsin from 1844 - 2014.



The following list summarizes damages attributed to flooding in Milwaukee County by the National Flood Insurance Program through 2016.

List of Communities with Repetitive Loss Properties

Municipality	Type	Mitigated	Number
Bayside	Single family	No	3
Bayside	Single family	No	3
		TOTAL	6

Municipality	Type	Mitigated	Number
Brown Deer	Single family	No	2
		TOTAL	2

Municipality	Type	Mitigated	Number
Glendale	Single family	No	2
Glendale	Single family	No	2
Glendale	Single family	No	3
Glendale	Single family	No	2
Glendale	Single family	No	3
Glendale	Single family	No	2
Glendale	Single family	No	2
Glendale	Single family	No	3
Glendale	Single family	No	2
Glendale	Single family	No	2
Glendale	Single family	No	3
Glendale	Single family	No	2
Glendale	Single family	No	2
		TOTAL	30

Municipality	Type	Mitigated	Number
Oak Creek	2-4 Family	No	2
Oak Creek	Single family	No	2
		TOTAL	4

Municipality	Type	Mitigated	Number
River Hills	Single family	No	2
River Hills	Single family	No	3
River Hills	Single family	No	3
		TOTAL	8

Municipality	Type	Mitigated	Number
Wauwatosa	Single family	No	2
Wauwatosa	Single family	No	2
Wauwatosa	Single family	No	2
Wauwatosa	Single family	No	2
Wauwatosa	Single family	No	2
Wauwatosa	Single family	No	2
		TOTAL	12

Municipality	Type	Mitigated	Number
West Allis	Single family	No	2
West Allis	Single family	No	2
		TOTAL	4

A careful review of the geography and history of flooding in Milwaukee County leads to the conclusion that there is a very high probability of flooding in the future and a very high probability of damage and losses due to flooding. This flooding could occur due to urban stream flooding, flash flooding or, less likely, due to a dam failure.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.9.4 Vulnerability

Published 2/27/2017 08:40 by Leah Redding

Vulnerability

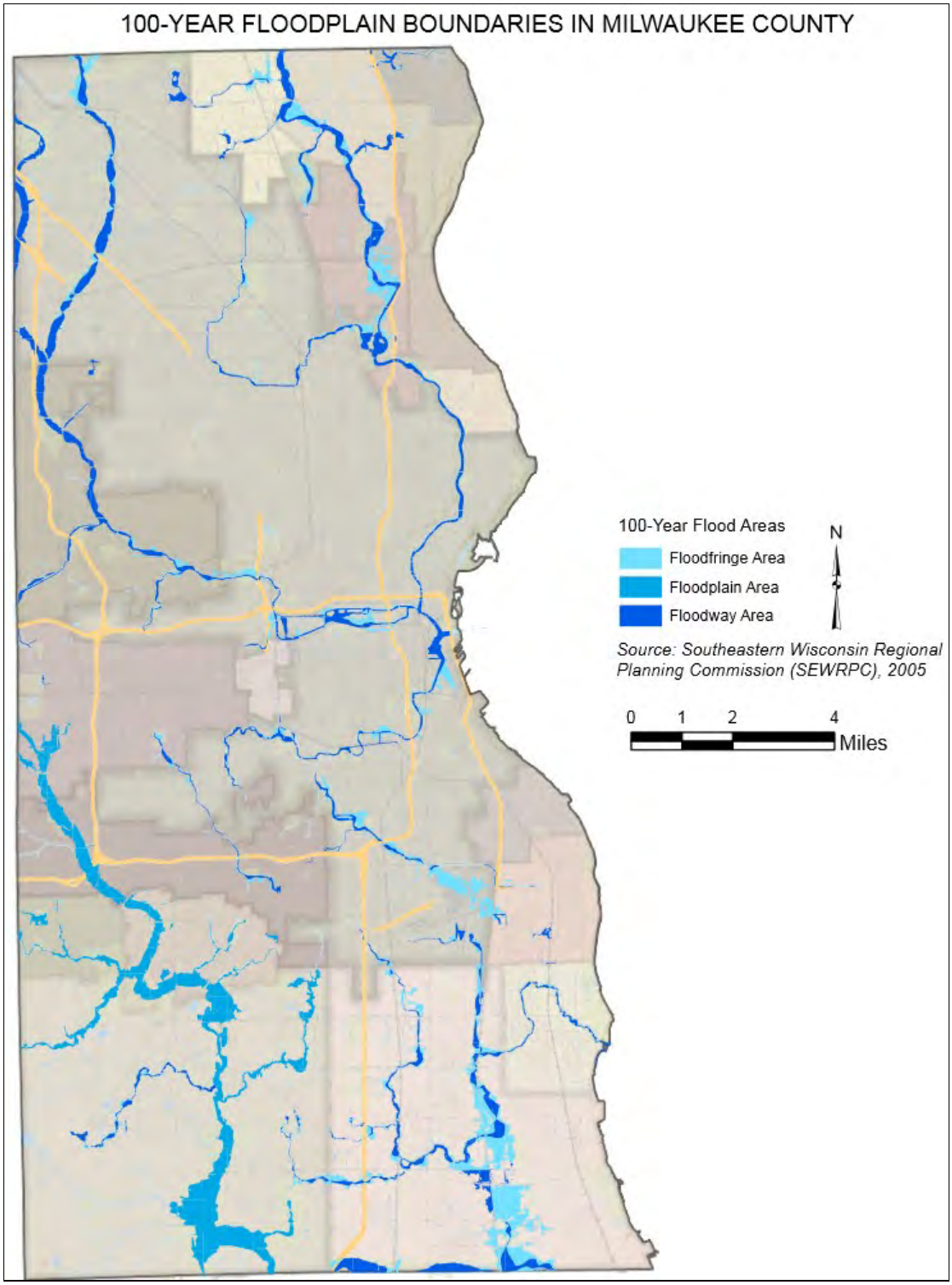
After flooding, whether caused by a storm or dam failure, there is often damage. Potential vulnerabilities due to flooding events can include flooded public facilities and schools, many of which are the community's shelters needed when individual housing is uninhabitable. Utilities are also vulnerable in floods, which can bring down electric lines/poles/transformers, telephone lines and can disrupt radio communications. The loss of communications can impact the effectiveness of first response agencies, which need to communicate via two-way radio to mount emergency response and recovery activities. The public media communications utilized by emergency managers to provide timely and adequate emergency public information can also be impacted.

Residential structures may suffer from flooded basements, damaged septic systems and damaged functionals (e.g., HVAC systems, clothes washers and driers). Homes may also be impacted by sewer back-up and, if the home is not properly cleaned after a flood, bacterial growth and mold may impact the home's air quality and cause illness among the occupants.

Businesses can suffer building and equipment damage similar to homes. Businesses may lose expensive product stored in basement or other low areas as well as the ability to operate from their facility. If the facility must close, its owners and employees will most likely suffer economic hardships beyond what their personal losses may have entailed. Agricultural business losses involve the loss of standing crops and harvests that are damaged by flooded storage facilities in the immediate time period. On a longer time scale, the erosion of rich topsoil by floodwaters can degrade the land and impact future crop yields.

Perhaps one of the most expensive types of flood damage is that to roadways, which are washed out, inundated and/or covered by debris, blocking access to emergency and general public traffic.

In the Wisconsin Hazard Mitigation Plan, HAZUS-MH and Milwaukee County forecast the highest potential flooding loss out of 19 focus counties they looked at. The overall risk for flood loss for Milwaukee County was calculated at $15,086. Additionally, HAZAUS-MH flood analysis found that Milwaukee County has the highest total building exposure, at $79 billion, and that it's building loss estimate over $100 million is $286,370. The total economic loss estimate over $250 million for Milwaukee County is $732,195.



(Source: MC Land Information Office. Data: SWERPC, 2005)

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Hazard Assessment		
Flooding and Dam Failure		
Frequency/Probability (i.e. Future Probability)	▶	**High**
Magnitude/Extent (i.e. Strength or Magnitude)	▶	**Medium**
Vulnerability (i.e. Consequence and Impact)	▶	**High**
Overall Risk Rating	▶	**High**

HAZUS

The Milwaukee County Land Information Office does not yet have the updated ArcGIS software required to run a Hazus analysis and produce maps for Milwaukee County. However, it will be updated within the year, at which point it will be used and the information entered into this plan.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.9.5 National Flood Insurance Program (NFIP)

Published 12/23/2016 11:35 by Leah Redding

Jurisdictions:	National Flood Insurance Program (NFIP) Status:*			
	Yes	No	N/A	Community Rating System (CRS) Class
Milwaukee County	Y			
Village of Bayside	Y			
Village of Brown Deer	Y			
City of Cudahy	Y			
Village of Fox Point	Y			
City of Franklin	Y			
City of Glendale	Y			
Village of Greendale	Y			
City of Greenfield	Y			
Village of Hales Corners	Y			
City of Oak Creek	Y			
Village of River Hills	Y			
Village of Shorewood	Y			
City of South Milwaukee	Y			
City of St. Francis	Y			
City of Wauwatosa	Y			
City of West Allis	Y			
Village of West Milwaukee	Y			
Village of Whitefish Bay	Y			

***Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

NFIP Policies in Force

Community	Policies in Force	Insurance in-force whole $	Written premium in force
BAYSIDE, VILLAGE OF	24	7,391,000	13,617
BROWN DEER, VILLAGE OF	47	15,682,500	52,451
CUDAHY, CITY OF	9	1,810,200	4,728
FOX POINT, VILLAGE OF	47	13,352,500	28,431
FRANKLIN, CITY OF	37	9,825,000	13,798
GLENDALE, CITY OF	231	41,020,600	378,078
GREENDALE, VILLAGE OF	19	5,718,000	16,789
GREENFIELD, CITY OF	24	5,888,300	15,064
HALES CORNERS, VILLAGE OF	21	4,881,500	23,237
OAK CREEK, CITY OF	28	10,239,200	25,218
RIVER HILLS, CITY OF	22	7,140,500	17,707
SHOREWOOD, CITY OF	37	10,296,000	13,990
SOUTH MILWAUKEE, CITY OF	11	2,802,700	8,864
ST. FRANCIS, CITY OF	1	350,000	415
WAUWATOSA, CITY OF	115	34,528,700	139,303
WEST ALLIS, VILLAGE OF	48	11,349,100	30,175
WEST MILWAUKEE, VILLAGE OF	1	50,000	360
WHITEFISH BAY, VILLAGE OF	70	16,786,000	24,050
MILWAUKEE, COUNTY OF			

Current as of 8/31/2016
Source: http://bsa.nfipstat.fema.gov/reports/1011.htm#WIT

List of Communities with Repetitive Loss Properties

County Name	Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties	Property Type
Milwaukee County	Bayside, Village Of	0	0	18,165.68	6,055.23	6	2	Single family
	Brown Deer, Village Of	0	0	6,945.06	3,372.53	2	1	Single family
	Glendale, City Of	0	0	150,342.22	66,284.99	21	13	Single family
	Oak Creek, City Of	0	0	9,928.21	75,667.32	4	2	condo (2-4 families)
	River Hills, Village Of	0	0	23,825.04	9,351.81	8	3	Single family
	Wauwatosa, City Of	0	0	103,259.90	51,629.96	14	6	Single family
	West Allis, City Of	0	0	59648.25	29,824.13	4	2	Single family
	Milwaukee County TOTAL*	0	0	372,114.36	244,185.97	59	29	Single family

**The City of Wauwatosa has one Severe Repetitive Loss Property (SRL), identified by Wisconsin Emergency Management as one of the State. This property has been mitigated since then. SRL properties are: NFIP-insured residential properties that have at least 4 or more claim payments over $5,000 each, and where at least two of the claims have occurred within a ten-year period, and with the cumulative amount of the claims exceeding $20,000.

(Source: The State of Wisconsin Hazard Mitigation Plan. 2011)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B4. Does the Plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods? (Contact Wisconsin Emergency Management to obtain this information for your jurisdiction.) 44 CFR 201.6(c)(2)(ii)
    - B4.1. Estimate of the numbers of repetitive loss properties located in identified flood hazard areas
    - B4.2. Description of the types (residential, commercial, industrial, etc.) of repetitive loss properties identified above
- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy

- C2. Does the Plan address each jurisdiction's participation in the National Flood Insurance Program (NFIP) and continued compliance with NFIP requirements as appropriate? 44 CFR 201.6(c)(3)(ii)
  - C2.1. List of jurisdictions and their NFIP participation status
  - C2.2. Description of floodplain management programs/activities that contribute to continued compliance for each NFIP-participating jurisdiction
  - C2.3. Reasons for non-participation for any jurisdictions that do not participate in the NFIP

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014

-
  - National Flood Insurance Program (NFIP) Status
    - Jurisdictions
    - Participating (Y/N)
    - Community Rating System (CRS) Class

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.
  - 15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance; Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.
    - 15.A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?
    - 15.B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?

4.10 Fog

Published 2/22/2017 10:00 by Leah Redding

Fog, at its basic definition, is a cloud based on the ground rather than in the atmosphere. Differing from drizzle, fog does not fall to the ground but stays suspended, reducing horizontal visibility to up to 5/8th of a mile. Because of this, it can be dangerous to drivers, mariners, and aviators, contributing to many travel accidents annually. Limited public transportation options throughout Wisconsin increase the number of drivers on the road, and therefore the risk for fog-related crashes. Policy changes related to public transportation and speed limits could help mitigate the dangerous effects of fog on travel.

Fog Advisories help to inform the public of dangerous conditions before they travel, hence it is important to understand their meanings:

- Dense Fog Advisory: issued by your local National Weather Service office when widespread dense fog develops. Visibilities frequently drop to one-quarter of a mile or less. Take extra caution when on the road or avoid driving if possible.
- Freezing Fog Advisory: issued by your local National Weather Service office when fog develops and surface temperatures are at or below freezing. Tiny liquid droplets in the fog can freeze instantly to any surface, including vehicles and road surfaces. Freezing fog makes driving, boating, flying and other forms of transportation particularly hazardous. Visibilities are typically at or below 1 mile.

(Source: NWS, Fog Safety: http://www.nws.noaa.gov/om/fog/)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
  - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
  - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
  - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
  - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
  - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.10.1 Fog Hazard Profile

Published 2/22/2017 10:16 by Leah Redding

Hazard Profile

Fog occurs when the air near the ground is saturated with moisture and condenses on tiny particles suspended in the air. These particles are called cloud condensation nuclei and actually attract water vapor molecules to their surfaces. Once condensation occurs on these tiny surfaces, the resulting liquid drops can remain suspended in the air because their weight causes them to descend slowly to the ground or be carried around by wind. The dew-point temperature, or saturation vapor pressure, can be reached by either adding more water vapor to the air or cooling the air down to the dew-point temperature. Fog is classified by the dominant formation process and exists as long as processes continue to maintain saturated conditions. There are several basic types of fog:

Radiation Fog is caused by cooling close to the earth's surface. The earth gives off long-wave radiation which on a clear night travels out into space. If the temperature drops to the dew point close to the ground, radiation fog can form. Radiation fog is also known as ground fog. The fog normally disappears soon after sunrise as the sun's warmth evaporates it.

Valley Fog is one type of Radiation Fog that forms in mountain valleys during winter and can be more than 1,500 feet thick. Often, the winter sun is not strong enough to evaporate the fog during the day. When the air cools again the following night, the fog often becomes thicker, which makes it even harder for the sun to burn it off the following day. These fogs can last for several days until strong winds blow the moist air out of the valley. The tendency for cool, dense air to pool at the bottom of valleys also enhances valley fog.

- **Advection Fog** results from the movement (advection) of warm, moist air from the south over a colder land mass. During the winter this is common when snow covers much of the Midwest. The snow cools the bottom portion of the moist airmass often resulting in condensation. The thickest advection fog usually forms during nights with light winds because humid air near the ground is not mixed with the drier air above. With light winds, the fog near the ground can become thick and reduce visibilities to zero; usually the fog burns off during the day but it can last many days if it is thick enough to block out the sun’s light. This type of fog can occur almost anywhere in the United States, especially during winter warm-ups and early spring thaws. It can be widespread and very dangerous to commuters and aircraft travel.
- **Evaporation Fog** around Wisconsin is caused by cold air crossing over warmer bodies of water. The water evaporates its moisture into the colder air which immediately condenses it into clouds and fog. This is what looks like steam over Lake Michigan, inland lakes and rivers on a cold autumn or winter day. This rising fog can be found above thermal pools in Yellowstone National Park and is what you see when cool rain hits hot pavement. This may also be called “steam fog” or “sea smoke” when it forms over oceans. Sometimes this fog is lifted quickly and forms rotating whirls of fog known as steam devils.
- **Upslope Fog** is common near the Rockies, including the Denver area. If the winds are out of the east, the air flows up as it rises in elevation approaching the mountains. This can cool the air to its dew point and result in widespread fog.
- **Rain Fog** is created when late afternoon or evening showers and thunderstorms during the spring and summer leave the ground soaked just as the sun sets. Though the rain usually stops overnight, the high humidity level created by the rainfall will not allow the moisture to evaporate and as a result, fog forms. This occurs especially at times when there are light winds. As the air warms up the next morning, this rain-enhanced fog will usually burn off by midday.
- **Precipitation Fog** forms when rain or snow falls. As precipitation falls into drier air below the cloud, the liquid drops or ice crystals evaporate or sublimate directly into water vapor. The water vapor increases the moisture content of the air while cooling the air. This often saturates the air below the cloud and allows fog to form.

(Source: NWS: Fog Resource. http://www.nws.noaa.gov/om/fog/index.shtml)

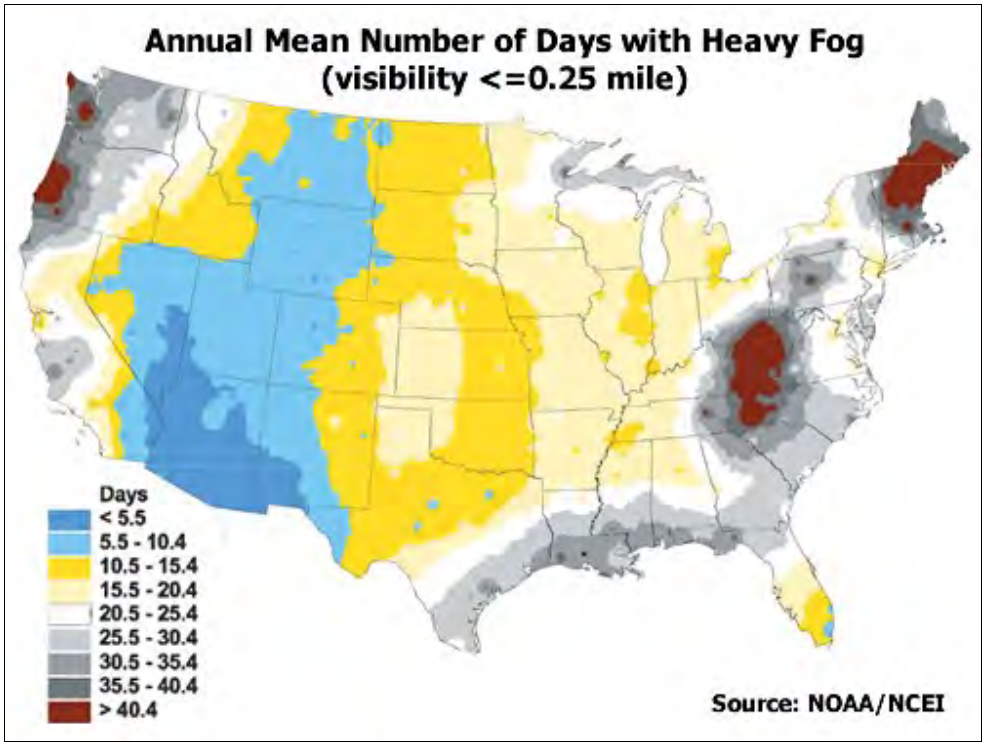
4.10.2 Location and Extent

Published 2/22/2017 10:15 by Leah Redding

Some locations on this planet have weather conditions that are conducive to making fog: high dew points and similar temperatures (high humidity), coastal areas, areas with a high elevation, etc. Hence, places in the Pacific North West which have high levels of annual precipitation and are mountainous, experience high levels of fog.

The Southern half of Milwaukee County according to the National Weather Service has about 15-20 days of heavy fog every year. Hence, for most of the year, Wisconsinites enjoy fairly clear skies, reducing visibility-related travel issues. However, this does not make days of heavy fog any less dangerous or any less important to plan for.

Average Annual Number of Days with Heavy Fog in the United States (National Oceanic Atmospheric Admin.)



4.10.3 Frequency and Probability

Published 2/22/2017 09:37 by Leah Redding

NOAA's National Center for Environmental Information reports 58 dense fog events in the Milwaukee County between 1 January 1950 and 28 November 2016. The most recent fog events include:

Location	Fog Type	Date	Death	Injury	Property Damage
Milwaukee County	Dense Fog	9/21/2008	0	0	0
Milwaukee County	Dense Fog	12/26/2008	0	0	0
Milwaukee County	Dense Fog	2/09/2009	0	0	0
Milwaukee County	Dense Fog	2/26/2009	0	0	0
Milwaukee County	Dense Fog	3/10/2009	0	0	0
Milwaukee County	Dense Fog	4/30/2009	0	0	0
Milwaukee County	Freezing Fog	12/26/2009	0	0	0
Milwaukee County	Freezing Fog	3/7/2010	0	0	0
Milwaukee County	Dense Fog	3/10/2010	0	0	0
Milwaukee County	Dense Fog	5/21/2010	0	0	0
Milwaukee County	Dense Fog	12/30/2010	0	0	0
Milwaukee County	Dense Fog	3/23/2012	0	0	0
Milwaukee County	Dense Fog	10/22/2012	0	0	0
Milwaukee County	Dense Fog	10/23/2012	0	0	0
Milwaukee County	Dense Fog	11/17/2012	0	0	0
Milwaukee County	Dense Fog	11/20/2012	0	0	0
Milwaukee County	Dense Fog	12/3/2013	0	0	0

(Source: NOAA, NCEI: Storm Events Database. https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29 Dense Fog&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=11&endDate_dd=30&endDate_yyyy=2016&county=MILWAUKEE%3A79&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=55%2CWISCONSIN)

Considering its geographical location and history, Milwaukee County has a high probability of fog occurrence in the future and the likelihood of damage (i.e., death and/or injury) due to fog is considered low.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.10.4 Vulnerability

Published 3/2/2017 12:58 by Leah Redding

Perhaps the largest vulnerability to fog is due to automobile traffic crashes. According to the Wisconsin Department of Transportation, dense fog contributes to hundreds of car accidents per year in the state. Following are the Wisconsin Department of Transportation's statistics for fog-related traffic crashes from 1999-2004:

Death and Injury Statistics for Fog-Related Traffic Crashes

	1999	2000	2001	2002	2003	2004
Total Crashes	1,259	1,008	1,066	595	772	1,141
Fatal Crashes	14	12	19	12	11	16
People Killed	15	13	22	22	11	19
Injury Crashes	528	445	425	238	274	423
People Injured	777	643	593	372	391	615
Property Damage Crashes	717	551	622	345	487	702

Traffic Conditions at the Time of Fog-Related Traffic Crashes

	1999	2000	2001	2002	2003	2004
Total Crashes	1,259	1,008	1,066	595	772	1,141
Daylight	467	340	295	158	257	398
Dark/Lighted	130	107	130	324	80	140
Dark/Unlit	547	439	491	46	343	456
Dusk	9	18	16	56	7	16
Dawn	99	101	126	9	77	122
Unknown Light Conditions	7	3	8	2	8	9

Some notable fog-related traffic crashes in the area of southeastern Wisconsin (which includes Milwaukee County) follow:

- The "deadliest highway crash in Wisconsin history" happened on the morning of Friday, October 11, 2002. Fifty vehicles were involved in a massive vehicle accident on Interstate 43 in Sheboygan County near Cedar Grove, Wisconsin just north of Milwaukee County. This accident killed ten individuals and injured 39. Of the injured, seven were in critical condition and one was in serious condition at area hospitals immediately after the incident; 28 other people were treated and released for injuries ranging from burns to broken bones. The accident occurred as cars heading south collided into one another as some vehicles slowed down in a dense fog. This led to a chain reaction as cars behind the crash could not see the scene which was hidden behind a veil of fog. Chad Kruse, a driver interviewed after the accident, described it by saying, "I entered the wall of fog, like someone took a blanket and threw it over the windshield." At the same time but separate from this incident, four other accidents occurred nearby on the interstate; one individual involved with these accidents was killed.

  (Source: "Families mark 10 Years since Interstate Crash in Cedar Grove. Patrick Paolantonio. October 2012. http://www.wisn.com/article/families-mark-10-years-since-interstate-crash-in-cedar-grove-1/6311754)

- Fourteen people were injured in January 1996 in a 26-car pileup on southbound I-43 near Ozaukee County Highway KK. The first driver struck said he had missed his exit because of heavy fog and had slowed down to look for another when he was hit from behind.

  (Source: Waukesha County Hazard Mitigation Plan, 2011. Page 111.

  https://www.waukeshacounty.gov/uploadedFiles/Media/PDF/Emergency_Preparedness/APPROVED%20Waukesha%20Co%20PDM%20Final-Updated%2001-06-2014.pdf)

- In March 1990, three people were killed and 31 injured in a 52-vehicle pileup on the Tower Drive Bridge in Green Bay

after dense fog and smoke from nearby paper mills created a "white wall" that reduced visibility to less than 10 feet. The accident was believed to be triggered when a tanker truck overturned and a ruptured gas tank ignited. Vehicles following too closely on the fog-shrouded bridge slammed into the tanker and were engulfed by a sheet of flames.

(Source: Waukesha County Hazard Mitigation Plan, 2011. Page 111.

https://www.waukeshacounty.gov/uploadedFiles/Media/PDF/Emergency_Preparedness/APPROVED%20Waukesha%20Co%20PDM%20Final-Updated%2001-06-2014.pdf)

As seen in the true examples above, fog-related incidents can cause death, injury, and property loss to the vehicle owners and occupants and their insurance companies. Responding governmental agencies also may suffer losses due to the cost of response for damage done to roadways and structures due to fires and for potential injuries to responders working in a reduced- visibility zone. Citizens may be impacted by the closure of roadways and delay of activities; businesses may suffer losses due to the absence of workers due to delay, injury and/or death and because of the delay of product on the roadways and direct loss of product in the crash (e.g., due to fire).

Although Milwaukee County has not had any deaths resulting from fog-related crashes in recent years, accidents in nearby areas and the frequency of fog events demonstrate that it is a very real possibility. Although there are limited direct "mitigation" actions that can be taken to reduce the effect of fog on transportation (other than policy changes), Milwaukee County can at least be prepared to respond to crash events, including highway pileups and mass casualty events to reduce severe highway traffic and loss of life. Milwaukee County has a mass causality plan (MC OEM Fatality Management plan & the Healthcare Emergency Readiness Coalition's Mass Fatality Plan) which has been exercised, along with MABAS 107 to help recover from serious crashes that could result from heavy fog. Additionally, the Milwaukee County Office of Emergency Management will post weather warnings issued by the National Weather Service on both our website and social media pages to increase public awareness and to encourage that precautions be taken before travel in heavy fog.

Hazard Assessment		
Fog		
Frequency/Probability (i.e. Future Probability)	▶	Medium
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Low
Vulnerability (i.e. Consequence and Impact)	▶	Low
Overall Risk Rating	▶	Low

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.11 Forest and Wildfires

Published 12/1/2016 10:36 by Leah Redding

The forest fire and wildfire (fires on open or agricultural land) season in Milwaukee County begins in March and continues through November, although fires can occur at any time during any month of the year. Generally speaking, however, fires are more likely to occur whenever vegetation is dry as a result of a winter with little snow or a summer with sparse rainfall.

The Wisconsin Department of Natural Resources is responsible for forest fire protection on approximately 18 million acres of forest and wild land in Wisconsin. The U.S. Forest Service maintains forest fire protection on two million acres of this land while local fire departments retain responsibility for the remaining wooded acreage.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
  - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
  - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
  - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
  - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
  - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.11.1 Forest and Wildfires Hazard Profile

Published 11/18/2016 13:42 by Leah Redding

Hazard Profile

A wildfire is a naturally occurring event, often ignited by lightning and fueled by grasses, brush, and trees. Wildfires help to control the buildup of woody debris, improve soil conditions, reduce weedy and invasive plants, reduce plant disease, and maintain the habitat conditions thus providing a healthy ecosystem. The wildland-urban interface describes the area of transition between non-human inhabited areas and the built environment. This zone is best described as a set of conditions; according to the National Fire Protection Association, conditions include (but are not limited to): amount, type, and distribution of vegetation; flammability of structures (homes, businesses, outbuildings, decks, fences) in the area, and proximity to fire-prone vegetation and to other combustible structures; weather patterns and general climate conditions; topography; hydrology; average lot size; and road construction.

According to FEMA, a wildland-urban interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. An urban-wildland interface fire is typically ignited by human activities including campfires, uncontrolled burns, smoking, vehicles, trains, equipment use, and arsonists. People start more than four out of every five wildfires, usually through debris burns, arson, or carelessness.

Wildfire behavior is based on three primary factors: **fuel, topography, and weather**. The type and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. Topography affects the movement of air and fire over the ground surface. Slope and terrain can change the rate of speed at which fire travels. Temperature, humidity, and wind (both short and long term) affect the severity and duration of wildfires. Weather phenomena such as El Nino and La Nina events further complicate the delicate balance of these three essential components to wildfire. The deluge of rainfall that occurs during El Nino events creates excessive vegetative growth. El Nino is followed by La Nina, which creates drought conditions and excessive heat. As a result, the abundant vegetative growth dies off and provides ample fuel for wildfires.

Fire Danger Levels

The National Fire Danger Rating System (NFDRS) allows local agencies to estimate today's or tomorrow's fire danger. It integrates the effects of existing and expected fire danger factors into one or more qualitative values that reflect an area's fire protection needs. It links local agencies readiness level to the potential fire problems for that particular day.

Level	Criteria
Low	Ignition: Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires. Spread: Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. Spotting: There is little danger of spotting. Control: Easy
Moderate	Ignition: Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Spread: Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Spotting: Short-distance spotting may occur, but is not persistent. Control: Fires are not likely to become serious and control is relatively easy.
High	Ignition: All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Spread: Fires spread rapidly. High-intensity burning may develop on slopes or in concentrations of fine fuels. Spotting: Short-distance spotting is common. Control: Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High	Ignition: Fires start easily from all causes. Spread: Immediately after ignition, spread rapidly and increase quickly in intensity. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels. Spotting: Spot fires are a constant danger; long distance spotting likely. Control: Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
Extreme	Ignition: Fires start quickly and burn intensely. All fires are potentially serious. Spread: Furious spread likely, along with intense burning. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Spotting: Spot fires are a constant danger; long distance spotting occurs easily. Control: Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: National Fire Danger Rating System

The National Weather Service provides alerts when conditions are favorable for Wildfires.

Alert	Criteria
Fire Weather Watch	Conditions are favorable for red flag conditions in and close to the watch area in the next 12 to 48 hours.
Red Flag Warning	Issued for weather events which may result in extreme fire behavior that will occur within 24 hours. Red Flag criteria occurs whenever a geographical area has been in a dry spell for a week or two, or for a shorter period, and the National Fire Danger Rating System (NFDRS) is high to extreme and if there is a sustained wind average 15 mph or greater, a relative humidity less than or equal to 25 percent, and a temperature of greater than 75ºF.

Hazard Consequence

Area Impacted:

- High risk ecosystems
- Urban-Wildland Interface

Duration of the event:

- Wildfires can occur instantly and spread extremely quickly if conditions (fuel, heat, oxygen) are right.
- Although most fires are small and last only a few hours, some fires can last for several days if large enough.
- Essential Service Disruption
- Disruption of essential government services

Special Needs:

- None

Direct Damage:

- The presence of combustible or vulnerable building material, dense vegetation within 30 feet of structures, and potential losses to physical structures and equipment
- Wildfire events cause a release of certain emissions into the surrounding air. The major emissions include: particulate, carbon dioxide, and carbon monoxide. All of these can affect the local environment.
- Hazardous Material Release – Both transportation and fixed facilities have the potential to be at risk to wildfires.
- Potential risks include destruction of land, property, and structures, as well as injuries and loss of life.

Economic Damage:

- Business interruption
- Decreases in tourism and gaming
- Loss agricultural fields and crops or pastures and livestock can last for months and result in significant damage to the farming community.

Emergency Services:

- Fire suppression costs.
- Inadequate water supply to effectively manage fire.
- Large areas that lack wildland maintenance (prescribed burn).
- Evacuation of gaming facilities and residents of reservation property.
- Emissions can cause a decrease in visibility, which can become of great concern with respect to road rights-of-way and traffic hazards.
- Inadequate service roads to remote locations.
- Major fires have the ability to disrupt transportation.

Social Factors:

- Many of the rural communities of Wisconsin do not have adequate management of wildlands nor equipment and supplies to suppress wildfires.
- Urban sprawl into once uninhabitable areas will continue.

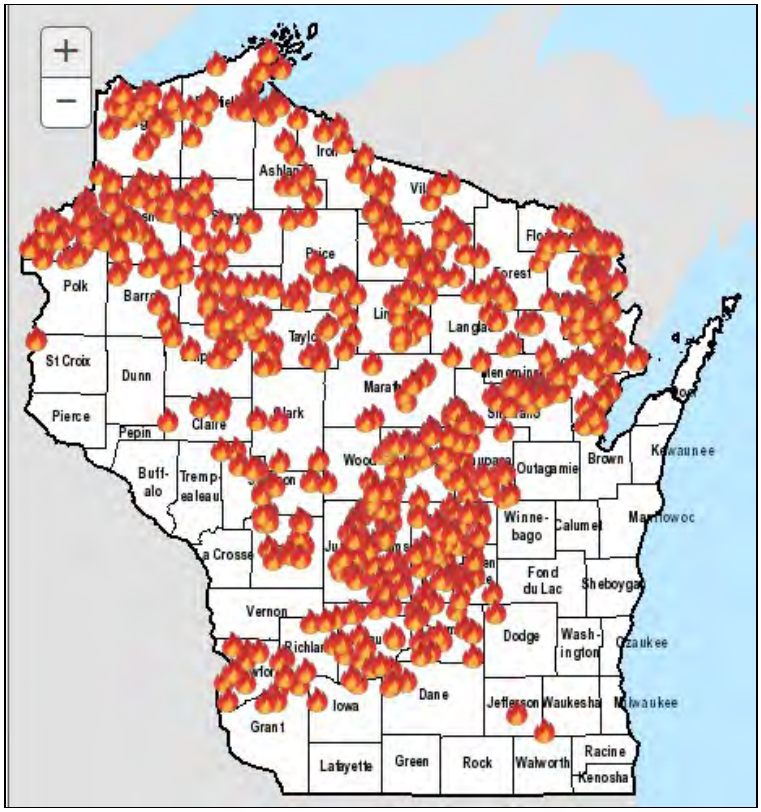
4.11.2 Location and Extent

Published 2/1/2017 15:53 by Leah Redding

According to the Wisconsin Department of Natural Resources, there are approximately 1,500 fires annually that burn over 5,000 acres of the land that they protect; over 90% of these fires are human-caused. It should be noted that these figures do not include areas of the state where a local fire department has primary responsibility for service. According to the DNR, current fire danger in Milwaukee is low. To get up to date fire danger information, visit: http://dnr.wi.gov/topic/ForestFire/restrictions.html.

Cudahy Woods, the Warnimont Bluff Fens, and Franklin Savanna are the natural areas in Milwaukee County. Local fire departments are responsible for fire protection in these open acreage areas although state firefighting assets would provide mutual aid assistance in the state-owned lands.

The following map shows wildfires in Wisconsin in 2016.



(Source: WI Department of Natural Resources. Burning Restrictions and Fire Activity: Wildfires this year.)

4.11.3 Frequency and Probability

Published 11/18/2016 14:33 by Leah Redding

While the total number of open fires in Wisconsin has decreased over the years, the potential danger to lives and property remains due to the increased encroachment of development into previously open lands. Overall, the probability for a forest fire in Milwaukee County is very low and the probability of a wildfire is moderate-low. The probability of damage from forest or wildfire is also considered low. There has been 19 statewide wildfire events recorded since 1950 by the National Weather Service. These events caused a total of 3 injuries, 1 death, and approximately $1.81 million of property damage.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
        - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.11.4 Vulnerability

Published 12/1/2016 10:41 by Leah Redding

Forest and wildfires can impact the ecology of the open lands. Milwaukee County, which has numerous county and municipal parks, would be impacted by a wildfire since a disruption from fire could erase the usability of this habitat for wildlife and/or recreational purposes for many years.

Hazard Assessment		
Forest and Wildfires		
Frequency/Probability (i.e. Future Probability)	▶	Low
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Low
Vulnerability (i.e. Consequence and Impact)	▶	Low
Overall Risk Rating	▶	Low

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.12 Severe Temperatures

Published 1/8/2016 12:47 by Daiko Abe

Temperature extremes can cause disruption of normal activities for the population, property loss and even the loss of life, especially among the more vulnerable members of our population such as children and the elderly.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
        - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
        - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
        - B1.4. Extent (strength or magnitude) of each hazard
    - B5. Hazard Matrix
        - B5.2. Location (if the risk is not equal for the entire jurisdiction)
        - B5.3. Extent (strength or magnitude)
        - B5.5. Future Probability
        - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
    - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
    - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
    - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
    - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.12.1 Severe Temperature Hazard Profile

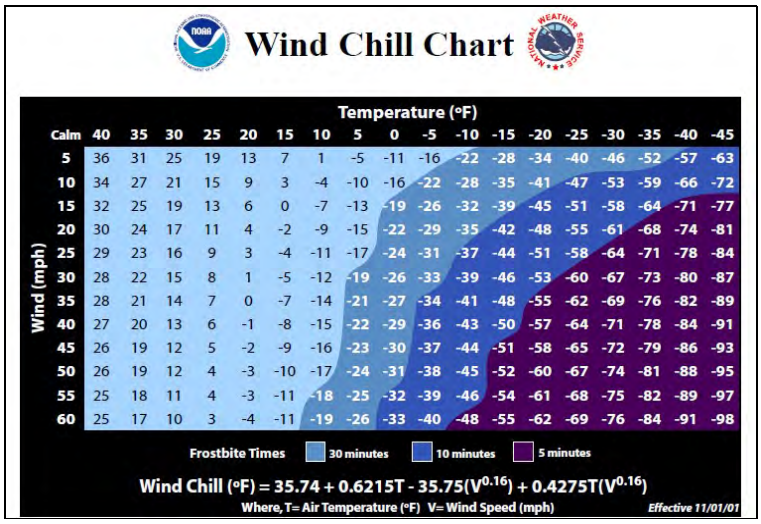
Published 2/2/2017 11:00 by Leah Redding

HAZARD PROFILE

Extreme Cold

Extreme cold consisting of long periods of below freezing temperatures sometimes accompany a winter storm. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Frostbite occurs when the extremities become excessively cold, and hypothermia is a serious health condition where a person's body temperature falls below 90 degrees. Both conditions are influenced by wind conditions. Various wind chill indices have been developed to predict cold temperature's effect on humans. For instance, a temperature of 5 degrees will have a wind chill of -19 degrees if the wind is blowing 30 mph.

Wind chill is a relationship between wind and cold that is based on the rate of heat loss from exposed skin. As the wind speed increases, heat is drawn from the body, driving down skin temperature and eventually core body temperature. The table below illustrates the relationship between wind speed, temperature, and frostbite.



Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

(Source: NOAA, National Weather Service. Wind Chill Chart. http://www.nws.noaa.gov/om/winter/windchill-images/windchillchart3.pdf)

The major risks to people due to extreme cold are:

- Hypothermia - occurs when, due to exposure to cold, the body is unable to maintain its proper core temperature. It may occur in temperatures above freezing and may lead to death.
- Frostbite - describes local cooling, usually to an extremity, which occurs when exposure to cold air or liquid causes constriction of the blood vessels. There are three degrees of frostbite:
  - Frostnip - brought on by direct contact with a cold object or exposure to cold air or water. Tissue damage is minor and response to treatment is usually very good.
  - Superficial frostbite - involves the skin and subcutaneous layers.
  - Freezing - is deep frostbite in which the skin, subcutaneous layers and deeper structures (e.g., muscles, bone, deep blood vessels, organ membranes) of the body are affected and can become frozen.
  - Chilblains - lesions that occur from repeated/chronic exposure of bare skin to temperatures of 60°F or lower.
  - Trenchfoot - a condition that occurs when the lower extremities remain in cool water for a prolonged period of time.

Extreme Heat

Extreme heat is defined as temperatures that are approximately 10 degrees or more above the average high temperature

for a given region lasting a prolonged period of time, usually several weeks. Extreme heat occurs when a layer of high atmospheric pressure descends over a geographical area. High pressure causes the air normally located high in our atmosphere to descend, compress, and increase in temperature. This leads to hazy, humid, and muggy air. High pressure systems can reside in an area for weeks as they are resistant to being moved by other weather systems. In addition, high pressure inhibits wind and clouds which normally mitigates the effects of the sun.

Every year, most municipalities experience periods in which the air temperature and humidity creates conditions that could potentially harm human health. Urban areas in particular experience a “heat island” effect. Urban heat island is when an urban area experiences warmer temperatures than its surrounding rural areas. This is caused by large amounts of concrete absorbing heat from the sun during the day. The heat releases at night keeping temperatures high and allowing little time for cooling. This can lead to increased energy demands and stress at-risk populations, especially those without access to air conditioning.

Although extreme heat conditions may not be as notable as other hazards, its consequences can still be devastating. Between 1992 and 2001, deaths from extreme heat in the United States numbered 2,190, compared to 880 deaths from floods and 150 from hurricanes. The average annual number of fatalities directly attributed to extreme heat in the United States is approximately 400.

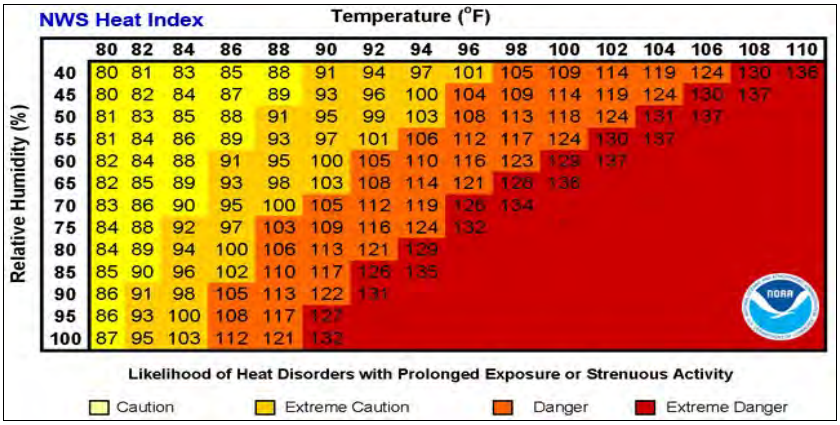
Extreme heat is typically seasonal in nature with heat waves occurring in the summer months. However, heat waves are associated with high pressure systems and can occur in late spring and early fall as well. For regions in southern latitudes, extreme heat events can occur any time of the year. High pressure systems associated with heat waves can move into an area within a matter of days. These systems are resistant to being moved by other systems and can affect a region for days, weeks, or months. The frequency of extreme heat is dependent on weather patterns within a particular region. Weather patterns are affected by many variables including ocean currents, jet streams, and man’s footprint on the environment.

Extreme heat is correlated to high-pressure weather systems and can occur several times a season. High pressure systems associated with heat waves can move into an area within a matter of days. These systems are resistant to being moved by other systems and can affect a region for days, weeks, or months.

The frequency of extreme heat is dependent on weather patterns within a particular region. Weather patterns are affected by many variables including ocean currents, jet streams, and man’s footprint on the environment. Extreme heat is correlated to high-pressure weather systems and can occur several times a season. The magnitude of the hot weather is also affected by many variables including where the system originates, strength and size of the system, the relative humidity and precipitation in the area, and whether another system forms that will push the existing system out. The magnitude of the hot weather is also affected by many variables including where the system originates, strength and size of the system, the relative humidity and precipitation in the area, and whether another system forms that will push the existing system out.

Heat Index

Heat index is created by the National Weather Service. It is the apparent temperature (i.e. the temperature the human body generally feels) when the air temperature is combined with the relative humidity. The heat index is generally used to determine the effects the temperature and humidity can have on the population. Heat index values are reduced by shady, light wind conditions. Full sunshine conditions can increase heat index values by up to 15 degrees.



(Source: NOAA, NWS Heat Index. http://www.nws.noaa.gov/om/heat/heat_index.shtml)

In the event of extreme heat, the National Weather Service will issue heat advisories based on heat indices through media messages. The National Weather Service provides assistance to state and local health officials in preparing civil emergency messages in severe heat waves in addition to issuing special weather statements such as who are at most risk, safety rules, and the severity of the hazard. The National Weather Service will also aid state and local authorities on issuing warnings and survival tips. State and local health officials will be responsible to check on vulnerable populations such as the disabled and the elderly. Residents will be notified to remain indoors and refrain from strenuous activities. They will also be reminded to consume fluids often throughout the day and to stay near air conditioning, fans, and so forth. Exposure to extreme heat can result in various health issues such as sunburn, dehydration, heat cramps, heat exhaustion, and heat stroke. The following table lists some common health hazards that correspond to a certain range of heat index and how dangerous the conditions may be:

Category	Heat Index	Possible Heat Disorders for people in high risk groups
Extreme	130 degrees F or higher	Heat stroke or sun stroke likely.
Danger	105-129 degrees F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90-105 degrees F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	80-90 degrees F	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Urban areas may be at greater risk from the effects of a prolonged heat wave than rural areas. Asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the “urban heat island effect. Heat causes more fatalities than all weather related fatalities in the US.”

Heat exceeding 100 degrees is generally considered dangerous; however, lower temperatures coupled with high humidity are also considered dangerous. Heat indices have been developed to account for this interaction. At 80 degrees, a heat index of 101 degrees is reached if the humidity is 90percent. At 90 degrees, a heat index of 106 degrees is reached if the humidity is 70 percent.

Extreme heat can pose a significant risk to all populations but especially the elderly. Extreme heat also has the potential to result in other related hazards. The severity of a drought is directly related to the temperature extreme. Very hot conditions can dry out plant life making it much more susceptible to fire. Heat waves can also cause massive amounts of energy to be consumed. Maximum energy use days all occur on days of extreme heat. Rolling blackouts are not unusual due to the large demand from the power grid.

Hazard Considerations

Area impacted:

- Regional or statewide

Duration of the event:

- Extreme temperatures can last days, weeks or months. Essential Service Disruption
- Excessive power use results in power disruption or outages.
- Transportation – Severe winter storm conditions present a significant transportation hazard. These conditions slow down and hurt the transportation infrastructure. Depending on the intensity of the storm event, the impacts on transportation can range from a system wide delay to a major breakdown of the infrastructure.

Special Considerations:

- The elderly are particularly susceptible to heat and cold waves; young adults participating in sports or recreational outdoor activities during heat waves are also susceptible to fatigue, heat stroke and death.
- Elderly persons and small children, or persons who are on certain medications or overweight are vulnerable to heat stress.

Direct Damage:

- Individual can die from excessive heat. Heat waves can impact the human body in the following adverse ways: sunstroke, muscle cramps, and/or heat exhaustion likely; heatstroke possible with prolonged exposure and/or physical activity.

Economic Damage:

- Business interruption, e.g., airports can be closed and transportation systems shutdown for extended periods of time during periods of extreme heat or cold.
- Decreases in tourism and gaming
- Severe drought combined with heat waves can cause significant losses to agricultural-related industries, e.g., the drought/heat wave of 2000 is estimated to have caused over $4.0 billion in damages and 140 deaths nationwide.

Emergency Services:

- EMS transports to medical facilities and well-being checks will increase dramatically.
- Emergency shelters for special populations
- Heat waves and drought can cause severe dry conditions which can fuel wildfires.

Social Factors:

- The lack of insulation and adequate heating can lead to serious consequences for residents such as hypothermia and death. During heat waves, individuals need to stay hydrated and avoid outdoor activity from the hours of 10 a.m. to 4 p.m. to avoid excessive sun exposure, which can cause heat stroke and death.

4.12.2 Location and Extent

Published 12/1/2016 12:01 by Leah Redding

Physical Characteristics

Wisconsin is well known for their frigid winters and their extreme heat. In 1995, at least 68 people died during an extreme heat event when temperatures remained over 90°F for seven consecutive days. The characteristics of extreme heat will fluctuate dependent on region. Therefore, extreme heat in Wisconsin may not qualify for extreme heat in Louisiana. Extreme heat health problems are also related to urbanization and social, economic, and physiological vulnerability. According to research conducted by the Wisconsin Initiative on Climate Change Impacts, extreme heat events are projected to become more frequent, longer lasting, and geographically widespread. By the middle of the century, Wisconsin residents are projected to experience 1.5 to 4 more weeks of daytime temperatures exceeding 90 ºF. Public health officials and concerned citizens will be charged with the task of protecting the most vulnerable populations in the face of these changes.

Another dangerous winter weather situation is the combination of extremely cold temperatures and strong winds that can result in wind chills that cause bodily injury such as frostbite and death due to exposure (hypothermia). Despite the fact that Wisconsin's harsh winter temperatures have become slightly milder over the past couple of decades, the number of severe winter storms shows an increasing trend. This may be partially related to better documentation generated by the NWS, but may also be related to the fact that warmer air can hold more moisture which ultimately can fall as snow.

4.12.3 Frequency and Probability

Published 2/2/2017 11:22 by Leah Redding

Temperature extremes, both cold and hot, have a medium likelihood of occurrence in any given year. Excessive heat events recorded by the National Weather Service between January 1st 1950 and October 31st, 2016 are outlined below:

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Statewide	6/4/1994	Heat Wave	0	0	0	0
Milwaukee County	7/11-27/1995	Excessive Heat	85	30		
Milwaukee County	6/29/1996	Heat	0	70	0	0
Milwaukee County	7/16/1997	Heat	1	0	0	0
Milwaukee County	10/03/1997	Heat	0	0	0	0
Milwaukee County	10/12/1997	Heat	0	0	0	0
Milwaukee County	1/02/1998	Heat	0	0	0	0
Milwaukee County	3/26/1998	Heat	0	0	0	0
Milwaukee County	6/25/1998	Heat	0	21	0	0
Milwaukee County	9/27/1998	Record Heat	0	0	0	0
Milwaukee County	11/28/1998	Heat	0	0	0	0
Milwaukee County	12/01/1998	Excessive Heat	0	0	0	0
Milwaukee County	2/11/1999	Heat	0	0	0	0
Milwaukee County	7/04/1999	Heat	0	0	0	0
Milwaukee County	7/23/1999	Heat	0	0	0	0
Milwaukee County	7/29/1999	Heat	4	0	0	0
Milwaukee County	1/02/2000	Excessive Heat	0	0	0	0
Milwaukee County	2/23/2000	Excessive Heat	0	0	0	0
Milwaukee County	3/04/2000	Excessive Heat	0	0	0	0
Milwaukee County	5/06/2000	Excessive Heat	0	0	0	0
Milwaukee County	7/21/2001	Heat	2	0	0	0
Milwaukee County	8/06/2001	Excessive Heat	4	0	0	0
Milwaukee County	4/15/2002	Heat	1	0	0	0
Milwaukee County	6/20/2002	Heat	1	0	0	0
Milwaukee County	6/22/2002	Heat	1	0	0	0
Milwaukee County	6/30/2002	Heat	0	0	0	0
Milwaukee County	7/01/2002	Heat	0	0	0	0
Milwaukee County	7/08/2002	Heat	0	0	0	0
Milwaukee County	7/21/2002	Heat	0	0	0	0
Milwaukee County	7/26/2002	Heat	0	0	0	0
Milwaukee County	7/24/2005	Heat	0	0	0	0
Milwaukee County	7/16/2006	Heat	0	0	0	0
Milwaukee County	7/30/2006	Heat	0	40	0	0
Milwaukee County	8/1/2006	Heat	2	0	0	0
Milwaukee County	7/20/2011	Heat	0	0	0	0
Milwaukee County	6/18/2012	Heat	2	0	0	0
Milwaukee County	6/28/2012	Heat	0	0	0	0
Milwaukee County	7/03/2012	Heat	0	0	0	0
Milwaukee County	7/16/2012	Heat	0	0	0	0

Milwaukee County	7/23/2012	Heat	0	0	0	0
Milwaukee County	7/25/2012	Heat	0	0	0	0
Milwaukee County	7/16/2013	Heat	0	0	0	0
Milwaukee County	8/30/2013	Heat	0	0	0	0
Milwaukee County	7/21/2016	Heat	0	29	0	0
Milwaukee County	7/27/2016	Heat	1	0	0	0

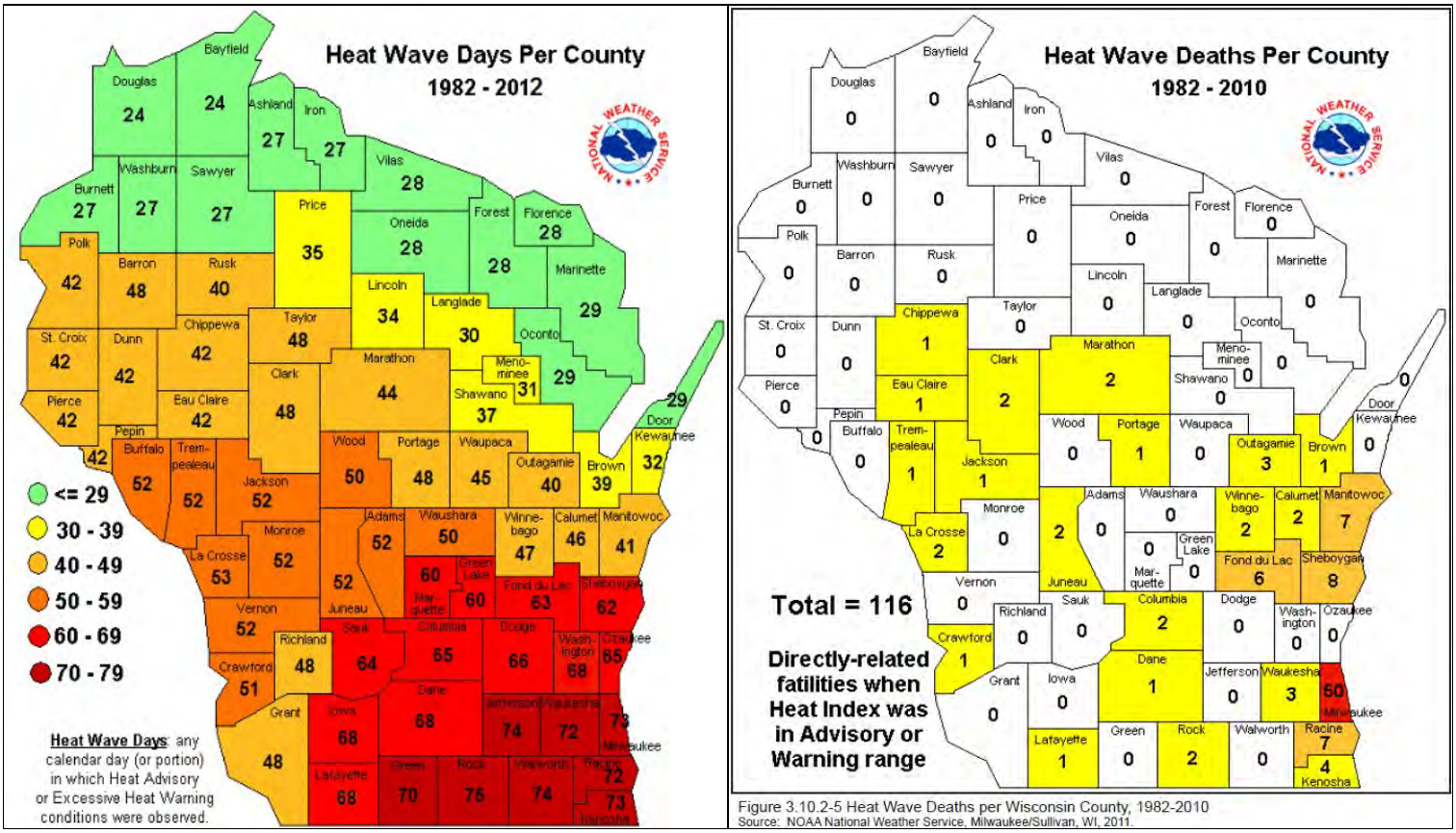


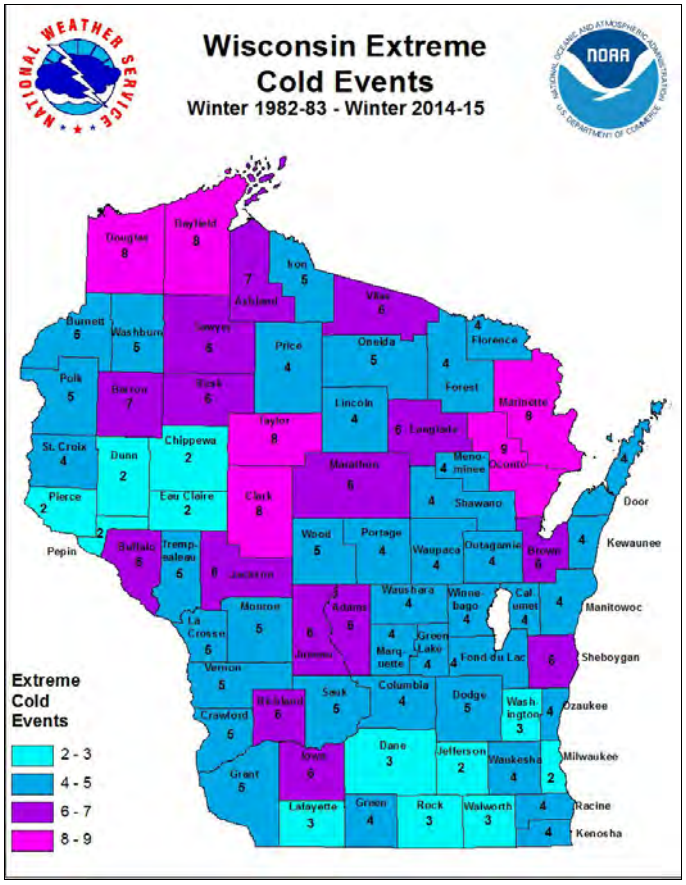
Figure 3.10.2-5 Heat Wave Deaths per Wisconsin County, 1982-2010
Source: NOAA National Weather Service, Milwaukee/Sullivan, WI, 2011.

*Source: *NOAA, (http://www.aos.wisc.edu/~sco/clim_impacts/nat_hazards.html). Heat Wave Days & Heat-Wave Deaths, 1982-2012*.

Below is a chart that outlines severe cold events that have been recorded by the National Weather Service in Milwaukee County between January 1st, 1950 and October 31st, 2016:

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Statewide	1/13/1994	Cold	0	0	0	0
Milwaukee County	1/30/1996	Cold/wind Chill	0	0	0	0
Milwaukee County	1/31/1996	Cold/wind Chill	0	0	0	0
Milwaukee County	2/01/1996	Cold/wind Chill	4	15	0	0
Milwaukee County	1/17/1997	Cold/wind Chill	0	3	0	0
Milwaukee County	11/30/1997	Cold/wind Chill	2	0	0	0
Milwaukee County	1/05/1999	Cold/wind Chill	0	0	0	0
Milwaukee County	12/18/2005	Cold/wind Chill	0	0	0	0
Milwaukee County	2/17/2006	Cold/wind Chill	0	0	0	0
Milwaukee County	2/18/2006	Cold/wind Chill	0	0	0	0
Milwaukee County	12/07/2006	Cold/wind Chill	1	0	0	0
Milwaukee County	2/03/2007	Cold/wind Chill	0	0	20,000	0
Milwaukee County	1/19/2008	Cold/wind Chill	0	0	0	0
Milwaukee County	1/30/2008	Cold/wind Chill	0	0	0	0
Milwaukee County	12/15/2008	Cold/wind Chill	0	0	0	0
Milwaukee County	12/21/2008	Cold/wind Chill	0	0	0	0
Milwaukee County	1/14/2009	Cold/wind Chill	0	0	0	0
Milwaukee County	1/21/2011	Cold/wind Chill	0	0	0	0
Milwaukee County	1/21/2013	Cold/wind Chill	0	0	0	0
Milwaukee County	1/03/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	1/27/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	2/05/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	3/16/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	12/03/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	12/05/2014	Cold/wind Chill	1	0	0	0
Milwaukee County	1/01/2015	Wind chill	1	0	0	0
Milwaukee County	1/07/2015	Extreme Cold/ wind chill	0	0	0	0
Milwaukee County	1/09/2015	Cold/wind Chill	0	0	0	0
Milwaukee County	1/08/2016	Cold/wind Chill	1	0	0	0
Milwaukee County	1/17/2016	Cold/wind Chill	1	0	0	0

Below is a map of Extreme Cold events in Wisconsin from Winter 1982-83 to Winter 2013-14.



The loss of property due to temperature extremes is not likely but loss of life or injury to people has a medium likelihood of occurrence. Extreme temperatures marked by heat and cold waves can adversely affect the environment causing deaths in the population, drought, wildfires and economic losses for the agricultural-based industries. However, the economic impact upon Milwaukee County because of extreme temperatures would be minimal. Other potential impacts could be felt in higher energy costs, e.g., most record energy-use days occur on days of extreme heat. Excessive energy-use during a heat wave can cause serious energy hazards, such as rolling blackouts.

(Source: NOAA, NWS: Storm Events Database)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.12.4 Vulnerability

Published 12/1/2016 15:40 by Leah Redding

Vulnerability to temperature extremes is generally assessed on an individual basis with the most vulnerable sections of our community's population having the greatest risk. These people may include the elderly, the very young and the chronically ill. People from economically disadvantaged backgrounds, especially those listed in the categories above, are even more vulnerable since they are least able to afford the cost of adequate heating or air conditioning systems.

The Milwaukee County social services agencies are aware of many of these people who reside in our communities and they, along with the public health department, have plans and access to economic assistance programs to help these people in times of concern.

Hazard Assessment		
Severe Temperatures		
Frequency / Probability (i.e. Future Probability)	▶	Medium
Magnitude / Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Medium

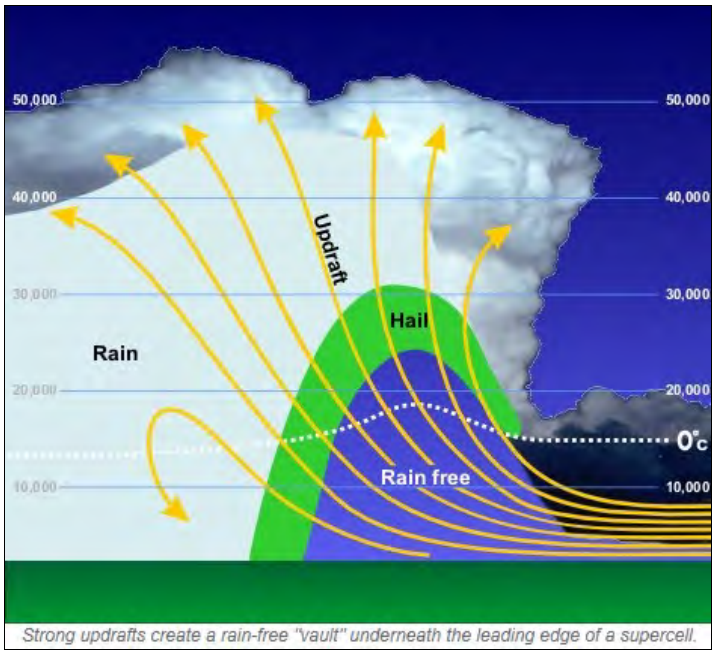
Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.13 Hail

Published 2/2/2017 11:33 by Leah Redding

Studies of thunderstorms indicate that two conditions are required for hail to develop: sufficiently strong and persistent up-draft velocities and an accumulation of liquid water in a super-cooled state in the upper parts of the storm. Hailstones are formed as water vapor in the warm surface layer rises quickly into the cold upper atmosphere. The water vapor is frozen and begins to fall; as the water falls, it accumulates more water vapor. This cycle continues until there is too much weight for the updraft to support and the frozen water falls too quickly to the ground to melt along the way. The graphic below depicts hail formation:



(Source: NWS, Thunderstorm Hazards- Hail. http://www.srh.noaa.gov/srh/jetstream/tstorms/hail.html)

Injury and loss of life are rarely associated with hailstorms, however extensive property damage is possible, especially to crops.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
  - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
  - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
  - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
  - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?

- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.13.1 Hail Hazard Profile

Published 4/22/2016 19:50 by a-reum han

Hail is a form of solid precipitation. Hail may be spherical, conical or irregular in shape and can range in size from barely visible in size to grapefruit-sized dimensions. Hailstones equal to or larger than a penny are considered severe.

Hail Size Estimates	
Size	**Inches in Diameter**
Pea	1/4 inch
Marble/mothball	1/2 inch
Dime/Penny	3/4 inch
Nickel	7/8 inch
Quarter	1 inch
Ping-Pong Ball	1 1/2 inch
Golf Ball	1 3/4 inches
Tennis Ball	2 1/2 inches
Baseball	2 3/4 inches
Tea cup	3 inches
Grapefruit	4 inches
Softball	4 1/2 inches

Source: NSW, January 10, 2003

Hail falls in swaths that can be from twenty to one hundred miles long and from five to thirty miles wide. A hail swath is not a large continuous path of hail but generally consists of a series of hail cells that are produced by individual thunderstorm clouds traveling in the same area.

There are methods available to detect hail-producing thunderstorms using weather satellites and weather radar imagery. Hailstones generally fall at higher speeds as they grow in size, though complicating factors such as melting, friction with air, wind, and interaction with rain and other hailstones can slow their descent through Earth's atmosphere. Severe weather warnings are issued for hail when the stones reach a damaging size, as it can cause serious damage to human-made structures and, most commonly, farmers' crops.

The size of hailstones is best determined by measuring their diameter with a ruler. In the absence of a ruler, hailstone size is often visually estimated by comparing its size to that of known objects, such as coins.

4.13.2 Location and Extent

Published 2/2/2017 11:34 by Leah Redding

Hailstorms usually occur from May through August and Wisconsin averages two or three hail days per year. According to the National Weather Service, since 1883 Milwaukee County has reported 64 "severe" hail events (hail bigger than 1 inch). Fortunately none have led to loss of life or injury. Milwaukee County, as can be seen in the map at the bottom of Frequency and Probability has a high probability of hail occurrence in Wisconsin. The likelihood of damage due to hail is therefore considered high.

Most hail damage occurs in rural areas because maturing crops are particularly susceptible to bruising and other damage caused by hailstones. The four months of hailstorm activity correspond to the growing and harvesting seasons for most crops.

4.13.3 Frequency and Probability

Published 2/2/2017 11:36 by Leah Redding

There have been 77 hail events in Milwaukee County recorded by the National Weather Service between January 1st, 1950 and October 31st, 2016.

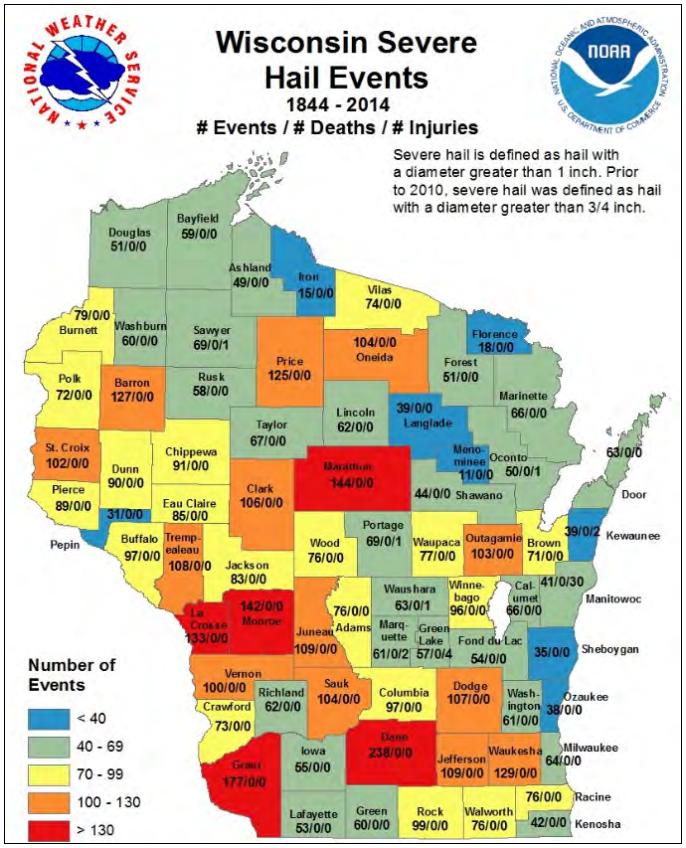
Location	Date	Size	Death	Injury	Property Damage	Crop Damage
Milwaukee County	7/11/1956	0.75 in.	0	0	0	0
Milwaukee County	8/07/1958	0.75 in.	0	0	0	0
Milwaukee County	6/28/1960	1.75 in.	0	0	0	0
Milwaukee County	8/04/1961	1.75 in.	0	0	0	0
Milwaukee County	9/13/1962	1.00 in.	0	0	0	0
Milwaukee County	3/19/1963	1.00 in.	0	0	0	0
Milwaukee County	3/19/1963	1.50 in.	0	0	0	0
Milwaukee County	6/08/1963	2.00 in.	0	0	0	0
Milwaukee County	7/31/1963	0.75 in.	0	0	0	0
Milwaukee County	8/01/1963	0.75 in.	0	0	0	0
Milwaukee County	4/06/1964	0.75 in.	0	0	0	0
Milwaukee County	7/22/1964	1.00 in.	0	0	0	0
Milwaukee County	7/13/1965	0.75 in.	0	0	0	0
Milwaukee County	6/221968	0.75 in.	0	0	0	0
Milwaukee County	6/29/1968	0.75 in.	0	0	0	0
Milwaukee County	8/11/1969	1.00 in.	0	0	0	0
Milwaukee County	9/04/1977	0.75 in.	0	0	0	0
Milwaukee County	6/17/1978	1.75 in.	0	0	0	0
Milwaukee County	5/18/1979	0.75 in.	0	0	0	0
Milwaukee County	6/05/1980	1.75 in.	0	0	0	0
Milwaukee County	6/07/1980	1.00 in.	0	0	0	0
Milwaukee County	8/04/1980	1.75 in.	0	0	0	0
Milwaukee County	6/17/1984	0.75 in.	0	0	0	0
Milwaukee County	8/09/1984	1.00 in.	0	0	0	0
Milwaukee County	8/09/1984	2.25 in.	0	0	0	0
Milwaukee County	5/11/1987	0.75 in.	0	0	0	0
Milwaukee County	5/21/1987	1.00 in.	0	0	0	0
Milwaukee County	5/21/1987	0.75 in.	0	0	0	0
Milwaukee County	7/06/1987	2.00 in.	0	0	0	0
Milwaukee County	6/26/1989	1.00 in.	0	0	0	0
Milwaukee County	7/27/1989	0.75 in.	0	0	0	0
Milwaukee County	3/13/1990	1.75 in.	0	0	0	0
Milwaukee County	4/08/1991	0.88 in.	0	0	0	0
Milwaukee County	9/09/1991	1.00 in.	0	0	0	0
Milwaukee County	9/09/1991	2.00 in.	0	0	0	0
Milwaukee County	6/17/1992	1.00 in.	0	0	0	0
Greenfield	4/18/1995	0.75 in.	0	0	0	0
Franklin	4/18/1995	0.75 in.	0	0	0	0
Wauwatosa	5/13/1995	0.88 in.	0	0	0	0
Wauwatosa	6/07/1995	0.75 in.	0	0	0	0
City of Milwaukee	7/15/1995	0.75 in.	0	0	0	0
West Allis	10/29/1996	0.88 in.	0	0	0	0

City of Milwaukee	8/10/1999	0.75 in.	0	0	0	0
Greenfield	3/08/2000	1.25 in.	0	0	0	0

City of Milwaukee	3/08/2000	1.00 in.	0	0	0	0
Greenfield	5/08/2000	1.00 in.	0	0	0	0
West Allis	5/18/2000	1.75 in.	0	0	20,000	0
Wauwatosa	5/18/2000	0.75 in.	0	0	0	0
North Milwaukee	5/18/2000	0.75 in.	0	0	0	0
City of Milwaukee	6/01/2000	0.75 in.	0	0	0	0
West Allis	5/14/2001	1.00 in.	0	0	0	0
West Allis	6/18/2001	0.88 in.	0	0	0	0
Greendale	6/10/2002	0.75 in.	0	0	0	0
Milwaukee County	6/15/2002	0.75 in.	0	0	0	0
GMIA	6/15/2002	0.75 in.	0	0	0	0
GMIA	6/15/2002	0.75 in.	0	0	0	0
Oak Creek	6/15/2002	0.75 in.	0	0	0	0
Wauwatosa	5/10/2004	1.00 in.	0	0	0	0
Brown Deer	5/23/2004	1.00 in.	0	0	0	0
Brown Deer	5/23/2004	1.50 in.	0	0	0	0
Hales Corners	6/23/2004	1.00 in.	0	0	0	0
City of Milwaukee	6/23/2004	0.75 in.	0	0	0	0
West Allis	3/30/2005	0.75 in.	0	0	0	0
City of Milwaukee	3/30/2005	0.75 in.	0	0	0	0
Wauwatosa	3/30/2005	0.75 in.	0	0	0	0
Wauwatosa	3/30/2005	0.75 in.	0	0	0	0
West Allis	6/04/2005	0.75 in.	0	0	0	0
GMIA	6/07/2005	1.50 in.	0	0	0	0
GMIA	6/07/2005	0.88 in.	0	0	0	0
South Milwaukee	6/07//2005	1.00 in.	0	0	20,000	0
Cudahy	6/07/2005	1.00 in.	0	0	20,000	0
Brown Deer	4/13/2006	2.00 in.	0	0	1.99M	0
Brown Deer	4/13/2006	1.00 in.	0	0	1.99M	0
Glendale	4/13/2006	1.00 in.	0	0	1.99M	0
City of Milwaukee	4/13/2006	0.88 in.	0	0	0	0
West Allis	4/13/2006	1.00 in.	0	0	1.99M	0
West Allis	4/13/2006	1.00 in.	0	0	0	0
City of Milwaukee	4/13/2006	1.00 in.	0	0	0	0
West Allis	7/09/2006	1.00 in.	0	0	0	0
West Allis	7/09/2006	1.00 in.	0	0	0	0
West Allis	7/09/2006	0.75 in.	0	0	0	0
West Allis	7/09/2006	1.00 in.	0	0	0	0
City of Milwaukee	7/09/2006	1.00 in.	0	0	0	0
City of Milwaukee	7/09/2006	1.00 in.	0	0	0	0
West Allis	7/09/2006	1.00 in.	0	0	0	0
Oak Creek	7/09/2006	0.75 in.	0	0	0	0
Wauwatosa	7/9/2006	1.00 in.	0	0	0	0
Shorewood	8/02/2006	0.88 in.	0	0	0	0
Milwaukee	8/23/2006	0.75 in.	0	0	0	0
West Allis	10/02/2006	1.00 in.	0	0	0	0
Brown Deer	10/02/2006	0.75 in.	0	0	0	0
West Allis	10/04/2006	0.75 in.	0	0	0	0
Downtown Milwaukee	2/21/2007	0.88 in.	0	0	0	0
Brown Deer	3/21/2007	0.75 in.	0	0	0	0

Brown Deer	3/21/2007	0.88 in.	0	0	0	0
Milwaukee County	3/21/2007	0.75 in.	0	0	0	0
Franklin	9/27/2007	0.75 in.	0	0	0	0
Oak Creek	9/27/2007	0.88 in.	0	0	0	0
West Allis	9/27/2007	0.75 in.	0	0	0	0
Milwaukee County	9/27/2007	0.75 in.	0	0	0	0
Franklin	6/21/2010	1.00 in.	0	0	0	0
Downtown Milwaukee	9/06/2010	0.88 in.	0	0	0	0
West Allis	9/06/2010	1.00 in.	0	0	0	0
Franklin	9/21/2010	1.00 in.	0	0	0	0
West Allis	6/08/2011	1.00 in.	0	0	0	0
Hales Corners	9/17/2012	0.75 in.	0	0	0	0
GMIA	9/17/2012	1.25 in	0	0	0	0
Greenfield	9/17/2012	0.75 in.	0	0	0	0
GMIA	11/17/2013	1.00 in.	0	0	0	0
South Milwaukee	11/17/2013	1.50 in.	0	0	0	0
Cudahy	11/17/2013	1.00 in.	0	0	0	0
Wauwatosa	4/12/2014	1.00 in,	0	0	0	0
Wauwatosa	4/12/2014	0.75 in.	0	0	0	0
State Fair Park	4/12/2014	0.75 in.	0	0	0	0
Downtown Milwaukee	5/07/2014	0.88 in.	0	0	0	0
State Fair Park	5/12/2014	0.75 in.	0	0	0	0
Wauwatosa	5/12/2014	2.00 in.	0	0	0	0
Mitchell Park Domes	5/12/2014	0.75 in.	0	0	0	0
Downtown Milwaukee	6/17/2014	1.25 in.	0	0	0	0
Wauwatosa	6/17/2014	0.88 in.	0	0	0	0
Mitchell Park Domes	6/17/2014	1.00 in.	0	0	0	0
Milwaukee County	6/18/2014	1.00 in.	0	0	0	0
UW-Milwaukee Campus	6/18/2014	0.88 in.	0	0	0	0
Cudahy	8/01/2014	0.75 in.	0	0	0	0
Milwaukee Hoan Bridge	8/01/2014	1.00 in.	0	0	0	0
St. Francis	8/01/2014	1.00 in.	0	0	0	0
Fox Pt.	8/02/2014	1.00 in.	0	0	0	0
State Fair Park	8/02/2015	1.00 in.	0	0	0	0
Greenfield	8/02/2015	1.25 in.	0	0	0	0
Milwaukee South Shore Park	8/02/2015	1.00 in.	0	0	0	0
Greendale	8/02/2015	1.00 in.	0	0	0	0
South Milwaukee	8/02/2015	1.25 in.	0	0	0	0
Greenfield	8/02/2015	1.00 in.	0	0	0	0
St. Martins (Franklin)	8/02/2015	3.00 in.	0	0	0	0
Milwaukee South Shore Park	8/10/2015	1.00 in.	0	0	0	0
Greendale	8/14/2015	1.00 in.	0	0	0	0
State Fair Park	4/25/2016	0.75 in.	0	0	0	0
West Milwaukee	4/25/2016	0.75 in.	0	0	0	0
Milwaukee South Shore Park	4/25/2016	0.75 in.	0	0	0	0
Milwaukee Timmerman Airport	4/25/2016	0.75 in.	0	0	0	0
Paynesville (Franklin)	4/25/2016	1.00 in.	0	0	0	0

Below is a map of Hail Events in Wisconsin from 1844 - 2014.



(Source: NWS, Severe Weather Statistics: Hail events)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.13.4 Vulnerability

Published 2/27/2017 08:42 by Leah Redding

Hail, typically occurring in conjunction with thunderstorms and lightning, can damage many types of infrastructure. Public and private vehicles (e.g., campers, boats, cars, trucks) are liable to have their windshields cracked, bodies dented and paint damaged as a result of hail. This damage can occur, depending on the size of the hail, whether the vehicle is moving through the storm or is stationary. Hail on the roadway can also cause vehicles to slide off the road. Vehicle damage and iced roadways are of particular concern when you consider the need for emergency vehicles such as police cars, fire trucks and ambulances to quickly move to assist victims in a disaster.

Hail can also damage critical infrastructure such as street signs, electric lines/poles/transformers, telephone lines and radio communication equipment. These pieces of infrastructure are needed by both first response agencies and the general community to ensure safe transport; warm, safe homes and good internal and external communications abilities.

Residential and business properties are liable to receive damage to signs, siding, billboards, trees and windows. Manufactured housing is particularly vulnerable to damage due to its lower construction standards.

Hail can be particularly damaging to agricultural concerns, including farm buildings, standing crops and livestock.

Hazard Assessment		
Hail		
Frequency/Probability (i.e. Future Probability)	▶	High
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Medium

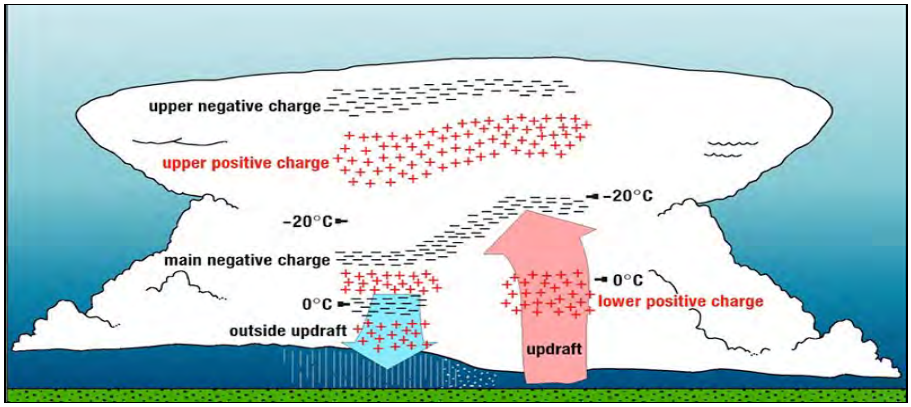
Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.14 Lightning

Published 2/2/2017 11:37 by Leah Redding

Lightning is a phenomenon associated with thunderstorms; the action of rising and descending air separates and builds-up positive and negative charge areas. When the built-up energy is discharged between the two areas, lightning is the result. Lightning may travel from cloud to cloud, cloud to ground, or if there are high structures involved, from ground to cloud.



(Source: NOAA, the National Severe Storms Laboratory. Severe Weather- Lightning)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
  - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
  - 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
  - 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
  - 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
  - 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.14.1 Lightning Hazard Profile

Published 7/13/2015 06:50 by Lauren Martin

The temperatures in a lightning stroke rise to 50,000°F (Fahrenheit). The sudden and violent discharge which occurs in the form of a lightning stroke is over in one-millionth of a second.

Lightning damage occurs when humans and animals are electrocuted, fires are caused by a lightning stroke, materials are vaporized along the lightning path or sudden power surges cause damage to electrical or electronic equipment. Lightning, an underestimated hazard, kills more people in an average year than do hurricanes or tornadoes.

4.14.2 Location and Extent

Published 7/13/2015 06:50 by Lauren Martin

Nationwide, forty-five percent of the people killed by lightning have been outdoors, about sixteen percent were under trees, six percent were on heavy road equipment and thirty-three percent were at various unknown locations. Less than ten percent of the deaths involved individuals inside buildings; these deaths were primarily due to lightning-caused fires.

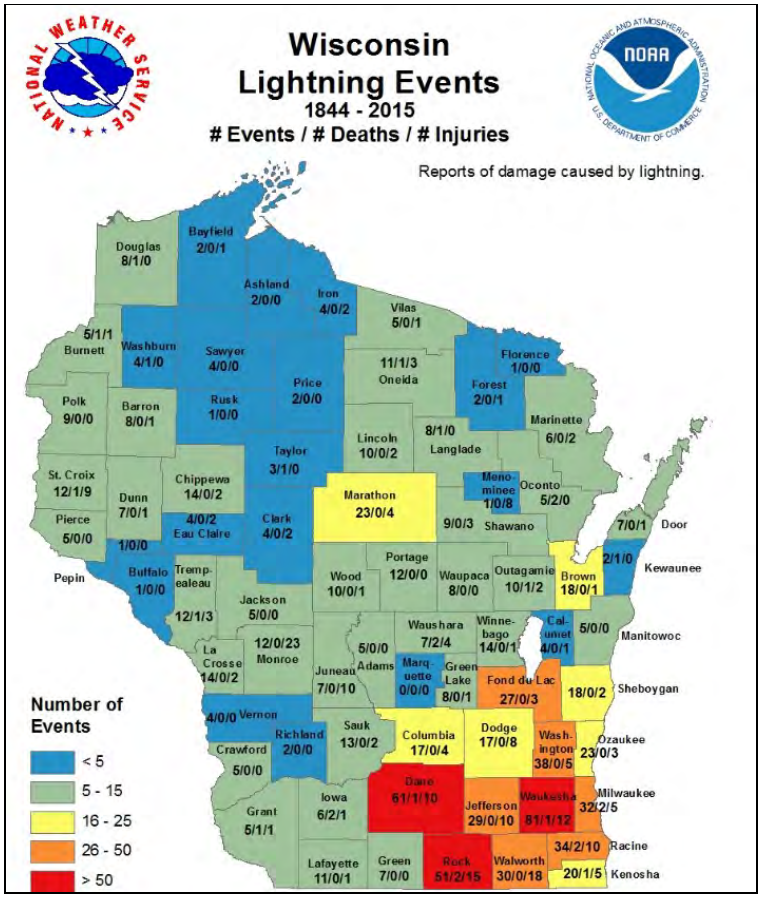
Wisconsin has a high frequency of property losses due to lightning. Insurance records show that annually one out of every fifty farms has been struck by lightning or had a fire which may have been caused by lightning. Generally, rural fires are more destructive than urban fires because of limited lightning protection devices, isolation, longer response times and inadequate water supplies.

4.14.3 Frequency and Probability

Published 2/20/2017 14:04 by Leah Redding

Milwaukee County has a medium-high probability of lightning occurrence.

Below is a map of lightning events in Wisconsin from 1844 - 2014.



The following table shows the 22 lightning events recorded by the National Weather Service between January 1st, 1950 and October 31st, 2015.

Milwaukee County Lightning Events					
Location	Date	Death	Injury	Property Damage	Crop Damage
South Milwaukee	6/30/1997	0	0	20,400	0
Shorewood	7/02/1997	0	0	25,000	0
Milwaukee	7/21/1997	0	0	1,000,000	0
Fox Point	6/18/1998	0	0	3,000	0

St. Francis	6/28/1998	0	0	20,000	0
City of Milwaukee	5/16/1999	0	0	4,000	0
City of Milwaukee	5/16/1999	0	0	4,000	0
Greenfield	5/17/1999	0	0	50,000	0
West Allis	7/20/1999	1	0	75,000	0
City of Milwaukee	5/08/2000	0	0	5,000	0
Franklin	7/02/2000	0	0	15,000	0
Franklin	7/02/2000	0	0	10,000	0
Milwaukee County	8/26/2000	0	0	50,000	0
City of Milwaukee	9/11/2000	0	0	30,000	0
Wauwatosa	6/11/2001	0	0	25,000	0
Fox Point	8/21/2002	0	0	500,000	0
Whitefish Bay	8/21/2002	0	0	1,000	0
Greenfield	8/03/2003	0	0	10,000	0
Milwaukee	7/20/2006	0	0	15,000	0
Brown Deer	4/03/2007	0	0	25,000	0
GMIA	4/24/2008	0	0	200,000	0
Wauwatosa	6/14/2008	0	0	20,000	0
West Allis	8/04/2008	0	0	10,000	0
West Milwaukee	7/22/2010	0	2	0	0
Brown Deer	9/06/2010	0	0	3,000	0

(Source of map & tables: NWS, Severe Weather Awareness. NOAA, Severe Weather Data base)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.14.4 Vulnerability

Published 2/27/2017 08:42 by Leah Redding

Lightning, which often occurs in conjunction with thunderstorms and hail, can damage many types of infrastructure, including electric lines/poles/transformers, telephone lines and radio communication equipment. These pieces of infrastructure are needed by both first response agencies and the general community to ensure safe transport; warm, safe homes and good internal and external communications abilities.

Residential and business properties are liable to receive damage either as a result of a lightning strike causing a fire or other type of direct damage or by overloading electronic equipment (e.g., computers, televisions) that have not been properly connected to a surge protector. The latter concern is especially important to business and government, which in modern America rely on computers and other electronic equipment to manage the large amounts of data manipulated in our information-based economy.

Lightning can damage agricultural assets including farm buildings, standing crops and livestock. It is also one of the major sources of ignition for forest and wildfires.

Hazard Assessment		
Lightning		
Frequency/Probability (i.e. Future Probability)	▶	High
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Medium

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
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    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.15 Thunderstorms

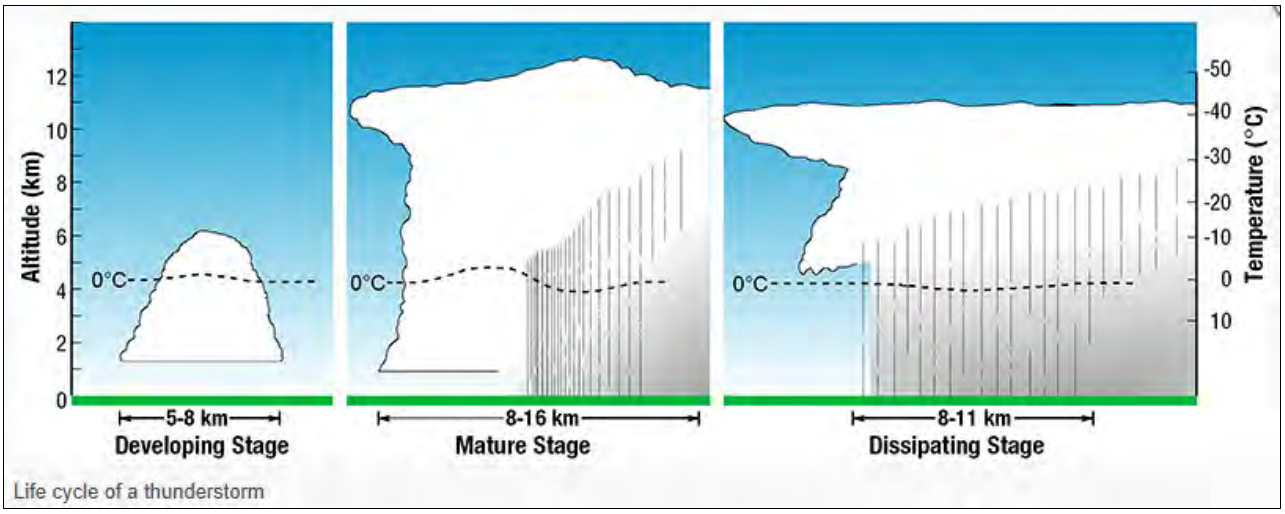
Published 2/2/2017 11:38 by Leah Redding

There are three distinct stages of development for thunderstorms: developing, maturity, and dissipating. Each stage is described below and shown in the image at the bottom.

In the first stage, the "developing" stage, a cumulus cloud is pushed upward by an updraft, driving warm air up and forming a tower-like cloud. There is occasional lightning in this stage but no rain.

The second stage of development is the "mature stage". The updraft continues to feed the storm, and precipitation begins to fall, creating a downdraft. When the downdraft and rain-cooled air spread out over the ground, it forms a gust front. This stage is when hail, strong winds, lightning, heavy rain, and tornados are most likely.

The final stage, the dissipating stage, occurs when the updraft is overcome by the downdraft. On the ground, the gust front moves away from the storm and blocks the warm, wet air that was feeding the thunderstorm. Rainfall decreases, but lightning still can occur.



(Source: NOAA, The National Severe Storms Laboratory: Severe Weather- Thunderstorms)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
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    - B1.4. Extent (strength or magnitude) of each hazard
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    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
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- 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.15.1 Thunderstorms Hazard Profile

Published 8/10/2015 03:49 by Lauren Martin

A thunderstorm often is born, grows, reaches maturity and dies in a thirty-minute period. The individual thunderstorm cell often travels between thirty and fifty miles per hour. Strong frontal systems may create one squall line after another, each composed of many individual thunderstorm cells. These fronts can often be tracked across the state from west to east with a constant cycle of birth, growth, maturity and death of individual thunderstorm cells.

Summers are generally rainy in Wisconsin, and the state experiences about 30 to 40 thunderstorms per year, with occasional hail and lightning. Precipitation is usually higher in areas with the highest elevations, such as the Northern Highlands and Western Uplands. Annual precipitation figures range from approximately 28 to 34 inches, depending on the region.

4.15.2 Location and Extent

Published 11/17/2016 14:54 by Leah Redding

There are approximately 100,000 thunderstorms in the United States every year and approximately 10% of those are considered severe (i.e., has at least ¾" hail, winds of at least 58 mph or a tornado). Most Wisconsin counties, including Milwaukee County, average between 30 and 40 thunderstorm days per year although a portion of southwestern and south-central Wisconsin average 40 to 50 thunderstorm days per year. In Milwaukee County there are typically several severe thunderstorms per year. Thunderstorms can occur throughout the year with the highest frequency during the months of May through September. The majority of storms occur between the hours of noon and midnight.

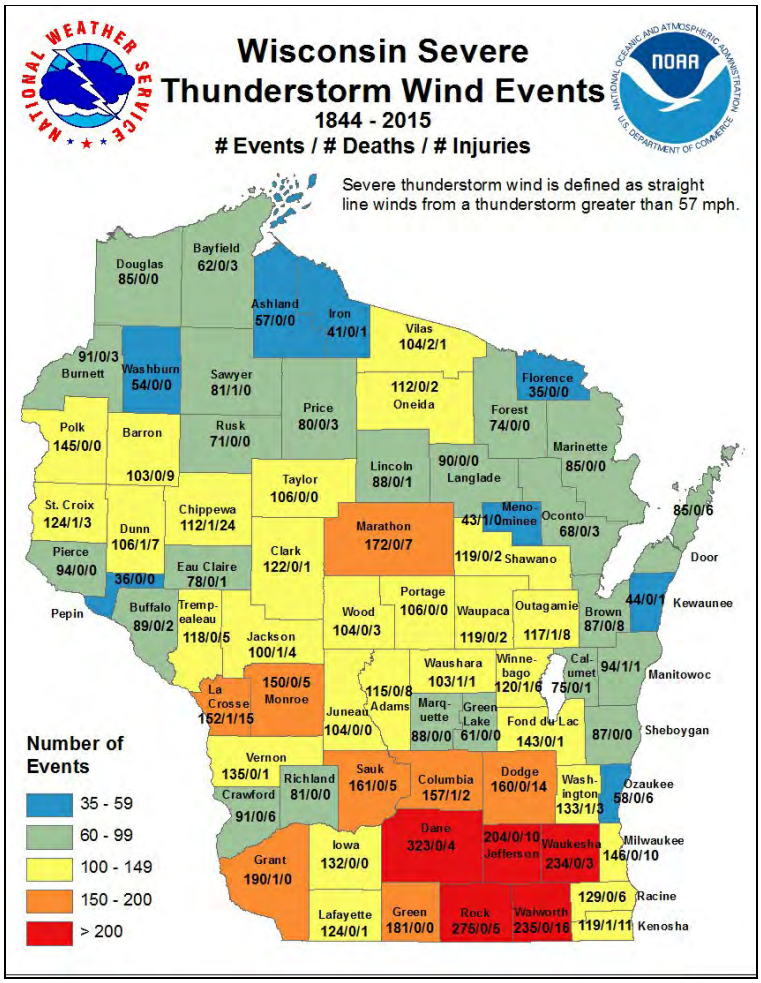
4.15.3 Frequency and Probability

Published 2/2/2017 11:46 by Leah Redding

Thunderstorm frequency is measured as the number of days per year with one or more incidents. There are approximately 100,000 thunderstorms in the United States every year and approximately 10% of those are considered severe (i.e., has at least 3⁄4" hail, winds of at least 58 mph or a tornado). Most Wisconsin counties, including Milwaukee County, average between 30 and 40 thunderstorm days per year although a portion of southwestern and south-central Wisconsin average 40 to 50 thunderstorm days per year. In Milwaukee County there are typically several severe thunderstorms per year. Hurricane-force winds are greater than or equal to 75 miles per hour. Thunderstorms can occur throughout the year with the highest frequency during the months of May through September. The majority of storms occur between the hours of noon and midnight.

The probability of thunderstorms occurring in Milwaukee County is high. Damage from thunderstorms usually is a result of the hail, lightning, winds and/or flash flooding that can occur as part of the storm. The likelihood of damage from these causes is discussed in the appropriate chapters.

Below is a map of Thunderstorm Wind Events in Wisconsin from 1844 - 2014



(NWS, Wisconsin climatology: http://www.weather.gov/images/mkx/svr-wx-stats/TstormWind.jpg)

There are 139 thunderstorms and high wind events that have been recorded in Milwaukee County by the National Weather Service between January 1st, 1950 and October 31st, 2016. The following table lists the most recent events:

Location	Date	Wind Speed	Death	Injury	Property Damage	Crop Damage
Brown Deer	7/22/2010	53 kts. EG	0	0	0	0
Timmerman Airport	8/09/2010	54 kts. EG	0	0	0	0
West Allis	4/10/2011	61 kts. EG	0	0	0	0
GMIA	4/10/2011	57 kts. EG	0	0	0	0
GMIA	4/10/2011	53 kts. MG	0	0	0	0
West Allis	6/08/2011	57 kts. EG	0	0	0	0
Greenfield	6/08/2011	56 kts. EG	0	0	0	0
Cudahy	6/30/2011	55 kts. MG	0	0	0	0
Timmerman Airport	9/03/2011	56 kts. EG	0	0	0	0
River Hills	5/01/2012	57 kts. EG	0	0	2,000	0
Greenfield	9/17/2012	52 kts. EG	0	0	2,000	0
Wauwatosa	5/14/2013	61 kts. EG	0	0	50,000	0
Wauwatosa	5/12/2014	52 kts. EG	0	0	0	0
Wauwatosa	6/17/2014	65 kts. EG	0	0	30,000	0
West Allis	6/28/2014	55 kts. EG	0	0	2,000	0
West Allis	6/30/2014	53 kts. EG	0	0	5,000	0
GMIA	6/30/2014	51 kts. MG	0	0	7,000	0
Greenfield	6/22/2015	52 kts. EG	0	0	1,000	0
Hales Corners	6/22/2015	52 kts. EG	0	0	1,000	0
North Milwaukee	6/222015	50 kts. MG	0	0	500	0
Greenfield	7/18/2015	55 kts. EG	0	0	1,000	0
South Milwaukee	6/05/2016	50 kts. EG	0	0	1,000	0
West Allis	8/03/2016	50 kts. EG	0	0	5,000	0
Greenfield	8/03/2016	50 kts. EG	0	0	5,000	0

Key: **E** = Estimated; **M** = Measured; **EG** = Wind Estimated Gust; **ES** = Estimated Sustained Wind; **MS** = Measured Sustained Wind; **MG** = Measured Wind Gust

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.15.4 Vulnerability

Published 10/25/2016 13:41 by Leah Redding

Thunderstorms, which often produce hail and lightning and may occasionally spawn tornadoes, high wind storms or flash flooding, can damage many types of infrastructure. Milwaukee County's thunderstorm vulnerabilities due to associated hail, lightning, winds and flood waters are discussed in the other hazard chapters of this plan.

Hazard Assessment		
Thunderstorms		
Frequency/Probability (i.e. Future Probability)	▶	High
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Low
Overall Risk Rating	▶	Medium

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.16 Tornadoes and High Winds

Published 2/2/2017 11:48 by Leah Redding

A tornado is a violently rotating funnel-shaped column of air. The lower end of the column may or may not touch the ground. Average winds in the tornado are between 173 and 250 miles per hour but winds can exceed 300 miles per hour. It should also be noted that straight-line winds may reach the same speeds and achieve the same destructive force as a tornado. Of all atmospheric storms, tornados are the most violent. The picture below shows the different parts of a tornado

Characteristics of a tornadic thunderstorm: A. Rear-flank, B. Striations indicating strong rotating updraft, C. Mesocyclone, D. Tail cloud, E. Wall cloud, F. Tornado (Credit: Brian & Steve Koch)

(Source: NWS, Severe weather 101: Tornado Basics. http://www.nssl.noaa.gov/education/svrwx101/tornadoes/)

A derecho is a widespread, long-lived, violent, convectively-induced straight-line windstorm that is associated with a fast-moving band of severe thunderstorms usually taking the form of a bow echo.

Derechos blow in the direction of movement of their associated storms; this is similar to a gust front except that the wind is sustained and generally increases in strength behind the "gust" front. A warm weather phenomenon, derechos occur mostly in summer, especially July, in the northern hemisphere. They can occur at any time of the year and occur as frequently at night as in the daylight hours.

The traditional criteria that distinguish a derecho from a severe thunderstorm are sustained winds of 58 mph during the storm as opposed to gusts, high and/or rapidly increasing forward speed and geographic extent (typically 250nautical miles in length). In addition, they have a distinctive appearance on radar (bow echo); several unique features, such as the rear inflow notch and bookend vortex and usually manifest two or more downbursts. There are three types of derechos:

- Serial: Multiple bow echoes embedded in a massive squall line typically around 250 miles long. This type of derecho is usually associated with a very deep low. Also because of embedded supercells, tornadoes can easily spin out of these types of derechos.
- Progressive: A small line of thunderstorms take the bow- shape and can travel for hundreds of miles.
- Hybrid: Has characteristics of a serial and progressive derechos. Hybrid derechos are associated with a deep low like serial derechos but are relatively small in size like progressive derechos.

(Source: NOAA, NWS-NCEP Storm Prediction Center: About Derechos. 3/2016)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
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        - B1.4. Extent (strength or magnitude) of each hazard
    - B5. Hazard Matrix
        - B5.2. Location (if the risk is not equal for the entire jurisdiction)
        - B5.3. Extent (strength or magnitude)
        - B5.5. Future Probability
        - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

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- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.16.1 Tornadoes and High Winds Hazard Profile

Published 4/3/2017 15:23 by Leah Redding

Hazard Profile

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 miles per hour or more. Damage paths can be in excess of one mile wide and 50 miles long. Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Tornadoes occur as part of strong thunderstorms that develop in unstable atmospheric conditions. Tornadoes can accompany tropical storms and hurricanes that move over land, and are most common to the right and ahead of the path of the storm center as it comes ashore. The strongest tornadoes form with super cells, rotating thunderstorms with a well-defined radar circulation called a mesocyclone. One in three super cells experience a decent of clouds or funnel cloud. These thunderstorms can also produce damaging hail and severe straight-line winds even without a tornado occurrence.

Tornadoes develop under three scenarios:

- Along a squall line ahead of an advancing cold front moving from the north;
- In connection with thunderstorm squall lines during hot, humid weather; and
- In the outer portion of a tropical cyclone.

Tornadoes are visible because low atmospheric pressure in the vortex leads to cooling of the air by expansion and to condensation and formation of water droplets. They are also visible as a result of the airborne debris and dust in its high winds. Wind and pressure differential are believed to account for ninety percent of tornado damage in most cases. Because tornadoes are associated with storm systems, they usually are accompanied by hail, torrential rain and intense lightning.

Tornadoes typically produce damage in an area that does not exceed one-fourth mile in width or sixteen miles in length. Tornadoes with track lengths greater than 150 miles have been reported although such tornadoes are rare. Tornado damage severity is measured by the Fujita Tornado Scale, which assigns an "F" ("Fujita") value from 0 – 5 to denote the wind speed.

The Fujita Tornado Scale		
Category	**Wind Speed**	**Description Damage**
F0	40-72 mph	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
F1	73-112 mph	Moderate damage. The lower limit is the beginning of hurricane speed. Roof surfaces peeled off; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
F2	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	158-206 mph	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
F4	207-260 mph	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off; cars thrown and large missiles generated.
F5	261-318 mph	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100-yards; trees debarked.

Enhanced Fujita (EF) Scale

On February 1, 2007, the National Weather Service adopted “Enhanced Fujita (EF) Scale”. The EF Scale evaluates and categorizes tornado events by intensity. Both the original Fujita Scale and the EF Scale estimate the intensity of a tornado (3-second gust speed) based on the magnitude of damage. The original scale had a lack of damage indicators and with the increasing standards for buildings, rating of tornadoes was becoming inconsistent. The EF Scale evaluates tornado damage with a set of 28 indicators (see NOAA website). Each indicator is a structure with a typical damage description for each magnitude of a tornado.

Fujita Scale			Derived EF Scale			Operational EF SCale
F Number	Fastest 1/4 Mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Downburst Characteristics

Downburst damage is often highly localized but resembles damage caused by a tornado. In some cases, even an experienced investigator cannot identify the nature of a storm without mapping the direction of the damaging winds over a large area. There are significant interactions between tornadoes and nearby downbursts.

A classic downburst example occurred on 4 July 1977 when a severe thunderstorm moved across Northern Wisconsin. Extensive areas of tree and property damage, somewhat like a tornado, were reported. After an aerial survey was completed to map both direction and F-scale intensity of the damaging winds it was determined that no evidence of a tornado was found anywhere within the path of the damage swath, which was 166 miles long and 17 miles wide. The survey revealed that there were scattered local centers from which straight-line winds diverged outward. These local wind

systems were identified as downbursts with at least 25 specific locations recognized by the low-flying aircraft.

Hazard Considerations

Area Impacted:

- Damage paths can be in excess of one mile wide and 50 miles long.

Duration of Event:

- Tornados can develop with short warning and last for minutes or hours
- Tornadoes can also develop at any time of the day or night during the landfall of a hurricane.
- However, by 12 hours after landfall, tornadoes tend to occur mainly during daytime hours.

Essential Service Disruption:

- Schools may be temporarily closed after the incident due to indirect reasons (public concerns for safety or a lack of transportation) or directly because the school was damaged.
- Electricity and other essential services to local areas can be disrupted during storm events. In severe cases, power can be lost for several days or weeks.
- Continuity of government.

Special Considerations:

- Special populations i.e. the elderly, infirm, disabled, children, infants, and foreign / out-of- state guests will be a real concern during a tornado due to the size and complexity of a tornado impact.
- If a tornado occurs during school hours, children will be required to shelter-in-place. Have schools briefed parents on what to expect during this time?
- Animals and pets will be set loose by their owners or by the storm itself; conversely owners will refuse evacuation or shelter unless pets have provisions for care.

Direct Damage:

- Structural damage to buildings directly in path of tornado. High winds can also damage or destroy structurally vulnerable facilities that are constructed with materials that have low tensile strength.
- A tornado generates high winds and the debris generated by those winds may disrupt landline, cellular phone, push-to-talk, land mobile radio (LMR), and Internet communications.
- High wind speeds and the resulting debris may disrupt electrical and gas power.
- A powerful tornado, F-3 to F-5, hitting an industrialized area can also generate secondary hazards such as a hazardous materials event
- Injuries that commonly occur during or after a tornado are for example: puncture wounds and concussion injuries from flying debris, electric shock from down power lines, orthopedic trauma from falling debris and structures, burns from fires, inhalation issues from hazardous material releases, and mental trauma from the shock of the event.
- Tornadoes do not have the strength to destroy the frame of a high-rise structure but falling glass and debris continuing after the impact will make search and rescue, and evacuation difficult and dangerous.
- Facilities and residences sustaining structural damage may cause natural gas leaks.
- Damage to the supply of electricity may cause water supply, sewage treatment, and gasoline / diesel supply disruptions.
- Humans and animals are often injured or killed by severe tornado activity. Most cases involve a direct impact combined with minimal shelter or protection.

Affected Population:

- Although tornadoes typically impacted a select area, it can also generate mass casualties if it hits an urban area or during the night.
- In rural areas, tornadoes can impact a significant number of the population if it hits a developed area of the community.

Economic Damage:

- The costs of losing revenue by the temporary closure of special event and commercial sites will be directly affected by the speed and efficiency of recovery phase operations and by retaining public confidence by efficient response operations.

Emergency Services:

- Debris scattered across roads and highways will make it difficult for first responder vehicles to have a rapid ingress / egress to impact areas e.g. damage to vehicle tires can greatly inhibit Fire, EMS, and Law Enforcement response.
- Tornados can cause mass casualties that will exceed local resources and capabilities.
- The lack of emergency warning sirens may inhibit effective tornado warning. Sirens with live voice broadcasting/adjustable audio output capabilities recommended due to their versatility.
- Temporary mass sheltering may be an operational requirement at schools, hotels, museums, and exhibits i.e. owners and operators should strongly encourage their patrons to remain until the situation improves and care arrives for these patrons.

Social Factors:

- None identified

4.16.2 Location and Extent

Published 10/25/2016 13:46 by Leah Redding

Wisconsin lies along the northern edge of the nation's tornado belt, which extends north-eastward from Oklahoma into Iowa and across to Michigan and Ohio. Winter, spring and fall tornadoes are more likely to occur in southern Wisconsin, which includes Milwaukee County, than in northern counties.

Wisconsin's tornado season runs from the beginning of April through September with the most severe tornadoes typically occurring in April, May and June. Tornadoes have, however, occurred in Wisconsin during every month except February. Many tornadoes strike in late afternoon or early evening but they do occur at other times. Deaths, injuries and personal property damage have occurred and will continue to occur in Wisconsin.

4.16.3 Frequency and Probability

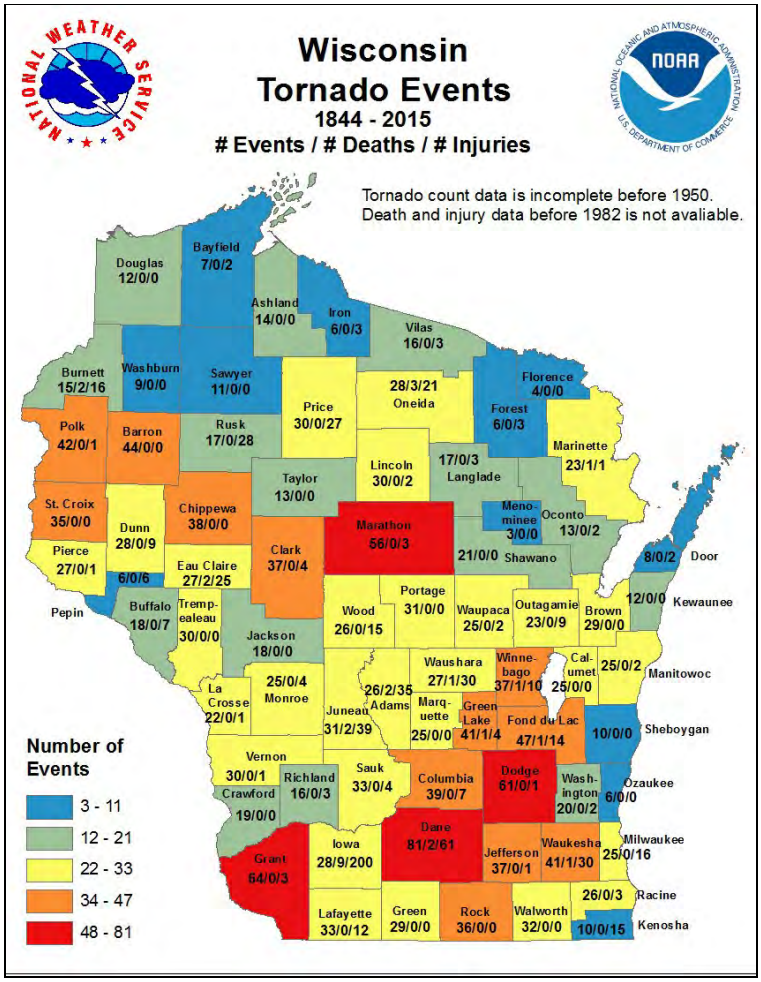
Published 2/2/2017 11:48 by Leah Redding

The probability of Milwaukee County being struck by a tornado in the future is medium and the likelihood of damage from future tornadoes is high.

According to the National Weather Service, Milwaukee County had 17 tornados between January 1st, 1950 and October 31st, 2016. The following table lists these events.

Location	Date	Type	Magnitude	Death	Injury	Property Damage	Crop Damage
Milwaukee County	8/07/1958	Tornado	F2	0	4	25,000	0
City of Milwaukee	9/26/1959	Tornado	F2	0	3	250,000	0
Milwaukee County	7/22/1962	Tornado	F2	0	0	25,000	0
Milwaukee County	10/04/1962	Tornado	F1	0	0	25,000	0
Milwaukee County	8/22/1964	Tornado	F1	0	0	250,000	0
Milwaukee County	9/03/1964	Tornado	F2	0	0	250,000	0
Milwaukee County	8/11/1969	Tornado	F1	0	153	250,000	0
Milwaukee County	8/25/1975	Tornado	F1	0	0	2,500	0
Milwaukee County	8/25/1975	Tornado	F2	0	0	25,000	0
Milwaukee County	4/02/1977	Tornado	F2	0	0	25,000	0
Milwaukee County	8/04/1980	Tornado	F2	0	0	250,000	0
Milwaukee County	7/20/1981	Tornado	F1	0	0	25,000	0
Milwaukee County	8/17/1985	Tornado	F1	0	0	0	0
Milwaukee County	5/24/1989	Tornado	F0	0	0	250,000	0
City of St. Francis, GMIA	3/08/2000	Tornado	F1	0	16	4,600,000	0
City of Franklin, City of Oak Creek, GMIA	7/02/2000	Tornado	F1	0	0	1,530,000	0

Below is a map of Tornado Events in Wisconsin from 1844 - 2015.



(Source: NWS, Severe Weather Stats: Wisconsin Tornado Events).

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.16.4 Vulnerability

Published 12/5/2016 14:23 by Leah Redding

Injury to people is a primary concern in tornado and high wind events. Two of the highest risk places are mobile home parks and campgrounds. Milwaukee County, being a very urban county, has only about 9 mobile home parks, and no campgrounds. These places are high risk because of the concentration of people in a small area and construction of the homes, generally without storm shelters. Other places of concern during these types of events include critical emergency facilities such as hospitals and public works/highway garages, police stations and fire departments, which contain equipment and services needed by the public after a tornado.

Schools, in addition to holding children, are the major type of structure used as community disaster shelters and their loss might therefore affect the community on several levels (e.g., the death or injury of children, the loss of a community housing shelter). School gymnasiums are often the specific location of the community shelter but they are especially vulnerable in tornadoes because the large-span roof structure is often not adequately supported.

Community infrastructure such as power lines, telephone lines, radio towers and street signs are often vulnerable to damage from tornadoes and high winds and can be expensive to replace. The loss of radio towers that hold public safety communications repeaters can adversely impact the ability of first responders to mount an effective response; damage to towers that hold public media equipment may adversely impact the ability to distribute adequate public information.

Residential property is likely to have siding and roofing materials removed, windows broken from flying debris and garages blown down due to light construction techniques. Perhaps one of the largest types of loss on private property is due to tree damage, which is generally not covered by federal disaster assistance.

Business properties are at risk for having damage to infrastructure including signs, windows, siding and billboards. Agricultural buildings, such as barns and silos, are also generally not constructed in a manner that makes them wind resistant, which can lead to the loss of livestock and harvest. Standing crops are also at risk from high winds and tornadoes.

Hazard Assessment		
Tornadoes and High Winds		
Frequency/Probability (i.e. Future Probability)	▶	Medium
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Medium

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.17 Winter Storms

Published 10/28/2016 09:16 by Leah Redding

Due to its position along the northern edge of the United States, Wisconsin, including Milwaukee County, is highly susceptible to a variety of winter weather storm phenomena.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
    - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
    - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
    - B1.4. Extent (strength or magnitude) of each hazard
  - B5. Hazard Matrix
    - B5.2. Location (if the risk is not equal for the entire jurisdiction)
    - B5.3. Extent (strength or magnitude)
    - B5.5. Future Probability
    - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
  - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
- 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.17.1 Winter Storms Hazard Profile

Published 4/22/2016 20:16 by a-reum han

A winter storm is an event in which the varieties of precipitation are formed that only occur at low temperatures, such as snow or sleet, or a rainstorm where ground temperatures are low enough to allow ice to form (i.e. freezing rain). In temperate continental climates, these storms are not necessarily restricted to the winter season, but may occur in the late autumn and early spring as well.

A winter storm can range from a moderate snow over a few hours to blizzard conditions with blinding wind-driven snow that lasts several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely reduce visibility.

The National Weather Service descriptions of winter storm elements are:

- Heavy snowfall - Accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.
- Blizzard - An occurrence of sustained wind speeds in excess of 35 miles per hour (mph) accompanied by heavy snowfall or large amounts of blowing or drifting snow.
- Ice storm - An occurrence of rain falling from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed objects near the ground.
- Freezing drizzle/freezing rain - Effect of drizzle or rain freezing upon impact on objects with a temperature of 32 degrees Fahrenheit or below.
- Sleet - Solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes. This ice does not cling to surfaces.
- Wind chill - An apparent temperature that incorporates the combined effect of wind and low air temperatures on exposed skin.

A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. People can become trapped at home, without utilities or other services. Heavy snowfall and blizzards can trap motorists in their cars. Attempting to walk for help in a blizzard can be a deadly decision.

Winter storms can make driving and walking extremely hazardous. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months. Storm effects such as extremely cold temperatures and snow accumulation, and sometimes coastal flooding, can cause hazardous conditions and hidden problems for people in the affected area.

Hazard Considerations

Area Impacted:

- Region and Statewide

Duration of Event

- Severe winter storms can last anywhere from several hours to several days.

Essential Service Disruption

- Disruption of utilities (i.e. power, telephone, etc.) may last for days.
- Continuity of government.

Special Considerations:

- Preservation of cultural and historical locations, facilities, and artifacts.

Direct Damage

- Ice storms may disrupt power lines.

Affected Population

- Winter storms can impact a significant number of the population.

Economic Damage

- Loss of revenue by the temporary closure of roads, special event and commercial sites.

4.17.2 Location and Extent

Published 7/13/2015 06:53 by Lauren Martin

In Wisconsin, the winter storm season generally runs from November through March and Wisconsin residents are most familiar with heavy snowstorms, blizzards, sleet and ice storms. The majority of Wisconsin snowfalls are between one and three inches per occurrence, although heavy snowfalls that produce at least ten inches may occur four or five times per season. Northwestern Wisconsin encounters more blizzards than the southeastern portions of the state.

Damage from ice storms can occur when more than half an inch of rain freezes on trees and utility wires, especially if the rain is accompanied by high winds. Another danger comes from accumulation of frozen rain pellets on the ground during a sleet storm, which can make driving hazardous.

4.17.3 Frequency and Probability

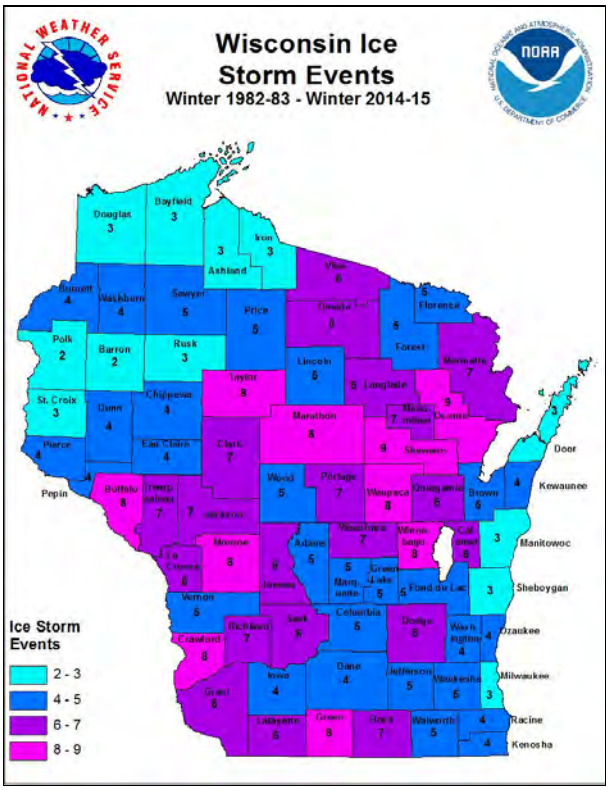
Published 2/2/2017 11:53 by Leah Redding

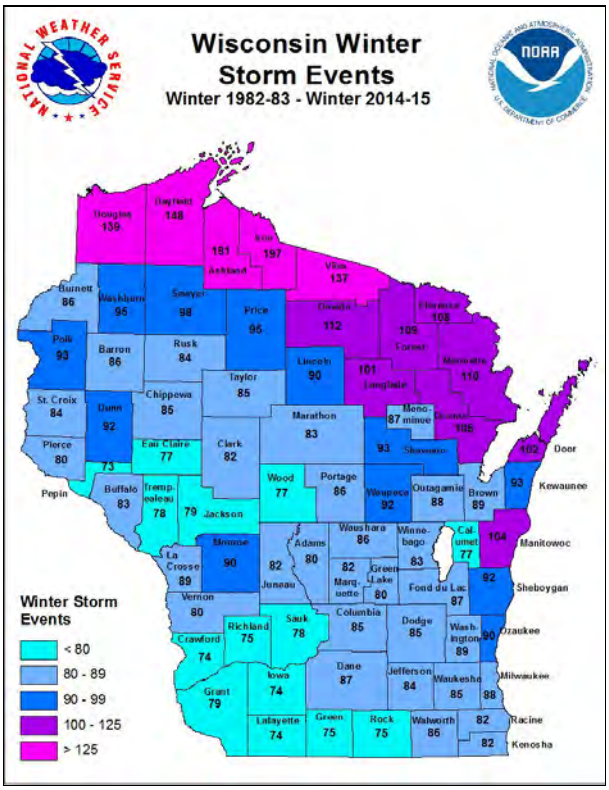
Annual snowfall in Wisconsin varies between thirty inches in southern counties to one hundred inches in the north. Milwaukee County averages approximately 47 inches of snow annually. Storm tracks originating in the southern Rockies or Plains states that move northeastward produce the heaviest precipitation, usually six to twelve inches. Low-pressure systems originating in the northwest (Alberta) tend to produce only light snowfalls of two to four inches. Snowfalls associated with Alberta lows occur more frequently with colder weather.

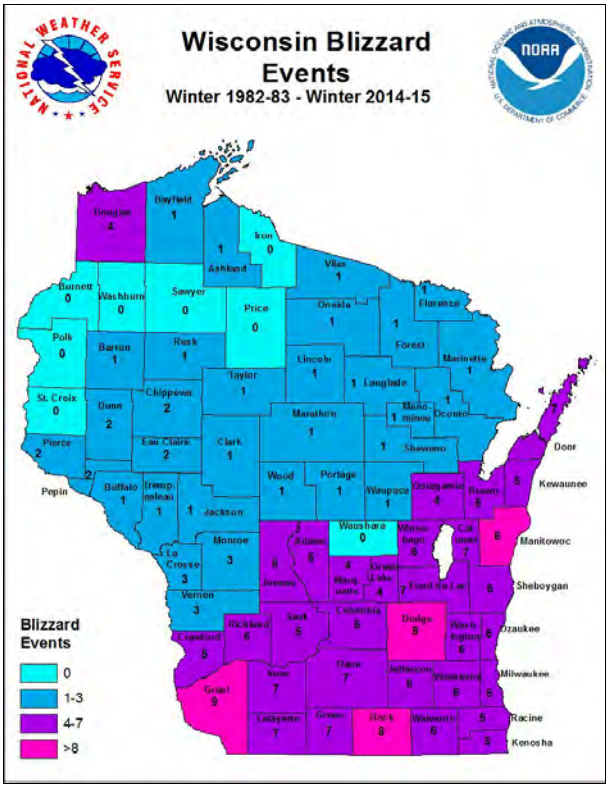
Although massive blizzards are rare in Wisconsin, blizzard-like conditions often exist during heavy snowstorms when gusty winds cause blowing and drifting of snow. Near blizzard conditions existed in Wisconsin in January 1979 when record snowfalls were recorded in many areas and wind speeds gusted to over thirty miles per hour.

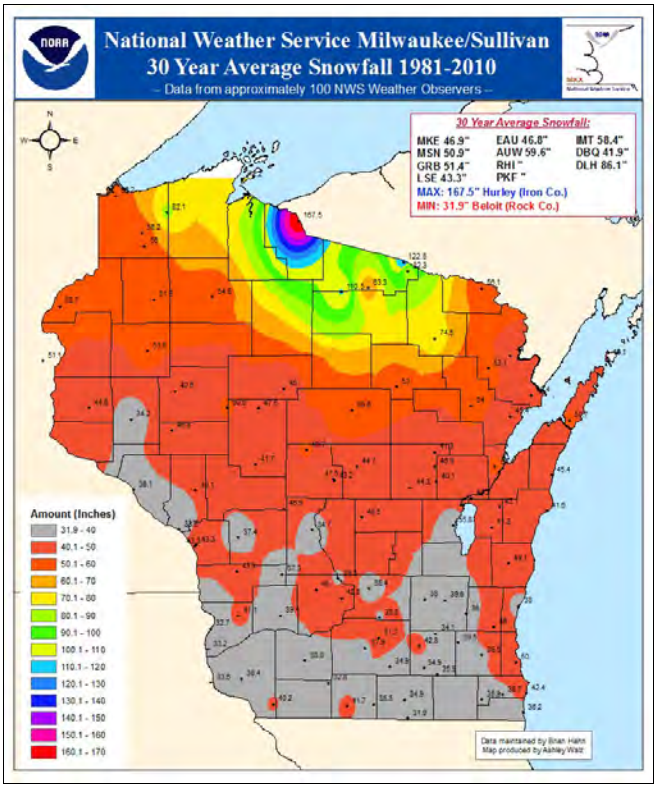
Both ice and sleet storms can occur at any time throughout the winter season from November to April. Ice storms of disastrous proportions occurred in central Wisconsin in February 1922 and in southern Wisconsin in March 1976. A Presidential Disaster Declaration occurred as a result of the 1976 storm. Utility crews from surrounding states were called in to restore power, which was off for up to ten days in some areas. Other storms of lesser magnitude caused power outages and treacherous highway conditions.

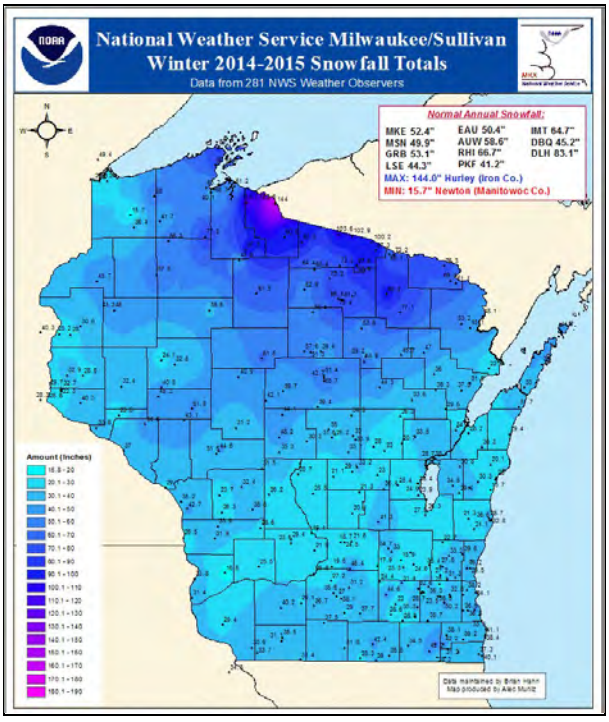
Below are maps demonstrating the frequency of Winter Storms, Blizzards, and Ice Storms in Wisconsin from Winter 1982-83 to Winter 2013-14.











The probability that there will be severe winter storms in Milwaukee County is medium and the likelihood that those storms will cause significant damage is also medium. The following table details Milwaukee County's 70 winter storm statistics (i.e., snow and ice events) and 8 heavy snow events as reported by the National Weather Service, including damage estimates, from January 1st, 1950 through October 31st, 2016:

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Milwaukee County	1/05/1996	Heavy Snow	0	0	0	0

Milwaukee County	1/16/1996	Winter Weather	0	0	0	0
Milwaukee County	1/23/1996	Winter Weather	0	0	0	0
Milwaukee County	12/11/2000	Heavy Snow	0	0	0	0
Milwaukee County	12/18/2000	Heavy Snow	0	0	0	0
Milwaukee County	3/02/2002	Heavy Snow	0	0	0	0
Milwaukee County	2/03/2003	Winter Weather	0	0	0	0
Milwaukee County	3/04/2003	Heavy Snow	0	0	0	0
Milwaukee County	4/04/2003	Winter Weather	0	0	0	0
Milwaukee County	4/07/2003	Winter Weather	0	0	0	0
Milwaukee County	1/04/2004	Winter Weather	0	0	0	0
Milwaukee County	1/16/2004	Winter Weather	0	0	0	0
Milwaukee County	1/26/2004	Heavy Snow	0	0	0	0
Milwaukee County	2/08/2004	Winter Weather	0	0	0	0
Milwaukee County	12/18/2004	Winter Weather	0	0	0	0
Milwaukee County	1/01/2005	Winter Weather	0	0	0	0
Milwaukee County	1/27/2005	Heavy Snow	0	0	0	0
Milwaukee County	11/10/2006	Winter Weather	0	0	0	0
Milwaukee County	1/12/2007	Winter Weather	0	0	0	0
Milwaukee County	1/14/2007	Winter Weather	0	0	0	0
Milwaukee County	1/21/2007	Winter Weather	0	0	0	0
Milwaukee County	2/13/2007	Winter Weather	0	0	0	0
Milwaukee County	3/02/2007	Winter Weather	0	0	0	0
Milwaukee County	11/21/2007	Winter Weather	0	0	0	0
Milwaukee County	12/04/2007	Winter Weather	0	0	0	0
Milwaukee County	12/15/2007	Winter Weather	0	0	0	0
Milwaukee County	12/28/2007	Winter Weather	0	0	0	0
Milwaukee County	1/21/2008	Heavy Snow	0	0	0	0
Milwaukee County	2/09/2009	Winter weather	0	0	0	0
Milwaukee County	2/11/2008	Winter weather/ wind chill	0	0	0	0
Milwaukee County	2/17/2008	Winter weather	0	0	0	0
Milwaukee County	11/24/2008	Winter weather	0	0	0	0
Milwaukee County	12/03/2008	Winter weather	0	0	0	0
Milwaukee County	12/16/2008	Winter weather	0	0	0	0
Milwaukee County	12/23/2008	Winter weather	0	0	0	0
Milwaukee County	12/24/2008	Winter weather	0	0	0	0
Milwaukee County	12/25/2008	Winter weather	0	0	0	0
Milwaukee County	1/03/2009	Winter weather	0	0	0	0
Milwaukee County	1/09/2009	Winter weather	0	0	0	0
Milwaukee County	1/12/2009	Winter weather	0	0	0	0
Milwaukee County	1/13/2009	Winter weather	0	0	0	0
Milwaukee County	2/26/2009	Winter Weather	0	0	0	0
Milwaukee County	2/24/2010	Winter Weather	0	0	0	0
Milwaukee County	3/19/2010	Winter Weather	0	0	0	0
Milwaukee County	12/03/2010	Winter weather	0	0	0	0
Milwaukee County	12/09/2010	Winter weather	0	0	5,000	0

Milwaukee County	12/12/2010	Winter weather	0	0	0	0
Milwaukee County	12/20/2010	Winter weather	0	0	0	0
Milwaukee County	12/25/2010	Winter weather	0	0	0	0
Milwaukee County	1/17/2011	Winter weather	0	0	0	0
Milwaukee County	2/06/2011	Winter weather	0	0	0	0
Milwaukee County	2/21/2011	Winter weather	0	0	0	0
Milwaukee County	3/09/2011	Winter weather	0	0	0	0
Milwaukee County	12/29/2011	Winter weather	0	0	0	0
Milwaukee County	1/12/2012	Winter weather	0	0	0	0
Milwaukee County	1/17/2012	Winter weather	0	0	0	0
Milwaukee County	2/23/2012	Winter weather	0	0	0	0
Milwaukee County	1/27/2013	Winter weather	0	0	0	0
Milwaukee County	1/30/2013	Winter weather	0	0	0	0
Milwaukee County	2/22/2013	Winter weather	0	0	0	0
Milwaukee County	3/05/2013	Winter weather	0	0	0	0
Milwaukee County	3/18/2013	Winter weather	0	0	0	0
Milwaukee County	11/25/2013	Winter weather	0	0	0	0
Milwaukee County	12/08/2013	Winter weather	0	0	0	0
Milwaukee County	12/19/2013	Winter weather	0	0	0	0
Milwaukee County	12/31/2013	Winter weather	0	0	0	0
Milwaukee County	1/01/2014	Winter weather	0	0	0	0
Milwaukee County	1/10/2014	Winter weather	0	0	0	0
Milwaukee County	1/14/2014	Winter weather	0	0	0	0
Milwaukee County	1/24/2014	Winter weather	0	0	0	0
Milwaukee County	1/26/2014	Winter weather	0	0	0	0
Milwaukee County	2/04/2014	Winter weather	0	0	0	0
Milwaukee County	2/13/2014	Winter weather	0	0	0	0
Milwaukee County	3/04/2014	Winter weather	0	0	0	0
Milwaukee County	4/14/2014	Winter weather	0	0	0	0
Milwaukee County	11/22/2014	Winter weather	0	0	0	0
Milwaukee County	11/28/2014	Winter weather	0	0	0	0
Milwaukee County	12/18/2014	Winter weather	0	0	0	0
Milwaukee County	1/08/2015	Winter weather	0	0	0	0
Milwaukee County	2/25/2015	Winter weather	0	0	0	0
Milwaukee County	3/03/2015	Winter weather	0	0	0	0
Milwaukee County	2/08/2016	Winter weather	0	0	0	0
Milwaukee County	2/29/2016	Winter weather	0	0	0	0
Milwaukee County	3/01/2016	Winter weather	0	0	0	0
Milwaukee County	3/24/2016	Winter weather	0	0	0	0
Milwaukee County	4/02/2016	Winter weather	0	0	0	0
Milwaukee County	2/08/2016	Winter weather	0	0	0	0

(Source: NOAA, NWS: Storm Events Database)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
        - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.17.4 Vulnerability

Published 4/22/2016 20:20 by a-reum han

Winter storms present a serious threat to the health and safety of affected citizens and can result in significant damage to property. Heavy snow or accumulated ice can cause the structural collapse of homes, commercial buildings and agricultural structures; down power lines or isolate people from assistance or services by impeding transportation by the general public, emergency responders and public transportation resources.

The loss of electrical service and/or the blocking of transportation routes can adversely affect the ability of commercial enterprises to conduct business. This economic injury may be felt by both the business owner and employees unable to work during this period.

Hazard Assessment		
Winter Storms		
Frequency / Probability (i.e. Future Probability)	▶	Medium
Magnitude / Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Low
Overall Risk Rating	▶	Medium

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.18 Hazardous Materials Release

Published 1/8/2016 12:48 by Daiko Abe

Hazardous materials are materials that if released, can pose a threat to human health or the environment. Hazardous material releases can cause long/short term health effects, damage to property, expensive cleanup/contractor costs, serious injury, and even death.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
        - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
        - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
        - B1.4. Extent (strength or magnitude) of each hazard
    - B5. Hazard Matrix
        - B5.2. Location (if the risk is not equal for the entire jurisdiction)
        - B5.3. Extent (strength or magnitude)
        - B5.5. Future Probability
        - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
- 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.18.1 Hazards Materials Release Hazard Profile

Published 3/24/2017 15:38 by Leah Redding

Hazard Profile

There are as many as 500,000 different products that qualify as a hazardous material. Hazardous materials are stored and transported throughout the Milwaukee area in various quantities. The storage of hazardous materials ranges from residential storage of household products to bulk storage of large volumes for industrial purposes. Hazardous materials are transported by various methods such as railcars, barges, and trucks. A “release” may occur by spilling, leaking, emitting toxic vapors, or any other process that enables the material to escape its container, enter the environment, and create a potential hazard. Hazards are classified in many different ways.

Hazard Classes:

Class 1: Explosives

Class 2: Gases

Class 3: Flammable Liquids

Class 4: Other Flammable Substances

Class 5: Oxidizing Substances and Organic Peroxides

Class 6: Toxic (Poisonous) & Infectious Substances

Class 7: Radioactive Materials

Class 8: Corrosives

Class 9: Miscellaneous Dangerous Goods

A material is classified as hazardous when it is corrosive, explosive, toxic, ignitable, biologically irritating, radioactive, or packaged in a dangerous container. Hazardous material spills involving vehicles provide unique challenges for personnel working to protect the public and the environment. When hazardous materials spill on roadways, personnel may have to negotiate traffic snarls that prevent emergency equipment and ambulances from getting to the scene, flammable and explosive materials, or toxic fumes which may require evacuations.

Hazard Considerations

Area Impacted:

- General hazard material releases are confined to several hundred to a thousand feet from the source

Population Exposed:

- Events at facilities in urban areas can result in mass casualties due to condensed community.

Duration of the Event:

- Hazardous material can pose a risk immediately after release
- Fixed facility events can last as long as several days if the substance released is extremely hazardous (i.e. radioactive material) or emergency response is complicated (i.e. large• scale fire at refinery)

Essential Service Disruption:

- Disruption of transportation networks

- Possibly disruption of water/wastewater service if source of release

Special Considerations:

- Evacuation of elderly from gaming facilities

Direct Damage:

- Contaminated material.
- Health effects from exposure.
- Infrastructure damage includes water/wastewater infrastructure and utilities
- Structural failure or damage if release causes a fire.

Economic Damage:

- Minimal economic damage unless release directly impacts a facility or Seminole HQ.

Emergency Services:

- Possible fire services

Social Factors:

- The release of hazardous materials can result in acute or chronic health problems.

4.18.2 Location and Extent

Published 3/27/2017 13:46 by Leah Redding

Hazardous materials can be released into the environment because of an accident, a natural event such as an earthquake, or an act of terrorism. Rail traffic accidents are less common than roadway spills, however their consequences can be greater simply because of the volume of toxic materials a train can transport. Hazardous material releases are rarely intentional, but terrorist or vandalism releases are possible. Once a hazardous material release is recognized, immediate action must be taken to respond to the release to preserve health and safety and reduce the impact to the neighboring community and the environment. Hazardous material releases in highly populated areas could result in evacuation or “shelter-in-place” situations.

Fixed Facilities

Hazardous materials being used or stored at industrial facilities and in buildings is defined as a fixed facility hazardous material release hazard. Fixed facilities include industrial facilities that store hazardous materials required for their processing or facilities that store hazardous materials that result from an industrial process. An uncontrolled release or mishandling of hazardous materials from a fixed facility may result in possible injury or fatality, severe financial loss or liability, contamination, and disruption of critical infrastructure.

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, was enacted in November 1986 to enable state and local governments to adequately prepare and plan for chemical emergencies. Facilities that have spilled hazardous substances, or that store, use, or release certain chemicals are subject to various reporting requirements. Common EPCRA topics include: emergency planning; hazardous chemical inventory reporting; chemical information; toxic chemical release reporting; risk management plans, and the Toxics Release Inventory (TRI) database. The TRI database includes facilities that manufacture (including importing), process, or otherwise use a listed toxic chemical above threshold quantities. Facilities covered by EPCRA must submit an emergency and hazardous chemical inventory form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC) and the local fire department annually. This report, also called a Tier I or Tier II, includes basic information including facility identification; employee contact information for emergencies and non-emergencies; and site specific information including facility description, chemical types and descriptions, releases or incidents, and chemical storage capacity, capabilities, and locations.

Transport

A 1998 report by the U.S. Department of Transportation entitled Hazardous Materials Shipments states that over 800,000 shipments of hazardous materials are estimated to occur within the United States per day, resulting in a total of 3.1 billion tons shipped annually. Of the 3.1 billion tons shipped annually, 42.9% is transported by truck, 4.4% by rail, 37.9% by pipeline, 14.7% by water, and 0.05% by air.

Truck

Although rail transports larger gross tonnage of hazardous materials, the number of truck traffic counts carrying hazardous materials shipments is greater. This is due to the larger volumes involved in a single rail shipment.

Railway

Because rail is the primary means for shipping crude, and Wisconsin railroads lie between the massive oil reserve and East Coast refineries, the state has seen its share of the growth in crude-by-rail traffic. Crude oil shipments by rail gained attention after a string of accidents, including an explosion in a small town in Quebec that killed 47 people in July 2013. The U.S. Department of Transportation issued an emergency order requiring railroads to notify states of large shipments of Bakken crude oil. The order will apply to shipments containing more than 1 million gallons of crude, or about 35 tank cars, and railroads will have to disclose volumes, frequencies of anticipated train traffic and routes.

Transporting crude on the country's railroads grew from just 9,500 carloads in 2008 to more than 400,000 carloads in 2013, according to the Association of American Railroads. The following rail roads run through Milwaukee County:

- Canadian National Rail Road
- Union Pacific Rail Road
- Canadian Pacific Rail System

Even though a hazardous material spill event can occur at any time, inclement weather such as fog, smoke, and heavy rainfall can increase the likelihood of a spill event on roads and railways. High winds can increase the likelihood of accidents for high-profile vehicles such as tractor-trailers and fan flames after ignition. The duration of an incident should be thought of in two ways: emergency and long-term. The duration of the emergency may last from several hours to several days depending upon the location of the event, the quantity and type of material involved, and the preparedness of the community for an emergency. The duration of the event long-term may be decades due to long-lasting effects on the community and environment.

Toxics Release Inventory (TRI) from the Environmental Protection Agency

The Toxics Release Inventory (TRI) provides information on toxic chemical releases from certain facilities in communities across the United States, covering 20,000 facilities and more than 675 toxic chemicals. For the purposes of the below information, a “release” refers to the different ways toxic chemicals from industrial facilities enter the air, water and land. Facilities who report to TRI:

1. Must be in a TRI-covered industry sector or category, including Manufacturing, Coal/Oil Electricity Generation, Certain Mining Facilities, Hazardous Waste Management, & Federal Facilities.
2. Facility must have the equivalent of at least 10 full-time employees.
3. Facility must manufacture, process or use more than a certain amount of a TRI-listed toxic chemical per year.

Description	Milwaukee County	Wisconsin	United States
	Number	Number	Number
Number of TRI Facilities	121	862	21,598
Total on-site	1.3 million ibs	18,831,624 lbs	3,739,532,090 lbs
Air	907.7 thousand ibs	12,534,867 lbs	773,028,732 lbs
Water	5.5 thousand ibs	2,938,152 lbs	212,120,819 lbs
Land	434.6 thousand ibs	3,358,605 lbs	2,754,382,540 lbs
Total off-site	957.7 ibs	16,865,237 lbs	405,418,333 lbs
Total on-site and off-site disposal or other releases	2.3 million ibs	32,060,074 lbs	4,144,950,423 lbs

(Source: Toxic Release Inventory, Environmental Protection Agency. https://iaspub.epa.gov/triexplorer/tri_factsheet.factsheet?&pstate=WI&pcounty=Milwaukee&pyear=2015&pParent=TRI&pDataSet=TRIQ1)

4.18.3 Frequency and Probability

Published 6/19/2017 15:43 by Leah Redding

Highway Frequency and Magnitude - The average frequency of hazardous material accidents in the United States for one year was estimated to be 2,484 accidents, with 768 resulting in the release of hazardous materials. The average annual frequency of hazard material incidents was 1,455. The average annual frequency for loading/unloading incidents was 10,746.

According to the National Transportation Safety Board, there were eight major accidents in the United States and Canada involving crude oil between March 2013 and April 2014. Aside from oil spills, Milwaukee and Waukesha counties experience about three to five significant derailments a year, defined as those that cause more than $10,000 in damage. According to Federal Railroad Administration data, Milwaukee County had one such derailment in 2013 and Waukesha County had two.

The derailed car in Milwaukee contained ethanol, and while there was no hazardous release, it caused more than $100,000 in damage to the tracks.

Major railroads in February agreed to voluntary measures, including passing through so-called high-threat urban areas at speeds less than 40 mph, down from 50 mph. These slower speeds apply to the Milwaukee area.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.18.4 Vulnerability

Published 3/24/2017 15:41 by Leah Redding

Hazardous materials release is a low to moderate hazard potential of occurring for those facilities located near transit hubs or large industrial facilities that store or produce hazardous materials. Due to security concerns, the quantity and type of hazardous materials contained at neighboring facilities could not be determined. It is expected that many of these facilities are gas stations, small service stores, and commercial business and therefore designated as small quantity generators. Since a hazardous materials release is more likely to occur during handling or shipping than during storage, a hazardous materials incident is more likely to occur as a result of a transportation accident.

Hazardous materials releases have the potential to cause significant health impacts and/or structural damage. These materials have different potential impacts upon release, depending on their chemical properties. Additionally, the impact differs depending on how much material is released to the environment.

Hazard Assessment		
Hazardous Materials Release		
Frequency / Probability (i.e. Future Probability)	▶	**Medium**
Magnitude / Extent (i.e. Strength or Magnitude)	▶	**Medium**
Vulnerability (i.e. Consequence and Impact)	▶	**Medium**
Overall Risk Rating	▶	**Medium**

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.19 Utility Failure

Published 1/8/2016 12:48 by Daiko Abe

A utility emergency usually means an electrical power or natural gas outage or a fuel shortage caused by an oil embargo, power failure or natural disaster.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
        - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
        - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
        - B1.4. Extent (strength or magnitude) of each hazard
    - B5. Hazard Matrix
        - B5.2. Location (if the risk is not equal for the entire jurisdiction)
        - B5.3. Extent (strength or magnitude)
        - B5.5. Future Probability
        - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
- 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.19.1 Utility Failure Hazard Profile

Published 4/22/2016 20:22 by a-reum han

Hazard Profile

An electric power outage (also power failure or power loss) is the loss of the electricity supply to a geographic area. The area of an outage (scale) can range from a single facility or neighborhood to a multi-state region. The length of the outage (scope) is determined by combination of factors to include the scale of the outage, weather, and redundant equipment and capacity.

A power outage can be described as a blackout if power is lost completely or as a brownout if the voltage level is below the normal minimum level specified for the system. The reasons for a power outage can for instance be a defect in a power station, damage to a power line or other part of the distribution system, a short circuit, or the overloading of electricity mains. 'Load shedding' is a common term for a controlled way of rotating available generation capacity between various districts or customers, thus avoiding total wide area blackouts.

Power outages are particularly serious for hospitals and other critical facilities and operations. Our society is extremely reliant upon life-critical medical devices, communications, and electronic information all of which require reliable (uninterrupted) electric power. This reliance on electric power has forced hospitals, data and telecommunications centers, and financial and trading institutions to have arrays of back-up batteries and emergency power generators. These generators, which are typically powered by diesel fuel, but should be ideally powered by natural gas where available, are configured to start automatically, as soon as a power failure occurs.

The entire energy system is complex and consists of three major parts: generation, transmission, and distribution. The control and communication between these parts are extremely important as the failure of one part could disrupt the entire system. The energy system is reliant upon the following factors: continual maintenance, equipment replacement and redundancy, and additional high-load capacity. These factors have to be carefully balanced against operating cost and profit i.e. these initiatives are expensive but the costs cannot be readily push down to the consumer due to public pressure and opinion.

Hazard Considerations

Area Impacted:

- Depending on cause, scale, and scope of the power outage one or more of the County’s jurisdictions could be directly and significantly affected.

Duration of the Event:

- A power outage can last minutes to multiple days, even weeks and months.

Essential Service Disruption:

- Disruption of essential government services.
- The loss of water treatment or distribution can be lead to additional expense for citizens in buying potable water and complicated logistics for support agencies i.e. water is heavy and is bulky to transport.
- A typical family can lose hundreds of dollars in food stored in the refrigerator or freezer if the outage exceeds 36 hours. Additionally, people may unwisely eat spoiled food resulting in illness or possibly death.

Special Considerations:

- People on life support at the hospital, care facility, or at home are in possibly life threatening danger.
- People with health conditions, the elderly and infirmed are at increased risk if environmental factors such as excessive heat / humidity and cold go beyond a highly maintained comfort level.

Direct Damage:

- Millions of dollars in losses to the equipment supporting the electrical system will be eventually passed to the consumer in the form of higher rates and fees.

Affected Population:

- Depending upon a variety of factors, the better people are prepared the less the affected population.

Economic Damage:

- Economic losses occur hourly and mount exponentially as the outage impacts business and commercial enterprises that are interconnected and reliant upon each other's ability to produce goods, services, personnel, and expertise.
- Business interruption
- Decreases in tourism

Emergency Services:

- Law enforcement, fire, and emergency medical services will be impacted indirectly by a loss of systems (e.g. data and communications, street and traffic lighting, alarm) and directly by increased calls for service.
- Emergency response and evacuation and may be adversely affected due to a lack of electric power to fuel pumps at fleet operations centers and service stations.
- Evacuation of facilities
- Burn-out of emergency service staff and wear and tear of equipment could be dramatic

Social Factors:

- The loss of alarm systems, lights, gates and other security systems will increase the likelihood of criminal and civil disturbance activity. People, particularly the elderly, will feel less secure and emotionally distressed.
- Down power lines are especially and directly dangerous during thunderstorms, winter storms, and flooding. The dangers of electrically charged lines in pools of water are a real danger to pedestrians and motorists.

4.19.2 Location and Extent

Published 2/2/2017 11:54 by Leah Redding

An electric power outage (also power failure or power loss) is the loss of the electricity supply to a geographic area. The area of an outage (scale) can range from a single facility or neighborhood to a multi-state region. The length of the outage (scope) is determined by combination of factors to include the scale of the outage, weather, and redundant equipment and capacity. The scale of the outage often directly affects the scope as often occurs during a severe storm; the greater number of down utility poles, wires, and transformers the longer the repair and restoration time.

Modern society is very dependent on electrical power for normal living and is therefore quite disrupted by loss of power. Most power outages last about fifteen minutes to one hour. If longer, the utilities will inform the local news media of the anticipated duration of the outage. Milwaukee County is provided with electric service by WE Energies. There are no electric power generating facilities located within the county. Natural gas service is provided by WE Energies and by the Wisconsin Gas Company.

Thunderstorms with lightning are a possible cause of power failure. Fuel shortages can be caused by localized imbalances in supply. Labor strikes, severe cold weather or snowstorms also can cause a local shortage.

Disruptions are often sudden, and there may or may not be time to prepare for them. The two types of outages are:

- Planned Outages: An upgrade to electricity or gas infrastructure or to perform important maintenance.
- Unplanned Outages: Unplanned outages can be caused by severe weather, accidents or natural disasters.

As populations increase, severe weather becomes more common, and the electrical grid ages, there has also been an increase in the frequency and magnitude of power outages. Major power outages are defined as those affecting more than 50,000 people.

4.19.3 Frequency and Probability

Published 12/5/2016 15:43 by Leah Redding

Milwaukee County has several short power outages (i.e., lasting less than six hours) per year but does not have a history of extended power outages. The possibility always exists that a man-made or natural disaster could affect the power system for an extended period of time.

In general, Milwaukee County has a medium likelihood of utility failures with a low risk of damage, death or injury due to a loss. Obviously, power outages are more likely to occur and the severity is greater in areas of higher human population (i.e., urban areas) but the loss of power to rural customers, while affecting fewer people, generally lasts longer and can be as life-threatening, especially if a person with special needs (e.g., the elderly, the young, those on special medical equipment) is involved.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.19.4 Vulnerability

Published 12/5/2016 15:44 by Leah Redding

The failure of a utility to function can have wide-ranging impact in Milwaukee County. People, especially special needs populations, in residential properties may not be able to safely live in their homes because of inadequate heat, the inability to cook, etc. Businesses, including the utilities themselves, may lose money due to the inability to produce goods and services for which they can bill. While there are generally back-up generators, certain utilities may be non-operational due to damaged infrastructure, which can be very expensive to replace and/or repair. Critical infrastructure such as hospitals, schools and governmental facilities may not be able to operate or may have to operate at a reduced capacity due to the loss of utility services. EPCRA facilities may not be able to adequately control and contain their chemicals and there may be a release of hazardous materials that can impact people or the environment.

Agricultural assets may be impacted by the loss of utilities because extreme temperatures reduce the volume of livestock products and products such as milk may not be able to be properly stored.

Finally, transportation on roadways may become unsafe due to the loss of directional and street lights.

Hazard Assessment		
Utility Failure		
Frequency/Probability (i.e. Future Probability)	▶	Medium
Magnitude/Extent (i.e. Strength or Magnitude)	▶	Medium
Vulnerability (i.e. Consequence and Impact)	▶	Medium
Overall Risk Rating	▶	Medium

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.20 Rail Transportation Incident

Published 1/8/2016 12:48 by Daiko Abe

The Rail Transportation system is a vast network connecting cities, producers, manufacturers, and retailers, moving substantial quantities of goods to, from, and through Wisconsin. Throughout the United States, there are hundreds of railroads, more than 143,000 route-miles of track, more than 1.3 million freight cars, and roughly 20,000 locomotives.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
    - B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and (iii)
        - B1.1. Description of natural hazards[1] that affect jurisdictions in the planning area
        - B1.3. Location (geographic areas in planning area) of each hazard; for multi-jurisdictional plans: description of hazards for participating jurisdictions that are unique or varied from those affecting the overall planning area (flooding, dam failure, wildfire)
        - B1.4. Extent (strength or magnitude) of each hazard
    - B5. Hazard Matrix
        - B5.2. Location (if the risk is not equal for the entire jurisdiction)
        - B5.3. Extent (strength or magnitude)
        - B5.5. Future Probability
        - B5.7. Vulnerability

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Risk Assessment; §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

- 5. Identify Hazards: Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.
    - 5. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
- 6. Profiling Hazards;Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- 6.A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
- 6.B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- 6.C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- 6.D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

4.20.1 Rail Transportation Incident Hazard Profile

Published 3/6/2017 08:46 by Leah Redding

Bakken Formation

The Bakken Formation, located in northwest North Dakota, northeastern Montana, southern Saskatchewan, and southwestern Manitoba, is one of the largest contiguous deposits of oil and natural gas in the United States. The formation is an interbedded sequence of black shale, siltstone, and sandstone.

The Bakken Formation has only recently been tapped for oil and natural gas. As recently as 2007, the Bakken Formation was considered to be a marginal to submarginal resource because the oil and natural gas are locked in a rock formation with low permeability. However advances in drilling and recovery technology such as horizontal drilling and hydrofracturing have allowed oil and natural gas to be extracted. In fact, the recent boom in oil production from the Bakken Formation has moved North Dakota to the second largest oil producer in the US. The Bakken Formation resources are expected to be productive for decades.

Hazard

This new source of oil and natural gas, brings with it a new hazards, such as accidents when transporting the crude oil via railroads. In fact, in recent years, accidents involving railroads and crude oil have increased.

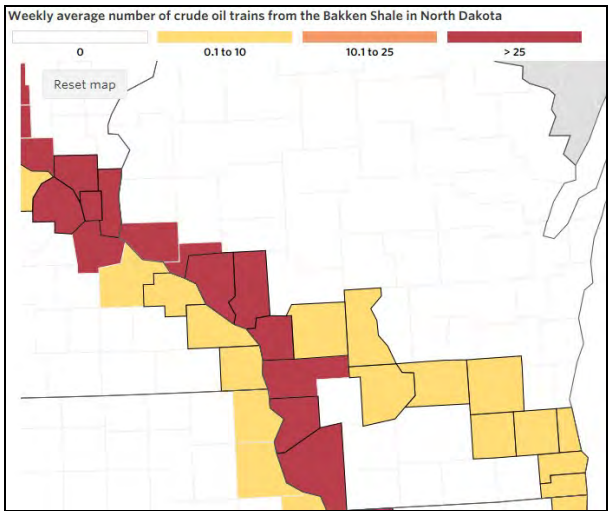
In January of 2014, the US Department of Transportation gave a "Call to Action" for those involved to work to keep crude oil shipments safe. One new emergency order by the Department of Transportation requires railroads transporting crude oil to notify state emergency response commissions.

(Source: Geoscience News and Information.2014. http://geology.com/articles/bakken-formation.shtml)

4.20.2 Location and Extent

Published 2/2/2017 11:57 by Leah Redding

Because of its proximity to the large transportation hub, Chicago, there are many rail routes through the state of Wisconsin, especially in the Southern Counties. This map shows that between 0.1 to 10 crude oil trains travel through Milwaukee County weekly; four is the weekly average.



Legend: 0.1-10 weekly crude oil trains, 10.1-25 weekly crude oil trains, Over 25 weekly crude oil trains

(Source: Wall Street Journal Graphic: http://graphics.wsj.com/crude-oil-by-rail/ ; data from the State Emergency Response Commission)

There are three main railroad companies that ship crude oil through Wisconsin:

- Canadian National RR
- Canadian Pacific RR
- Burlington Northern-Santa Fe RR

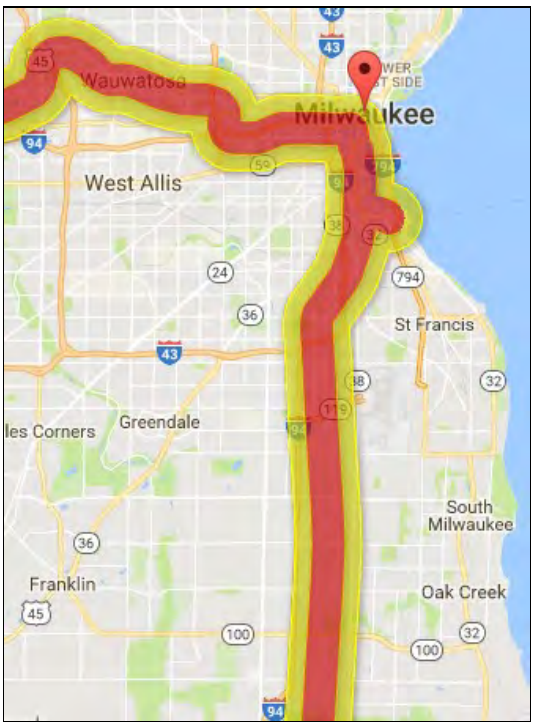
The first two listed above (Canadian National and Canadian Pacific Railroads) go through Milwaukee County. This is also within the area of the state with the highest population, with Milwaukee County being the most populous county in the state.

Figure: Rail Routes through Milwaukee County (blue & pink routes transport Crude Oil)

Legend: Blue = Canadian National RR; **Pink = Canadian Pacific RR**

(Source: Wisconsin Department of Transportation: Wisconsin Railroads & Harbors 2016)

The following image is a Blast Zone Map; it shows the areas that would be impacted by a crude oil train derailment.



Legend: *Red= 0.5 Mile US DOT Evacuation Zone for Oil Train Derailments

***Yellow= 1.0 Mile US DOT Potential Impact Zone in Case of Oil Train Fire**

(Source: Stand Earth: http://explosive-crude-by-rail.org/ ; data: DOT blast zone stats)

4.20.3 Frequency and Probability

Published 3/10/2017 12:32 by Leah Redding

Crude Oil Incidents

- July 6, 2013, Lac-Megantic, Quebec, CA - unattended train, derail, fire, 47 killed, evacuation
- November 8, 2013, Aliceville, AL - 26 cars derail, fire, wetlands impacted
- December 30, 2013, Casselton, ND - 21 cars derailed, 400,000 gallons released, fire
- April 30, 2014, Lynchburg, VA - 105 cars derail, fire, 30,000 gallons into James River, evacuation

Without a plan in place that is updated and exercised regularly, a catastrophic accident like the ones listed above could happen to any city that transports crude oil. To mitigate and plan for these events, Milwaukee County has participated in the annual rail incident action plan workshops since their inception in 2015. Additionally, Milwaukee County participated and helped plan crude oil table top exercises in 2016 in West Allis and February, 2017 in Wauwatosa.

Milwaukee County also has a Countywide Railroad Emergency Response Guidance, which provides instruction for a municipality affected by a rail disaster, and denotes supporting resources which can provide assistance. The objective of this plan is to outline procedures designed to protect life and property in the event of a rail disaster in Milwaukee County, and to render aid and help in the investigation of an effected municipality. The Milwaukee County Comprehensive Emergency Management Plan (CEMP) and the responding departments' Standard Operating Procedures would guide emergency response actions for hazardous materials incidents.

These actions greatly reduce Milwaukee County's vulnerability to a rail transportation incident along with the impact that a crude-oil derailment would have on the Milwaukee County area. The planning process to achieve this enhances relationships and cooperative planning with rail companies and municipalities. If an accident does happen, Milwaukee County has its own Fatality Management Plan along with the Region 7 Healthcare Emergency Readiness Coalition's (HERC) mass fatality plan to minimize impact and to help deal with the fallout.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.1. History of previous hazard events for each identified hazard; for plan updates: include hazard events that have occurred since the previous plan was developed

4.20.4 Vulnerability

Published 2/27/2017 08:44 by Leah Redding

Hazard Assessment		
Rail Transportation Incident		
Frequency / Probability (i.e. Future Probability)	▶	**Low**
Magnitude / Extent (i.e. Strength or Magnitude)	▶	**Medium**
Vulnerability (i.e. Consequence and Impact)	▶	**Medium**
Overall Risk Rating	▶	**Medium**

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)
    - B2.2. Probability of future events for each identified hazard
  - B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)
    - B3.2. Vulnerability of each participating jurisdiction to the identified hazards

4.21 Hazard Mitigation Goals and Objectives

Published 4/10/2017 09:45 by Leah Redding

VI. Goals and Objectives

One of the bedrock principles of emergency management is to approach issues from an all-hazards perspective. This is generally very cost effective because it accomplishes preparedness and/or mitigation goals for many types of disasters with one resource. Some of the all hazards mitigation projects that Milwaukee County would like to accomplish are detailed in the following sections. The planning committee also used the all hazards approach to identify mitigation goals for the county and all of its municipalities. The purpose hazard mitigation plan is to identify hazard areas, to assess the risks, to analyze the potential for mitigation and to recommend mitigation strategies where appropriate. Potential mitigation projects will be reviewed using criteria that stress the intrinsic value of the increased safety for people and property in relation to the monetary costs to achieve this (i.e., a cost-benefit analysis). With that in mind, the planning goals for this entire plan, as determined by the mitigation planning committee were:

Hazard Goals and Objectives	
Hazard Goals	**Hazard Objectives**
1. To preserve life and minimize the potential for injuries or death.	1. Identify natural and man made hazards that threaten life in Milwaukee County.
2. To preserve and enhance the quality of life throughout Milwaukee County by identifying potential property damage risks and recommending appropriate mitigation strategies to minimize potential property damage.	1. Implement programs and projects that assist in protecting lives by making homes, businesses, essential facilities, critical infrastructure, and other property more resistant to losses from all hazards. 2. Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventive measures for existing development in areas vulnerable to natural hazards. 3. Protect life and property by implementing state-of-the-art standards, codes and construction procedures.
3. To promote countywide coordination, planning, and training that avoids transferring the risk from one community to an adjacent community, where appropriate.	1. Continue developing and strengthening inter-jurisdictional coordination and cooperation in the area of emergency services. 2. Continue to support and develop comprehensive mutual aid agreements. 3. Continue providing Milwaukee County and municipal emergency services with training and equipment to address all identified hazards.
4. To identify potential funding sources for mitigation projects and form the basis for FEMA project grant applications.	1. NA
5. Increase public awareness	1. Increase public awareness of existing threats and the means to reduce these threats by conducting educational and outreach programs to all the various community groups in the County. 2. Provide informational items, partnership opportunities and funding resource information to assist in implementing mitigation activities.

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy
  - C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? 44 CFR 201.6(c)(3)(i)
    - C3.1. General hazard mitigation goals (broad policy statements) that are consistent with the hazards identified in the Plan
- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element D Plan Review, Evaluation, and Implementation (UPDATES ONLY)
  - D3. Was the Plan revised to reflect changes in priorities? 44 CFR 201.6(d)(3)
    - D3.2. If priorities have not changed, validate the information in the previous plan
    - D3.1. Description of whether and how priorities have changed since the previous plan
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

- 13. Local Hazard Mitigation Goals; Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
  - 13.A. Does the new or updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?

4.22 Mitigation Strategy & Initiatives

Published 4/10/2017 10:41 by Leah Redding

VII. Mitigation Strategy & Initiatives

The heart of the mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how the community will accomplish the overall purpose, or mission, of the planning process. This is the foundation that municipalities based their mitigation projects on in the next section: Mitigation Actions Matrix - Jurisdiction and Type. Mitigation actions/projects were updated/amended, identified, evaluated, and prioritized in coordination with this section.
The project section is organized as follows:

- New Mitigation Actions - New actions identified during this 2016 update process
- Ongoing Mitigation Actions - Ongoing actions with no definitive end. During the 2016 update, these "ongoing" mitigation actions and projects were modified and/or amended, as needed.
- Completed Mitigation Actions - Completed actions since 2011

4.22.1 Plan Integration

Published 4/11/2017 09:03 by Leah Redding

Planning Integration

In order for the Milwaukee County Pre-Disaster Mitigation Plan to be effective and far-reaching, it must inform and be informed by other comprehensive plans in the area. The community profile section of this plan contains specific information and maps related to the land and demographic characteristics of Milwaukee County, some information which came from the Milwaukee County Land and Water Resource Management Plan and the Regional Land Use Plan for Southeastern Wisconsin. Additionally, our GIS department created county maps with data from 2016 which will be relevant and useful for the planning efforts of other departments and municipalities. The MC Office of Emergency Management's Comprehensive Emergency Management Plan (CEMP) includes a shortened version of this plan in its "Annex I" section because of the important role of land information and mitigation in preparing for widespread disasters. Integrating information from other comprehensive plans shares it to a new audience, giving our jurisdictions and stakeholders the full picture of county resources and vulnerabilities. Additionally, it integrates concepts that are dependent on each other into one plan.

Members of all disciplines from all of our jurisdictions worked on this plan (GIS, DPW, emergency response, city government), ensuring that all players had input and influence in the plan. Additionally, these players continue to have access to this plan and will be able to incorporate relevant pieces into their jurisdiction's future plans. For example, all communities must have Emergency Operations Plans, in which it is important to include information on local vulnerabilities and disaster prone spots. This information can be found in the "GIS Mapping" and "Land Use" section of each municipality in this plan. Additionally, most municipalities have a local Land Use, Natural Features, or Transportation & Facilities plan. These plans must be seen in context to the larger Milwaukee County plan in order for local officials to make informed, smart decisions for their community. Because disasters rarely stay behind border lines, it is important for local planning efforts to be informed by data and mapping from surrounding municipalities.

Many of the strategy recommendations in the previous section have relationships to other plans and policies for which coordination, integration and consistency is vital. These related plans tend to fall within the following general categories:

- Local capital improvements plans and other budget documents. Most notable are infrastructure projects, such as those related to stormwater systems, water supplies, warning sirens, and communications equipment, which may be considered as part of local budgets. For instance, since the 2011 plan, significant road and flood mitigation improvements have been made in some areas which may have addressed past overland flooding concerns.
- Regulations, agreements, and related procedures. These strategies are primarily identified in the policy strategies. Amendments can often be performed in concert with other ordinance updates. Some related actions may be accomplished procedurally without an ordinance amendment.
- Existing emergency operating or response plans. Many local municipalities continue to update their emergency plans and procedures. County Emergency Management and other County offices will also work cooperatively with stakeholders regarding plans, procedures, and grant applications related to the issues identified within this plan.

Mitigation planning is on a different schedule than comprehensive planning, with most comprehensive plans likely to be updated no more frequently than once per decade.

While the mitigation plan was not specifically referenced in most participant comprehensive plans, some of the mitigation recommendations are included as comprehensive plan policies. Most communities with 100-year floodplains included strategies in their comprehensive plans to discourage or not allow any floodplain development, and are implementing these policies through floodplain zoning.

Stormwater management and emergency services are other common themes in many local comprehensive plans. Even so, greater effort is needed to ensure that the hazard mitigation plan is considered during other local planning efforts, and vice versa.

As the mitigation plan strategies reflect, Milwaukee County will continue to work with County Planning and Zoning Departments and local municipalities to encourage coordination and consistency between comprehensive planning and the hazard mitigation plan, and provide instruction on how to incorporate mitigation strategies into their comprehensive plans and other planning mechanisms.

Since key County staff were actively involved in the development and update of the County mitigation plan, many of the mitigation strategies are based on staff recommendations and give confidence that a high level of coordination between these various planning efforts will continue.

Plan Name	How the Document was Used
2011 Wisconsin Hazard Mitigation Plan	Risk assessment data
2016 National Climatic Data Center	Historical data for natural hazards
2011 Milwaukee County Hazard Mitigation Plan	Served as the primary framework for the 2016 update
2006 Milwaukee County Land and Water Resources Management Plan	Good demographic, environmental data and mapping
Regional Land Use Plan for Southeastern Wisconsin: 2035	Demographic, historical data, mapping

Standard:

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy

- C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? 44CFR 201.6 (c)(4)(ii)
  - C6.1. Description of the community's process for integrating data from the hazard mitigation plan into other planning mechanisms (for each participating jurisdiction)
  - C6.2. Identification of local planning mechanisms where hazard mitigation information may be incorporated
  - C6.3. For plan updates: explanation of how the jurisdiction(s) incorporated the previous mitigation plan, when appropriate, into other planning mechanisms

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Plan Maintenance Process

- 19. Incorporation into Existing Planning Mechanisms; Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.
-
  - 19.A. Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
  - 19.B. Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
  - 19.C. Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?

4.22.2 National Flood Insurance Program (NFIP)

Published 12/23/2016 11:35 by Leah Redding

Jurisdictions:	National Flood Insurance Program (NFIP) Status:*			
	Yes	No	N/A	Community Rating System (CRS) Class
Milwaukee County	Y			
Village of Bayside	Y			
Village of Brown Deer	Y			
City of Cudahy	Y			
Village of Fox Point	Y			
City of Franklin	Y			
City of Glendale	Y			
Village of Greendale	Y			
City of Greenfield	Y			
Village of Hales Corners	Y			
City of Oak Creek	Y			
Village of River Hills	Y			
Village of Shorewood	Y			
City of South Milwaukee	Y			
City of St. Francis	Y			
City of Wauwatosa	Y			
City of West Allis	Y			
Village of West Milwaukee	Y			
Village of Whitefish Bay	Y			

***Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

NFIP Policies in Force

Community	Policies in Force	Insurance in-force whole $	Written premium in force
BAYSIDE, VILLAGE OF	24	7,391,000	13,617
BROWN DEER, VILLAGE OF	47	15,682,500	52,451
CUDAHY, CITY OF	9	1,810,200	4,728
FOX POINT, VILLAGE OF	47	13,352,500	28,431
FRANKLIN, CITY OF	37	9,825,000	13,798
GLENDALE, CITY OF	231	41,020,600	378,078
GREENDALE, VILLAGE OF	19	5,718,000	16,789
GREENFIELD, CITY OF	24	5,888,300	15,064
HALES CORNERS, VILLAGE OF	21	4,881,500	23,237
OAK CREEK, CITY OF	28	10,239,200	25,218
RIVER HILLS, CITY OF	22	7,140,500	17,707
SHOREWOOD, CITY OF	37	10,296,000	13,990
SOUTH MILWAUKEE, CITY OF	11	2,802,700	8,864
ST. FRANCIS, CITY OF	1	350,000	415
WAUWATOSA, CITY OF	115	34,528,700	139,303
WEST ALLIS, VILLAGE OF	48	11,349,100	30,175
WEST MILWAUKEE, VILLAGE OF	1	50,000	360
WHITEFISH BAY, VILLAGE OF	70	16,786,000	24,050
MILWAUKEE, COUNTY OF			

Current as of 8/31/2016
Source: http://bsa.nfipstat.fema.gov/reports/1011.htm#WIT

List of Communities with Repetitive Loss Properties

County Name	Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties	Property Type
Milwaukee County	Bayside, Village Of	0	0	18,165.68	6,055.23	6	2	Single family
	Brown Deer, Village Of	0	0	6,945.06	3,372.53	2	1	Single family
	Glendale, City Of	0	0	150,342.22	66,284.99	21	13	Single family
	Oak Creek, City Of	0	0	9,928.21	75,667.32	4	2	condo (2-4 families)
	River Hills, Village Of	0	0	23,825.04	9,351.81	8	3	Single family
	Wauwatosa, City Of	0	0	103,259.90	51,629.96	14	6	Single family
	West Allis, City Of	0	0	59648.25	29,824.13	4	2	Single family
	Milwaukee County TOTAL*	0	0	372,114.36	244,185.97	59	29	Single family

**The City of Wauwatosa has one Severe Repetitive Loss Property (SRL), identified by Wisconsin Emergency Management as one of the State. This property has been mitigated since then. SRL properties are: NFIP-insured residential properties that have at least 4 or more claim payments over $5,000 each, and where at least two of the claims have occurred within a ten-year period, and with the cumulative amount of the claims exceeding $20,000.

(Source: The State of Wisconsin Hazard Mitigation Plan. 2011)

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Standard 2015; Element B: Hazard Identification and Risk Assessment (see the end of this element for a checklist to use in reviewing each hazard section)
  - B4. Does the Plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods? (Contact Wisconsin Emergency Management to obtain this information for your jurisdiction.) 44 CFR 201.6(c)(2)(ii)
    - B4.1. Estimate of the numbers of repetitive loss properties located in identified flood hazard areas
    - B4.2. Description of the types (residential, commercial, industrial, etc.) of repetitive loss properties identified above
- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy

- C2. Does the Plan address each jurisdiction's participation in the National Flood Insurance Program (NFIP) and continued compliance with NFIP requirements as appropriate? 44 CFR 201.6(c)(3)(ii)
  - C2.1. List of jurisdictions and their NFIP participation status
  - C2.2. Description of floodplain management programs/activities that contribute to continued compliance for each NFIP-participating jurisdiction
  - C2.3. Reasons for non-participation for any jurisdictions that do not participate in the NFIP

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014

-
  - National Flood Insurance Program (NFIP) Status
    - Jurisdictions
    - Participating (Y/N)
    - Community Rating System (CRS) Class

- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.
  - 15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance; Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.
    - 15.A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?
    - 15.B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?

4.23 Mitigation Actions Matrix - Jurisdiction and Type

Published 4/3/2017 15:45 by Leah Redding

1. **Applicable Jurisdiction:** Countywide, Multiple Jurisdictions, and Single Jurisdiction
2. **Hazard Type:**
    1. **Flooding and Dam Failure - (40):** 1-2, 4-9, 12, 14-22, 25-30, 32-34, 36-50, 52-56, 58-59, 62-65, 68, 71-72, 79, 80-81, 87-90, 93, 95-100, 103-104, 107
    2. **All Hazard - (31):** 3, 08-13, 10-11, 13, 23-24, 50, 56, 60, 66-69, 73-78, 86, 94, 101-102, 109-111
    3. **Tornadoes and High Winds - (1):** 70, 104
    4. **Utility Failure/Infrastructure - (5):** 35, 71, 83, 91-92, 105, 108
    5. **Winter Storms - (3):** 70, 79
    6. **Thunderstorms - (12:** 85
    7. **Hail - (0):**
    8. **Lightening - (1):** 82
    9. **Severe Temperatures - (0):** 82
    10. **Forest and Wild Fires - (0):**
    11. **Drought and Dust Storms - (0):**
    12. **Fog - (0):**
3. **NFIP Compliance - (5):** 6, 19-20, 22, 52, 88, 107-108

Action Prioritization			
POPULATION IMPACTED	**PROPERTY IMPACTED & PROJECT COST**	**COST BENEFIT FORMULA**	**COST/BENEFIT RANKING**
High = > 50% of Jurisdiction residents	High = > $1,000,000	High = "5" for Population Impacted & Property	High = 11 to 15
Medium = 20 to 50% of Jurisdiction residents	Medium = $500,000 to $1,000,000	Medium = "3" for Population Impacted & Property	Medium = 6 to 10
Low = < 20% of Jurisdiction residents	Low = < $500,000	Low = "1" for Population Impacted & Property	Low = 0 to 5

- All projects from the 2011 plan and 2016 plan (completed or not) were included in this table. Projects not included in this table were finished prior to the 2011 plan or were discontinued and are not longer relevant.
- The criteria for prioritizing the implementation of actions is at the municipal and organizational levels of the mitigation plan; this information is located in the Mitigation Projects Section and is linked to below.

All Mitigation Actions and Projects:

No.	Year Initiated	Applicable Jurisdiction	Primary Organization(s)	Hazard Type	Mitigation Actions	Priority	Status	NFIP Compliance	Year Reviewed/Updated
01	2004	Bayside	Municipal DPW	Flooding	Replace culvert across Santa Monica Blvd. at N. Regent Rd Intersection	Medium	Complete		2011
02	2004	Bayside	Municipal DPW	Flooding	Install larger culvert across Laramie Lane at Laramie Land and Ironwood Lane Intersection	Medium	Complete		2011

03	2004	Bayside	Municipal DPW	All Hazards	Pre-established mutual aid agreements between municipalities for equipment	High	Complete		2011
04	2011	Bayside	Municipal DPW	Flooding	Construct channel along property lines between Regent Rd and Fairway Drive	Medium	Deferred: Other mitigation addressing issue		2016
05	2011	Bayside	Municipal DPW	Flooding	Construct channel along property lines between Braidmoor Rd and Fairway Circle	Medium	Deferred: Other mitigation addressing issue		2016
06	2011	Bayside	Municipal DPW	Flooding	Provide overland flow from Laramie Lane to Fish Creek	Medium	Deferred: Other mitigation addressing issue	Yes	2016
07	2011	Cudahy	Civil Engineering	Flooding	Development of channel	High	Ongoing		2016
08	2011	Cudahy	City Engineering	Flooding	Easement of two repetitive loss structures	High	Ongoing		2016
09	2011	Cudahy	City Engineering	Flooding	Acquisition and demolition of five repetitive loss structures	High	Ongoing		2016
10	2011	Cudahy	Municipal DPW	All Hazards	Access to beach from Pulaski Avenue Pump Station	Medium	Ongoing		2016
11	2011	Cudahy	Municipal DPW	All Hazards	Maintain launch site at bottom of S curve at Sheridan Park	Medium	ongoing		2016
12	2011	Cudahy	Municipal DPW	Flooding	Access contracts for and mitigate all Cudahy detention ponds	Medium	Ongoing		2016
13	2011	Cudahy	Cudahy Health Department	All Hazards	Creation of emergency plans with senior housing, CBRFs, and day care centers	High	Ongoing		2016

14	2011	Fox Point	Municipal DPW	Flooding	Clear debris from ravine ditch between Fox Lane to Beach Drive; Replace rip rap and re-establish channel	Medium	Completed		2016
15	2011	Fox Point	Municipal DPW	Flooding	Create and expand ditches along West side of Beach Drive from 7600-7900 Block	High	Completed		2016
16	2011	Fox Point	Municipal DPW	Flooding	Place catchment systems in various ravines to catch debris that floats downstream in heavy rain events	Medium	Ongoing- 10 years		2016
17	2011	Fox Point	Municipal DPW	Flooding	Upsize drainage pipes in select locations throughout the Village to alleviate blockage	Medium	Ongoing- (5-10 years)		2016
18	2011	Fox Point	Municipal DPW	Flooding	Address erosion issue on North side of Beach Drive Hill	Low	Complete		2016
19	2010	Fox Point	Municipal DPW	Flooding	Remove and replace undersized drainage pipe throughout the village	Medium	Ongoing- (5-10 years)	Yes	2016
20	2010	Fox Point	Municipal DPW	Flooding	Remove obstructions in drainage channels at Regent Road / Regent Court and Indian Creek and Seneca	Low	Ongoing- (1-3 years)	Yes	2016

21	2016	Fox Point	DPW	Flooding	Stabilize ravine slopes and reduce erosion along the Goodrich Lane Ravines, particularly beneath the bridge decks and immediately adjacent to the outfall on Beach Drive	Medium	New		2016
2	2016	Franklin	Municipal DPW	Flooding and Dam Failure	Use fill excavated by City of Waukesha water return pipeline to raise floodplain at S. 60th St. and W. Oakwood Rd.	Low	New	Yes	2016
23	2011	Franklin	Milwaukee County & State	All hazards	Add new siren at St. Martins	High	Completed		2016
24	2011	Franklin	Police Department	All hazards	Reverse 911	High	Completed		2016
25	2004	Glendale	Municipal DPW	Flooding	Removal of accumulated rocks downstream of the Silver Spring Drive culvert	Low	Ongoing due to cost issues		2016
26	2004	Glendale	Municipal DPW	Flooding	Remove sediment and debris from Bender Creek	Low	Ongoing, cost issues and some of the land is on private property and they need permission from the owners to continue. 50% completed.		2016

27	2004	Glendale	Municipal DPW	Flooding	Impact and clean channel in wooded ravine north of Fairfield Court	Low	Ongoing due to cooperation needed by the City of Milwaukee, because it is their property		2016
28	2011	Glendale	Floodplain Administrator and Municipal DPW	Flooding	Purchase and install of backflow preventer valves in 50 residences	High	Ongoing, updated annually		2016
29	2011	Glendale	Floodplain Administrator and Municipal DPW	Flooding	Continue to develop and implement a citywide flood mitigation plan.	Medium	Ongoing		2016
30	2016	Glendale	Floodplain Administrator	Flooding	Implement program to reduce localized/urban flooding	Medium	New--> 1-5 years		2016
31	2016	Glendale	Floodplain Administrator	Flooding/Erosion	Streambank restoration study	Medium	New--> 1-5 years		2016
32	2016	Glendale	Floodplain Administrator & Municipal DPW	Flooding	Stormwater outfall improvements including backflow protection	High	New--> 1-5 years		2016
33	2016	Glendale	Floodplain Administrator	Flooding	Develop No Adverse Impact (NAI) plan locally and with adjacent communities	High	New-->1-5 years		2016
34	2016	Glendale	Floodplain Administrator & Municipal DPW	Flooding	Develop and implement green infrastructure plan for public and private development	High	New--> 1-5 years		2016

35	2016	Glendale	Common Council, NS Water Commission	Critical Facilities	Planning and Construction study for secondary water intake, pump station, and raw water transmission main for NS Water Plant	High	New--> 1-20 years		2016
36	2004	Greendale	Municipal DPW	Flooding	Clean channel along 43rd St. near Ramsey Ave	Low	Ongoing; maintenance project; Updated yearly		2016
37	2004	Greendale	Municipal DPW	Flooding	Regular cleaning and inspection of storm inlets	Low	Ongoing; maintenance project; Updated yearly		2016
38	2004	Greendale	Municipal DPW	Flooding	Work with Milwaukee County to keep Dale Creek free of obstructions	Low	Ongoing; maintenance project; Updated yearly		2016
39	2004	Greendale	Municipal DPW	Flooding	Continue and expand shared services with Greendale School District	Low	Ongoing; maintenance project; Updated yearly		2016
40	2004	Greendale	Municipal DPW	Flooding	Clean and straighten drainage channels	Low	Ongoing; maintenance project; Updated yearly		2016
41	2004	Greendale	Municipal DPW	Flooding	Encourage residents to report concerns early	Low	Ongoing; maintenance project; Updated yearly		2016
42	2004	Greendale	Municipal DPW	Flooding	Educate residents about dumping into storm sewers	Low	Ongoing; maintenance project; Updated yearly		2016
43	2011	Greendale	Municipal DPW	Flooding	Acquire repetitive loss structures in the Root River Drive Area.	High	Ongoing		2016

44	2011	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 B 123rd & Howard Box Culvert Replacement	High	Complete		2016
45	2011	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 A 124th & Howard Diversion Structure	High	Complete		2016
46	2012	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 C STH-100 Back Flow Preventer	High	Complete		2016
47	2013	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 A Cold Spring Road Channel Cleaning	High	Complete		2016
48	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 B 112th Street Profile Lowering	High	Complete		2016
49	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 B 112th Street Additional Culvert	High	Complete		2016
50	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 3 A Kulwicki Park Streambank Protection	High	Planned		2016
51	2004	Oak Creek	Administration	All Hazards	Reverse 911	High	Complete		2011
52	2011	Oak Creek	City Engineering	Flooding	Vacating mobile homes sites in Oak Creek Estates and acquisition of the underlying real estate	High	Ongoing	Yes	2016
53	2011	Oak Creek	City Community Development	Flooding	Acquire repetitive loss structure	High	Ongoing		2016
54	2011	Oak Creek	City Engineering	Flooding	Acquisition of 1.0 acres of a 6.613 acres mobile home park	High	Ongoing		2016
55	2011	Oak Creek	City Public Works	Flooding	Maintain storm sewer outlets	Medium	Ongoing		2016
56	2011	Oak Creek	Private Developer	Flooding	Install wet detention ponds	Medium	Ongoing		2016

57	2016	River Hills	Joint: Police/ Public Works	All Hazards	Establish SOP's Purchase needed equipment	Medium	New- 1-2 years		2016
58	2011	River Hills	Village Admin	Flooding	Acquire repetitive loss structures	Medium	Ongoing		2016
59	2011	Shorewood	Municipal DPW	Flooding	Acquire backflow valves, iron gate valves, sewer ejector systems, sump pumps w/backup power for 100 residences	High	Ongoing		2016
60	2004	South Milwaukee	County	All Hazards	Slope Stability Mill Pond Bridge Road Repair	Medium	Completed		2008
61	2008	South Milwaukee	City and County Parks Department	Erosion	Repair slope stability	Low	Ongoing Issue, identified previous projects from 2008, 2010 are completed		2016
62	2011	South Milwaukee	City	Flooding	Parkway Drive Storm Sewer work	High	2009 Completed one project		2016
63	2011	South Milwaukee	Municipal DPW	Flooding	Brookdale Court Storm Sewer work	High	2010 completed a project. Ongoing		2016
64	2016	South Milwaukee	City	Flooding	Research barriers for wastewater lift stations to prevent sewer backups if flooding of Oak creek	Medium	Ongoing		2016
65	2011	South Milwaukee	City	Flooding, erosion	Severe Channel Erosion and slope stabilization at Wastewater Treatment Plant Project	High	Complete		2016

66	2011	South Milwaukee	City	All Hazards	Slope stability Michigan Avenue to Oak Creek Parkway Repair	Low	Completed-annually updated		2016
67	2008	South Milwaukee	City	All Hazards	Slope Stability Hawthorne Avenue Repair	Low	2008 Completed, 2010 completed. ongoing.		2016
68	2011	South Milwaukee	County, City	All Hazards	Dredging of Oak Creek to remove overgrowth.	Low	Ongoing		2016
69	2011	South Milwaukee	County Parks Department	All Hazards	Dredging of the Mill Pond	Medium	Ongoing		2016
70	2011	South Milwaukee	City	Winter storms, high winds	Tree management program for public property	Medium	Ongoing		2016
71	2016	South Milwaukee	City	Flooding, sanitary sewer back-ups/hazardous materials	Sanitary Sewer project relocation of relay Lakeshore Blvd. Montana Ave. to Lift Station	Medium	Scheduled for completion 2017-2018		2016
72	2016	South Milwaukee	City	Flooding	Sanitary Sewer pipe lining to eliminate clear water intrusion from heavy rainfall	High	Ongoing		2016
73	2016	South Milwaukee	City	All Hazards	Repair, Replace, Relocate siren currently behind SM Fire Dept	High	Ongoing, repaired several times most recent 2014		2016
74	2011	South Milwaukee	City	All Hazards	Replace Police radios both portables and radios in squads	High	New radio system 2016, replacing equipment ongoing		2016
75	2011	South Milwaukee	City	All Hazards	Back up Generation installation Project at Wastewater Treatment Facility	High	Complete		2016

76	2016	South Milwaukee	City	All Hazards	Bidirectional Amplifier for Water Department for Radio Communication	Medium	Not presently funded- 1-2 years		2016
77	2016	South Milwaukee	City	All Hazards	Locating vulnerable facilities in GIS	High	Ongoing		2016
78	2011	South Milwaukee	City	All Hazards	Reverse 911 Emergency Notification System (Alertsense)	Medium	Ongoing		2016
79	2016	South Milwaukee	City/ County/ SM School District	Flooding, winter storms	Improve drainage at SM High School and around the Oak Creek	Medium	Ongoing		2016
80	2016	South Milwaukee	Union Pacific Railroad/ City/ County	Flooding	Initiate a study for the redesign of the railroad underpass on Marquette Avenue between 10th and 12th Avenues	Medium	New- 2-4 years		2016
81	2016	South Milwaukee	City	Flooding	Initiate study for sewer and storm water on Columbia Avenue at 6th Avenue	Medium	New- 2-4 years		2016
83	2016	St. Francis	County/City	severe weather notification	Replace and relocate new tornado siren with remote capabilities	Medium	New		2016
84	2016	St. Francis	City	Utility Failure, severe storms	Trim trees around power lines	Medium	New		2016
85	2016	St. Francis	City	Flooding	Mitigate flooding of roadway	High	New		2016
86	2016	St. Francis	City	Flooding, thunderstorms	Mitigate bluff erosion of Lake Michigan	Medium	New		2016
87	2004	Wauwatosa	Emergency Management	All hazards	County wide emergency communication system	Medium	Complete		2011

88	2011	Wauwatosa	Wauwatosa Water Dept.	Flooding	Replacement of retaining wall on Blanchard Street pumping station	Medium			2016
89	2011	Wauwatosa	Municipal DPW	Flooding	Flood proofing of 3 repetitive loss structures	High	Complete	yes	2011
90	2014	West Allis	Municipal DPW	Flooding	Remove Clear Water Infiltration from/to the Sanitary Sewer Systems	Medium	Ongoing		2016
91	2016	West Allis	Municipal DPW	Flooding	Work with local businesses to install storm water detention in large parking lots	Medium	No progress due to lack of funds		2016
92	2016	West Allis	Municipal DPW	Waterborne Disease	Provide Potable Water	Medium	Ongoing		2016
93	2016	West Allis	Municipal DPW	Disease Prevention	Remove Sanitary Waste	High	Ongoing		2016
94	2004	Whitefish Bay	Municipal DPW	Flooding	Storm sewer addition Cramer Street	Medium	Complete-annual update		
95	2004	Whitefish Bay	Administration		Update public information/ put on website	Low	Complete-annual update		
96	2011	Whitefish Bay	Municipal DPW	Flooding	Storm sewer additions Monrovia	Medium	Complete		2016
97	2011	Whitefish Bay	Engineering	Flooding	Storm sewer upgrade and replacement from Birch Ave (Marlborough to Lake)	Medium	Complete		2016
98	2011	Whitefish Bay	Engineering	Flooding	Storm sewer replacement for Bay Ridge Ave. (Monclaire to Devon)*	Medium	Complete		2016
99	2011	Whitefish Bay	Engineering	Flooding	Storm sewer replacement for Lydell Ave. (Devon to Water Tower Park)	Medium	Complete		2016

100	2015	Whitefish Bay	Engineering	Flooding	Storm water management plan for localized southwest drainage basin flooding	High	Complete		2016
101	2016	Whitefish Bay	Municipal DPW	Flooding	Storm sewer addition Cramer Street	Medium	New		2016
102	2004	Milwaukee County	Emergency Management	All Hazards	Migrate special facilities database from excel to internet application	Low	Complete		2016
103	2004	Milwaukee County	Emergency Management	All Hazards	Include Public Works Dept. in County wide communication network	High	Complete		2016
104	2016	Milwaukee County	Various County Departments	Flooding	Erosion protection along urban rivers and tributaries touching County lands - Root River, Menomonee, Kinnickinic, Lincoln, Milwaukee Rivers/Creeks	High	New-ongoing		2016
105	2016	Milwaukee County	Various County Departments	Flooding, storm events, high lake levels, high wind events	Erosion/bluff failure protection along County lands fronting Lake Michigan - overland storm management, bluff/shoreline protection	Medium	New-ongoing		2016
106	2016	Milwaukee County	Various County Facilities	Storm events, power loss	Install/replace emergency generators	High	New-ongoing		2016
107	2011	Countywide	County & Municipality	Floodplain Management	Continue to enforce municipal ordinances which require no development in the Floodplain.	Medium	Ongoing	Yes	2016

108	2011	Countywide	County & Municipality	New building and infrastructure	Continue to enforce local building codes for existing and new construction, based on the 2006 International Building Codes.	**High**	Ongoing	Yes	2016
109	2004	Countywide	County & Municipality	All Hazards	Pre-established mutual aid agreements between municipalities for equipment.	**Medium**	Ongoing		2016
110	2004	Countywide	County & Municipality	All Hazards	Contractor list of equipment	**Medium**	Ongoing		2016
111	2008	Countywide	County & Municipality	All Hazards	Equipment list by municipality	**Medium**	Complete		2016

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy
  - C4. Does the Plan identify and analyze a *comprehensive range* of specific mitigation actions and projects[1] for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and (iv)
    - C4.1. Analysis of actions/projects considered to reduce the impacts of hazards identified in the risk assessment
  - C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost-benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and (iv)
    - C5.1. Criteria for prioritizing the implementation of actions
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.
  - 14. Identification and Analysis of Mitigation Actions; Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
    - 14.A. Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
    - 14.B. Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
    - 14.C. Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?
  - 16. Implementation of Mitigation Actions; Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
    - 16.A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)
    - 16.B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?
    - 16.C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?
    - 16.D. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?
  - 17. Multi-Jurisdictional Mitigation Actions; Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
    - 17.A. Does the new or updated plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?
    - 17.B. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?

4.23.1 Countywide Mitigation Actions

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Countywide Mitigation Actions and Projects:

No.	Year Initiated	Applicable Jurisdiction	Primary Organization(s)	Hazard Type	Mitigation Actions	Priority	Status	NFIP Compliance	Year Reviewed/Updated
107	2011	Countywide	Individual Municipalities	Floodplain Management	Continue to enforce municipal ordinances which require no development in the Floodplain.	Medium	Ongoing	Yes	2016
108	2011	Countywide	Individual Municipalities	New building and infrastructure	Continue to enforce local building codes for existing and new construction, based on the 2006 International Building Codes.	High	Ongoing	Yes	2016
109	2004	Countywide	Individual Municipalities	All Hazards	Pre-established mutual aid agreements between municipalities for equipment.	Medium	Ongoing		2016
110	2004	Countywide	Individual Municipalities	All Hazards	Contractor list of equipment	Medium	Ongoing		2016
112	2008	Countywide	Individual Municipalities	All Hazards	Equipment list by municipality	Medium	Complete		2016

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy
  - C4. Does the Plan identify and analyze a *comprehensive range* of specific mitigation actions and projects[1] for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and (iv)
    - C4.1. Analysis of actions/projects considered to reduce the impacts of hazards identified in the risk assessment
  - C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost-benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and (iv)
    - C5.1. Criteria for prioritizing the implementation of actions
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.
  - 14. Identification and Analysis of Mitigation Actions; Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
    - 14.A. Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
    - 14.B. Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
    - 14.C. Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?
  - 16. Implementation of Mitigation Actions; Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
    - 16.A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)
    - 16.B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?
    - 16.C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?
    - 16.D. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?
  - 17. Multi-Jurisdictional Mitigation Actions; Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
    - 17.A. Does the new or updated plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?
    - 17.B. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?

4.23.2 Single Jurisdiction

Published 1/25/2017 10:03 by Leah Redding

1. **Applicable Jurisdiction:** Single Jurisdiction
2. **Hazard Type:**
    1. **Flooding and Dam Failure - (40):** 1-2,3-8, 21, 51-55, 57, 68, 71-74, 80-81, 88-90, 93-94, 96-99, 102-109, 113
    2. **All Hazard - (31):** 01, 03-06, 08-13, 18, 19, 21, 50, 56, 69, 75-78, 82-87, 95, 110-111
    3. **Tornadoes and High Winds - (1):** 79
    4. **Utility Failure - (5):** 34, 80, 91-92, 114
    5. **Winter Storms - (3):** 79, 88, 114
    6. **Thunderstorms - (12:** 79, 114
    7. **Hail - (0):**
    8. **Lightening - (1):** 77
    9. **Severe Temperatures - (0):**
    10. **Forest and Wild Fires - (0):**
    11. **Drought and Dust Storms - (0):**
    12. **Fog - (0):**
3. **NFIP Compliance - (5):** 6, 19, 21, 51, 82

Single Jurisdiction Mitigation Actions and Projects:

No.	Year Initiated	Applicable Jurisdiction	Primary Organization(s)	Hazard Type	Mitigation Actions	Priority	Status	NFIP Compliance	Year Reviewed/Updated
01	2004	Bayside	Municipal DPW	Flooding	Replace culvert across Santa Monica Blvd. at N. Regent Rd Intersection	Medium	Complete		2011
02	2004	Bayside	Municipal DPW	Flooding	Install larger culvert across Laramie Lane at Laramie Land and Ironwood Lane Intersection	Medium	Complete		2011
03	2004	Bayside	Municipal DPW	All Hazards	Pre-established mutual aid agreements between municipalities for equipment	High	Complete		2011
04	2011	Bayside	Municipal DPW	Flooding	Construct channel along property lines between Regent Rd and Fairway Drive	Medium	Deferred: Other mitigation addressing issue		2016
05	2011	Bayside	Municipal DPW	Flooding	Construct channel along property lines between Braidmoor Rd and Fairway Circle	Medium	Deferred: Other mitigation addressing issue		2016

06	2011	Bayside	Municipal DPW	Flooding	Provide overland flow from Laramie Lane to Fish Creek	Medium	Deferred: Other mitigation addressing issue	Yes	2016
07	2011	Cudahy	Civil Engineering	Flooding	Development of channel	High	Ongoing		2016
08	2011	Cudahy	City Engineering	Flooding	Easement of two repetitive loss structures	High	Ongoing		2016
09	2011	Cudahy	City Engineering	Flooding	Acquisition and demolition of five repetitive loss structures	High	Ongoing		2016
10	2011	Cudahy	Municipal DPW	All Hazards	Access to beach from Pulaski Avenue Pump Station	Medium	Ongoing		2016
11	2011	Cudahy	Municipal DPW	All Hazards	Maintain launch site at bottom of S curve at Sheridan Park	Medium	ongoing		2016
12	2011	Cudahy	Municipal DPW	Flooding	Access contracts for and mitigate all Cudahy detention ponds	Medium	Ongoing		2016
13	2011	Cudahy	Cudahy Health Department	All Hazards	Creation of emergency plans with senior housing, CBRFs, and day care centers	High			2016
14	2011	Fox Point	Municipal DPW	Flooding	Clear debris from ravine ditch between Fox Lane to Beach Drive; Replace rip rap and re-establish channel	Medium	Completed		2016
15	2011	Fox Point	Municipal DPW	Flooding	Create and expand ditches along West side of Beach Drive from 7600-7900 Block	High	Completed		2016

16	2011	Fox Point	Municipal DPW	Flooding	Place catchment systems in various ravines to catch debris that floats downstream in heavy rain events	Medium	Ongoing- 10 years		2016
17	2011	Fox Point	Municipal DPW	Flooding	Upsize drainage pipes in select locations throughout the Village to alleviate blockage	Medium	Ongoing- (5-10 years)		2016
18	2011	Fox Point	Municipal DPW	Flooding	Address erosion issue on North side of Beach Drive Hill	Low	Complete		2016
19	2011	Fox Point	Municipal DPW	Flooding	Remove and replace undersized drainage pipe throughout the village	Medium	Ongoing (5-10 years)	Yes	2016
20	2010	Fox Point	Municipal DPW	Flooding	Remove obstructions in drainage channels at Regent Road / Regent Court and Indian Creek and Seneca	Low	Ongoing- (1-3 years)	Yes	2016
21	2016	Fox Point	DPW	Flooding	Stabilize ravine slopes and reduce erosion along the Goodrich Lane Ravines, particularly beneath the bridge decks and immediately adjacent to the outfall on Beach Drive	Medium	New		2016

22	2016	Franklin	Municipal DPW	Flooding and Dam Failure	Use fill excavated by City of Waukesha water return pipeline to raise floodplain at S. 60th St. and W. Oakwood Rd.	Low	New	Yes	2016
23	2011	Franklin	Milwaukee County & State	All hazards	Add new siren at St. Martins	High	Completed		2016
24	2011	Franklin	Police Department	All hazards	Reverse 911	High	Completed		2016
25	2004	Glendale	Municipal DPW	Flooding	Removal of accumulated rocks downstream of the Silver Spring Drive culvert	Low	Ongoing due to cost issues		2016
26	2004	Glendale	Municipal DPW	Flooding	Remove sediment and debris from Bender Creek	Low	Ongoing, cost issues and some of the land is on private property and they need permission from the owners to continue. 50% completed.		2016
27	2004	Glendale	Municipal DPW	Flooding	Impact and clean channel in wooded ravine north of Fairfield Court	Low	Ongoing due to cooperation needed by the City of Milwaukee, because it is their property		2016
28	2011	Glendale	Floodplain Administrator and Municipal DPW	Flooding	Purchase and install of backflow preventer valves in 50 residences	High	Ongoing, updated annually		2016
29	2011	Glendale	Floodplain Administrator and Municipal DPW	Flooding	Continue to develop and implement a citywide flood mitigation plan.	Medium	Ongoing		2016

30	2016	Glendale	Floodplain Administrator	Flooding	Implement program to reduce localized/urban flooding	Medium	New--> 1-5 years		2016
31	2016	Glendale	Floodplain Administrator	Flooding/Erosion	Streambank restoration study	Medium	New--> 1-5 years		2016
32	2016	Glendale	Floodplain Administrator & Municipal DPW	Flooding	Stormwater outfall improvements including backflow protection	High	New--> 1-5 years		2016
33	2016	Glendale	Floodplain Administrator	Flooding	Develop No Adverse Impact (NAI) plan locally and with adjacent communities	High	New-->1-5 years		2016
34	2016	Glendale	Floodplain Administrator & Municipal DPW	Flooding	Develop and implement green infrastructure plan for public and private development	High	New--> 1-5 years		2016
35	2016	Glendale	Common Council, NS Water Commission	Critical Facilities	Planning and Construction study for secondary water intake, pump station, and raw water transmission main for NS Water Plant	High	New--> 1-20 years		2016
36	2004	Greendale	Municipal DPW	Flooding	Clean channel along 43rd St. near Ramsey Ave	Low	Ongoing; maintenance project; Updated yearly		2016
37	2004	Greendale	Municipal DPW	Flooding	Regular cleaning and inspection of storm inlets	Low	Ongoing; maintenance project; Updated yearly		2016
38	2004	Greendale	Municipal DPW	Flooding	Work with Milwaukee County to keep Dale Creek free of obstructions	Low	Ongoing; maintenance project; Updated yearly		2016

39	2004	Greendale	Municipal DPW	Flooding	Continue and expand shared services with Greendale School District	Low	Ongoing; maintenance project; Updated yearly		2016
40	2004	Greendale	Municipal DPW	Flooding	Clean and straighten drainage channels	Low	Ongoing; maintenance project; Updated yearly		2016
41	2004	Greendale	Municipal DPW	Flooding	Encourage residents to report concerns early	Low	Ongoing; maintenance project; Updated yearly		2016
42	2004	Greendale	Municipal DPW	Flooding	Educate residents about dumping into storm sewers	Low	Ongoing; maintenance project; Updated yearly		2016
43	2011	Greendale	Municipal DPW	Flooding	Acquire repetitive loss structures in the Root River Drive Area.	High	Ongoing		2016
44	2011	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 B 123rd & Howard Box Culvert Replacement	High	Complete		2016
45	2011	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 A 124th & Howard Diversion Structure	High	Complete		2016
46	2012	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 1 C STH-100 Back Flow Preventer	High	Complete		2016
47	2013	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 A Cold Spring Road Channel Cleaning	High	Complete		2016
48	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 B 112th Street Profile Lowering	High	Complete		2016
49	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 2 B 112th Street Additional Culvert	High	Complete		2016

50	2014	Greenfield	Greenfield Engineering	Flooding	Wildcat Creek Phase 3 A Kulwicki Park Streambank Protection	High	Planned		2016
51	2004	Oak Creek	Administration	All Hazards	Reverse 911	High	Complete		2011
52	2011	Oak Creek	City Engineering	Flooding	Vacating mobile homes sites in Oak Creek Estates and acquisition of the underlying real estate	High	Ongoing	Yes	2016
53	2011	Oak Creek	City Community Development	Flooding	Acquire repetitive loss structure	High	Ongoing		2016
54	2011	Oak Creek	City Engineering	Flooding	Acquisition of 1.0 acres of a 6.613 acres mobile home park	High	Ongoing		2016
55	2011	Oak Creek	City Public Works	Flooding	Maintain storm sewer outlets	Medium	Ongoing		2016
56	2011	Oak Creek	Private Developer	Flooding	Install wet detention ponds	Medium	Ongoing		2016
57	2016	River Hills	Joint: Police/ Public Works	All Hazards	Establish SOP's Purchase needed equipment	Medium	New- 1-2 years		2016
58	2011	River Hills	Village Admin	Flooding	Acquire repetitive loss structures	Medium	Ongoing		2016
59	2011	Shorewood	Municipal DPW	Flooding	Acquire backflow valves, iron gate valves, sewer ejector systems, sump pumps w/backup power for 100 residences	High	Ongoing		2016
60	2004	South Milwaukee	County	All Hazards	Slope Stability Mill Pond Bridge Road Repair	Medium	Completed		2008
61	2008	South Milwaukee	City and County Parks Department	Erosion	Repair slope stability	Low	Ongoing Issue, identified previous projects from 2008, 2010 are completed		2016

62	2011	South Milwaukee	City	Flooding	Parkway Drive Storm Sewer work	High	2009 Completed one project		2016
63	2011	South Milwaukee	Municipal DPW	Flooding	Brookdale Court Storm Sewer work	High	2010 completed a project. Ongoing		2016
64	2016	South Milwaukee	City	Flooding	Research barriers for wastewater lift stations to prevent sewer backups if flooding of Oak creek	Medium	Ongoing		2016
65	2011	South Milwaukee	City	Flooding, erosion	Severe Channel Erosion and slope stabilization at Wastewater Treatment Plant Project	High	Complete		2016
66	2011	South Milwaukee	City	All Hazards	Slope stability Michigan Avenue to Oak Creek Parkway Repair	Low	Completed-annually updated		2016
67	2008	South Milwaukee	City	All Hazards	Slope Stability Hawthorne Avenue Repair	Low	2008 Completed, 2010 completed. ongoing.		2016
68	2011	South Milwaukee	County, City	All Hazards	Dredging of Oak Creek to remove overgrowth.	Low	Ongoing		2016
69	2011	South Milwaukee	County Parks Department	All Hazards	Dredging of the Mill Pond	Medium	Ongoing		2016
70	2011	South Milwaukee	City	Winter storms, high winds	Tree management program for public property	Medium	Ongoing		2016
71	2016	South Milwaukee	City	Flooding, sanitary sewer back-ups/hazardous materials	Sanitary Sewer project relocation of relay Lakeshore Blvd. Montana Ave. to Lift Station	Medium	Scheduled for completion 2017-2018		2016

72	2016	South Milwaukee	City	Flooding	Sanitary Sewer pipe lining to eliminate clear water intrusion from heavy rainfall	High	Ongoing		2016
73	2016	South Milwaukee	City	All Hazards	Repair, Replace, Relocate siren currently behind SM Fire Dept	High	Ongoing, repaired several times most recent 2014		2016
74	2011	South Milwaukee	City	All Hazards	Replace Police radios both portables and radios in squads	High	New radio system 2016, replacing equipment ongoing		2016
75	2011	South Milwaukee	City	All Hazards	Back up Generation installation Project at Wastewater Treatment Facility	High	Complete		2016
76	2016	South Milwaukee	City	All Hazards	Bidirectional Amplifier for Water Department for Radio Communication	Medium	Not presently funded- 1-2 years		2016
77	2016	South Milwaukee	City	All Hazards	Locating vulnerable facilities in GIS	High	Ongoing		2016
78	2011	South Milwaukee	City	All Hazards	Reverse 911 Emergency Notification System (Alertsense)	Medium	Ongoing		2016
79	2016	South Milwaukee	City/ County/ SM School District	Flooding, winter storms	Improve drainage at SM High School and around the Oak Creek	Medium	Ongoing		2016
80	2016	South Milwaukee	Union Pacific Railroad/ City/ County	Flooding	Initiate a study for the redesign of the railroad underpass on Marquette Avenue between 10th and 12th Avenues	Medium	New- 2-4 years		2016

81	2016	South Milwaukee	City	Flooding	Initiate study for sewer and storm water on Columbia Avenue at 6th Avenue	Medium	New- 2-4 years		2016
82	2016	St. Francis	County/City	severe weather notification	Replace and relocate new tornado siren with remote capabilities	Medium	New		2016
83	2016	St. Francis	City	Utility Failure, severe storms	Trim trees around power lines	Medium	New		2016
84	2016	St. Francis	City	Flooding	Mitigate flooding of roadway	High	New		2016
85	2016	St. Francis	City	Flooding, thunderstorms	Mitigate bluff erosion of Lake Michigan	Medium	New		2016
86	2004	Wauwatosa	Emergency Management	All hazards	County wide emergency communication system	Medium	Complete		2011
87	2011	Wauwatosa	Wauwatosa Water Dept.	Flooding	Replacement of retaining wall on Blanchard Street pumping station	Medium			2016
88	2011	Wauwatosa	Municipal DPW	Flooding	Flood proofing of 3 repetitive loss structures	High	Complete	yes	2011
89	2014	West Allis	Municipal DPW	Flooding	Remove Clear Water Infiltration from/to the Sanitary Sewer Systems	Medium	Ongoing		2016
90	2016	West Allis	Municipal DPW	Flooding	Work with local businesses to install storm water detention in large parking lots	Medium	No progress due to lack of funds		2016
91	2016	West Allis	Municipal DPW	Waterborne Disease	Provide Potable Water	Medium	Ongoing		2016
92	2016	West Allis	Municipal DPW	Disease Prevention	Remove Sanitary Waste	High	Ongoing		2016
93	2004	Whitefish Bay	Municipal DPW	Flooding	Storm sewer addition Cramer Street	Medium	Complete-annual update		
94	2004	Whitefish Bay	Administration		Update public information/ put on website	Low	Complete-annual update		

95	2011	Whitefish Bay	Municipal DPW	Flooding	Storm sewer additions Monrovia	Medium	Complete		2016
96	2011	Whitefish Bay	Engineering	Flooding	Storm sewer upgrade and replacement from Birch Ave (Marlborough to Lake)	Medium	Complete		2016
97	2011	Whitefish Bay	Engineering	Flooding	Storm sewer replacement for Bay Ridge Ave. (Monclaire to Devon)*	Medium	Complete		2016
98	2011	Whitefish Bay	Engineering	Flooding	Storm sewer replacement for Lydell Ave. (Devon to Water Tower Park)	Medium	Complete		2016
99	2015	Whitefish Bay	Engineering	Flooding	Storm water management plan for localized southwest drainage basin flooding	High	Complete		2016
100	2016	Whitefish Bay	Municipal DPW	Flooding	Storm sewer addition Cramer Street	Medium	New		2016
101	2004	Milwaukee County	Emergency Management	All Hazards	Migrate special facilities database from excel to internet application	Low	Complete		2016
102	2004	Milwaukee County	Emergency Management	All Hazards	Include Public Works Dept. in County wide communication network	High	Complete		2016
103	2016	Milwaukee County	Various County Departments	Flooding	Erosion protection along urban rivers and tributaries touching County lands - Root River, Menomonee, Kinnickinic, Lincoln, Milwaukee Rivers/Creeks	High	New-ongoing		2016

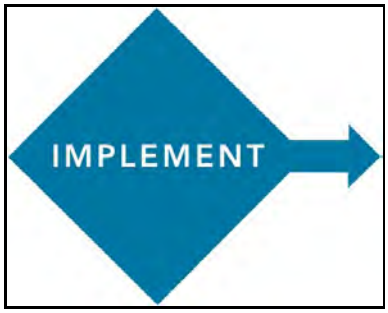
104	2016	Milwaukee County	Various County Departments	Flooding, storm events, high lake levels, high wind events	Erosion/bluff failure protection along County lands fronting Lake Michigan - overland storm management, bluff/shoreline protection	Medium	New-ongoing		2016
105	2016	Milwaukee County	Various County Facilities	Storm events, power loss	Install/replace emergency generators	High	New-ongoing		2016

Standard:

- Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element C: Mitigation Strategy
  - C4. Does the Plan identify and analyze a *comprehensive range* of specific mitigation actions and projects[1] for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and (iv)
    - C4.1. Analysis of actions/projects considered to reduce the impacts of hazards identified in the risk assessment
  - C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost-benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and (iv)
    - C5.1. Criteria for prioritizing the implementation of actions
- Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Mitigation Strategy; §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.
  - 14. Identification and Analysis of Mitigation Actions; Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
    - 14.A. Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
    - 14.B. Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
    - 14.C. Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?
  - 16. Implementation of Mitigation Actions; Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
    - 16.A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)
    - 16.B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?
    - 16.C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?
    - 16.D. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?
  - 17. Multi-Jurisdictional Mitigation Actions; Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
    - 17.A. Does the new or updated plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?
    - 17.B. Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?

4.24 Plan Maintenance Strategy

Published 2/23/2017 09:42 by Leah Redding



VIII. Plan Maintenance & Implementation

The Disaster Mitigation Act of 2000 requires the monitoring, evaluation and updating of the hazard mitigation plan every five years. This hazard mitigation plan is designed to be a “living” document and therefore will be reviewed and updated within five years from its approval date. The Milwaukee County Hazard Mitigation Plan Workgroup will provide leadership and guidance throughout the plan’s life cycle (i.e., monitoring, evaluating and updating.) Updates will allow municipal leaders and the public to provide input into the process. The public will be notified of this opportunity via legal public notices.

The Milwaukee County Hazard Mitigation Plan maintenance process includes a schedule for annual monitoring and evaluation of the programmatic outcomes established in the Plan and for producing a formal Plan revision every five years.

Formal Review Process

The Plan may be reviewed on an annual basis by the Emergency Management Coordinator and if possible, by the steering committee as well. The plan will be reviewed and revised every five years by the committee to determine the effectiveness of programs and to reflect changes that may affect mitigation priorities. The Emergency Management Coordinator or designee will be responsible for contacting the Mitigation Steering Committee members and organizing the review. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan. The Committee will review the goals and action items to determine their relevance to changing situations in the County as well as changes in Federal policy, and to ensure they are addressing current and expected conditions. The Committee will also review the risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The organizations responsible for the various action items will report on the status of the projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised or removed.

The Coordinator or designee will be responsible for ensuring the updating of the Plan. The Coordinator will also notify all holders of the Plan and affected stakeholders when changes have been made. Every five years the updated plan will be submitted to Wisconsin Emergency Management and to the Federal Emergency Management Agency for review.

Continued Public Involvement

Milwaukee County Emergency Management is dedicated to involving the public directly in the review and updates of the Plan. The Coordinator is responsible for the review and update of the Plan. The public will also have the opportunity to provide input into Plan revisions and updates. Copies of the Plan will be kept by appropriate County departments and outside agencies.

Public meeting will be held when deemed necessary by the Coordinator. The meetings will provide a forum where the public can express concerns, opinions, or new alternatives that can then be included in the Plan. The Coordinator will be responsible for using County resources to publicize the public meetings and maintain public involvement.

To further facilitate continued public involvement in the planning process, Milwaukee County will ensure that:

- The Milwaukee County Office of Emergency Management keeps a copy of the plan on hand at their office for review

and comment by the public.
- The Milwaukee County Office of Emergency Management conducts outreach after a disaster event to remind members of the importance of mitigation and to solicit mitigation ideas to be included in the plan.

Monitoring, Evaluation, and Updating the Plan

To ensure the County Hazard Mitigation Plan continues to provide an appropriate path for risk reduction throughout the County, it is necessary to regularly evaluate and update it. The Milwaukee County Office of Emergency Management will be responsible for monitoring the status of the plan and gathering appropriate parties to report of the status of Mitigation Actions. The Mitigation Steering Committee will convene on an annual basis to determine the progress of the identified mitigation actions. The Mitigation Steering Committee will also be an active participant in the next plan update. As the County Hazard Mitigation Plan matures, new stakeholders will be identified and encouraged to join the existing Mitigation Steering Committee.

The Milwaukee County Office of Emergency Management is responsible for contacting committee members and organizing the annual meeting. The Committee's responsibilities include:

- Annually reviewing each goal and objective to determine its relevance and appropriateness.
- Monitor and evaluate the mitigation strategies in this plan to ensure the document reflects current hazard analyses, development trends, code changes and risk analyses and perceptions.
- Ensure the appropriate implementation of annual status reports and regular maintenance of the plan. The committee will hear progress reports from the parties responsible for the various implementation actions to monitor progress.
- Create future action plans and mitigation strategies. These should be carefully assessed and prioritized using benefit-cost analysis (BCA) methodology that FEMA has developed.
- Ensure the public is invited to comment and be involved in mitigation plan updates.
- Ensure that the County complies with all applicable Federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR.
- Reassess the plan in light of any major hazard event. The committee will convene within 45 days of any major event to review all applicable data and to consider the risk assessment, plan goals, objectives, and action items given the impact of the hazard event.
- Review the hazard mitigation plan in connection to other plans, projects, developments, and other significant initiatives.
- Coordinate with appropriate municipalities and authorities to incorporate regional initiatives that transcend the boundaries of the County.
- Update the plan every five years and submit for FEMA approval.
- Amend the plan whenever necessary to reflect changes in State or Federal laws and statutes required in 44 CFR.

The Five Year Action Plan

This section outlines the implementation agenda that the Mitigation Committee should follow five years following adoption of this plan, and then every five years thereafter. The Mitigation Steering Committee, led by the Milwaukee County Office of Emergency Management, is responsible to ensure the Hazard Mitigation Plan is updated every five years.

The Committee will consider the following an action plan for the first 5-year planning cycle. It should be noted that the schedule below can be modified as necessary and does not include any meetings and/or activities that would be necessary following a disaster event (which would include reconvening the Mitigation Steering Committee within 45 days of a disaster or emergency to determine what mitigation projects should be prioritized during the community recovery). If an emergency meeting of the Mitigation Steering Committee occurs, this proposed schedule may be altered to fit any new needs.

Year 0:

- 2016: Update Hazards Mitigation Plan, including a series of Mitigation Steering Committee meetings & Public meetings. Submit 2016 Hazards Mitigation Plan for FEMA approval.
- January 2017 – December 2017: Work on Mitigation Actions, Milwaukee County Office of Emergency Management to stay in contact with lead departments to keep tabs on project status.

Year 1:

- April 2017 - February 2017: Prepare for and promote first annual Plan Review and Public meetings.
- September 2017: Reconvene Committee for first annual Mitigation Steering Committee meeting. Introduce the concept of Mitigation Plan Integration with other planning documents. Host first annual Public meeting.
- April 2017 – December 2017: Work on Mitigation Actions, the Milwaukee County Office of Emergency Management to stay in contact with lead departments to keep tabs on project status. Encourage plan integration efforts.

Year 2:

- January 2018 - February 2018: Prepare for and promote second annual Plan Review and Public meetings.
- September 2018: Reconvene Committee for second annual Mitigation Steering Committee meeting. Review plan integration efforts. Host second annual Public meeting.
- April 2018 – December 2018: Work on Mitigation Actions, the Milwaukee County Office of Emergency Management to stay in contact with lead departments to keep tabs on project status. Encourage plan integration efforts.

Year 3:

- January 2019 - February 2019: Prepare for and promote third annual plan review and public meetings.
- September 2019: Reconvene Committee for third annual Mitigation Steering Committee meeting. Review plan integration efforts. Host second annual Public meeting.
- April 2019 – December 2019: Work on mitigation actions, the Milwaukee County Office of Emergency Management to stay in contact with lead departments to keep tabs on project status. Encourage plan integration efforts.

Year 4:

- January 2020 - February 2020: Prepare for and promote fourth annual Plan Review and Public meetings.
- September 2020: Reconvene Committee for fourth annual Mitigation Steering Committee meeting. Review plan integration efforts. Host fourth annual Public meeting.
- April 2020 – December 2020: Work on Mitigation Actions, the Milwaukee County Office of Emergency Management to stay in contact with lead departments to keep tabs on project status. Encourage plan integration efforts.

Year 5:

- January 2020 - December 2020: Update 2016 Hazards Mitigation Plan, including a series of Mitigation Steering Committee meetings & Public meetings.
- January 2021: Submit 2021 Hazards Mitigation Plan for FEMA approval. Repeat.

Annual Mitigation Steering Committee Meetings

During each annual Mitigation Steering Committee meeting, the Committee will be responsible for a brief evaluation of the 2016 Hazard Mitigation Plan and to review the progress on Mitigation Actions.

Plan Evaluation

To evaluate the plan, the Mitigation Steering Committee should answer the following questions:

- Are the goals and objectives still relevant?
- Is the risk assessment still appropriate, or has the nature of the hazard and/or vulnerability changed over time?
- Are current resources appropriate for implementing this plan?
- Have lead agencies participated as originally proposed?
- Has the public been adequately involved in the process? Are their comments being heard?
- Have departments been integrating mitigation into their planning documents?

If the answer to each of the above questions is “yes,” the plan evaluation is complete. If any questions are answered with a “no,” the identified gap must be addressed.

Review of Mitigation Actions

Once the plan evaluation is complete, the Committee must review the status of the Mitigation Actions. To do so, the Mitigation Steering Committee should answer the following questions:

- Have the Mitigation Actions been implemented as planned?
- Have outcomes been adequate?
- What problems have occurred in the implementation process?

Meeting Documentation

Each annual Mitigation Steering Committee meeting must be documented, including the plan evaluation and review of Mitigation Actions. Mitigation Actions have been formatted to facilitate the annual review process.

Implementation through Existing Programs

Hazard mitigation practices must be incorporated within existing plans, projects and programs. Therefore, the involvement of all departments, private non-profits, private industry, and appropriate jurisdictions is necessary in order to find mitigation opportunities within existing or planned projects and programs. To execute this, the Milwaukee County Office of Emergency Management will assist and coordinate resources for the mitigation actions and provide strategic outreach to implement mitigation actions that meet the goals and objectives identified in this plan.

Standard:

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process

- A5. Is there discussion on how the community/-ies will continue public participation in the plan maintenance process? 44 CFR 201.6(c)(4)(iii)
  - A5.1. How the jurisdiction(s) will continue to seek public participation after plan approval and during plan implementation, monitoring, and evaluation
- A6. Is there a description of the method and schedule for keeping the Plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle)? 44 CFR 201.6(c)(4)(i)
  - A6.1. How the Plan will be monitored (monitoring means tracking the implementation of mitigation actions over time)
  - A6.2. When the Plan will be monitored
  - A6.3. By whom the Plan will be monitored (title of individual or name of department or agency)
  - A6.4. How the Plan will be evaluated (evaluating means assessing the effectiveness of the Plan at achieving its stated purpose and goals)
  - A6.5. When the Plan will be evaluated
  - A6.6. By whom the Plan will be evaluated (title of individual or name of department or agency)
  - A6.7. How the Plan will be updated (updating means reviewing and revising the plan at least once every five years)
  - A6.8. When the Plan will be updated
  - A6.9. By whom the Plan will be updated (title of individual or name of department or agency)
- C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? 44CFR 201.6 (c)(4)(ii)
  - C6.4. For plan updates: description of how the mitigation strategy will continue to be incorporated into other planning mechanisms

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Plan Maintenance Process

- 18. Monitoring, Evaluating, and Updating the Plan; Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
  - 18.A. Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department?
  - 18.B. Does the new or updated plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e. the responsible department)?
  - 18.C. Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?
- 20. Continued Public Involvement; Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
  - 20.A. Does the new or updated plan explain how continued public participation will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)

4.25 Appendix A: Notice of Endorsement & Adoption

Published 11/29/2016 10:51 by Leah Redding

Action Item: Upon formal approval, Notices of Endorsement and Adoption will be obtained and provided in this section for each jurisdiction in the County.

Notice of Endorsement and Adoption

In the Milwaukee County All Hazard Mitigation Plan

I, _____, Mayor for the City/Village/Town of _____

do hereby endorse and agree to participate in the implementation of the Milwaukee County

Hazard Mitigation Plan as it applies to this jurisdiction.

DATED this _____day of _____, 2016

Signed: _____

Mayor

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Prerequisites

- 2. Multi-Jurisdictional Plan Adoption; Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
  - 2.B. For each jurisdiction, has the local governing body adopted the new or updated plan?
    - 2.C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?

4.26 Appendix B: Public Outreach & Participation

Published 2/27/2017 11:04 by Leah Redding

The following subsections detail the Milwaukee County Office of Emergency Management's efforts to reach out to the public and to encourage their participation in the planning process. Meeting management was done in the Milwaukee County Mitigation Steering Committee.

Standard

Wisconsin Emergency Management (WEM) Mitigation Crosswalk; Element A: Planning Process

- A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1). Involved in the process means engaged as participants and given the chance to provide input affecting the Plan's content; plan updates must include documentation of the current planning process.
  - A1.5. How each jurisdiction was involved
  - A1.A Recommended documentation: narrative description, meeting agendas and sign-in sheets, meeting minutes, newspaper articles, copies of letters or surveys distributed.
- A3. Does the Plan document how the public was involved in the planning process during the drafting stage? 44 CFR 201.6(b)(1) and (c)(1)
  - A3.1. How the public was given the opportunity to be involved (must be prior to final approval/adoption)
  - A3.2. How public feedback was incorporated into the Plan

Federal Emergency Management Agency (FEMA) Local Mitigation Standard 2014; Planning Process; §201.6(b): An open public involvement process is essential to the development of an effective plan.

- 4. Document the Planning Process; Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved
  - 4.C. Does the new or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)

4.26.1 Steering Committee Meeting Management

Published 3/27/2017 08:19 by Leah Redding

The Milwaukee County Steering Committee Workgroup was used to schedule, coordinate, organize, and maintain meetings based on the multi-year requirements of the Mitigation Steering Committee.

Members of the Steering Committee continue to have access to this workgroup in order to review, comment, and approve the ongoing activities of the committee.

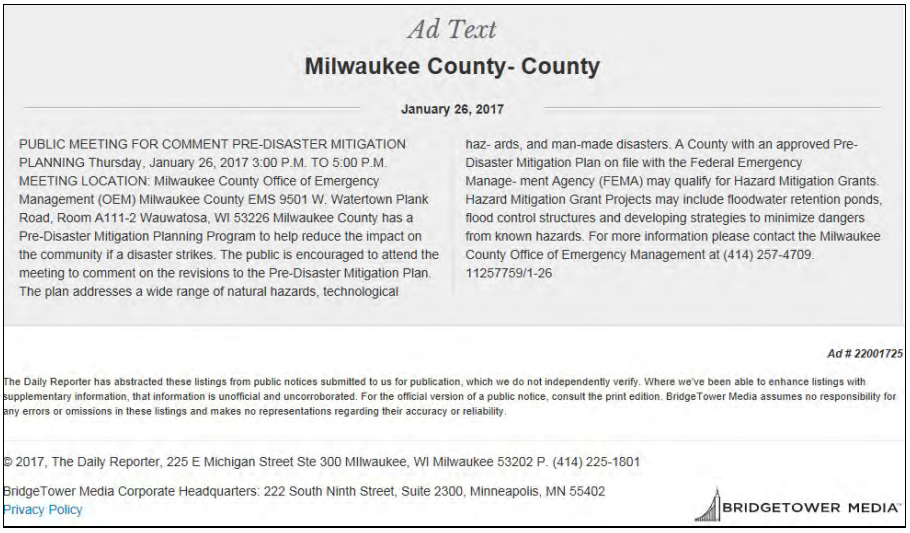
4.26.2 Public Participation

Published 3/27/2017 08:20 by Leah Redding

Press Releases and Notices:

A press release and meeting notices were issued to encourage greater participation and input into the Hazard Mitigation Plan.

- **Link**: http://publicnotices.dailyreporter.com/search/detail.aspx?detail=10964029



Ad Text

Milwaukee County- County

January 26, 2017

PUBLIC MEETING FOR COMMENT PRE-DISASTER MITIGATION PLANNING Thursday, January 26, 2017 3:00 P.M. TO 5:00 P.M. MEETING LOCATION: Milwaukee County Office of Emergency Management (OEM) Milwaukee County EMS 9501 W. Watertown Plank Road, Room A111-2 Wauwatosa, WI 53226 Milwaukee County has a Pre-Disaster Mitigation Planning Program to help reduce the impact on the community if a disaster strikes. The public is encouraged to attend the meeting to comment on the revisions to the Pre-Disaster Mitigation Plan. The plan addresses a wide range of natural hazards, technological haz- ards, and man-made disasters. A County with an approved Pre-Disaster Mitigation Plan on file with the Federal Emergency Manage- ment Agency (FEMA) may qualify for Hazard Mitigation Grants. Hazard Mitigation Grant Projects may include floodwater retention ponds, flood control structures and developing strategies to minimize dangers from known hazards. For more information please contact the Milwaukee County Office of Emergency Management at (414) 257-4709. 11257759/1-26

Ad # 22001725

The Daily Reporter has abstracted these listings from public notices submitted to us for publication, which we do not independently verify. Where we've been able to enhance listings with supplementary information, that information is unofficial and uncorroborated. For the official version of a public notice, consult the print edition. BridgeTower Media assumes no responsibility for any errors or omissions in these listings and makes no representations regarding their accuracy or reliability.

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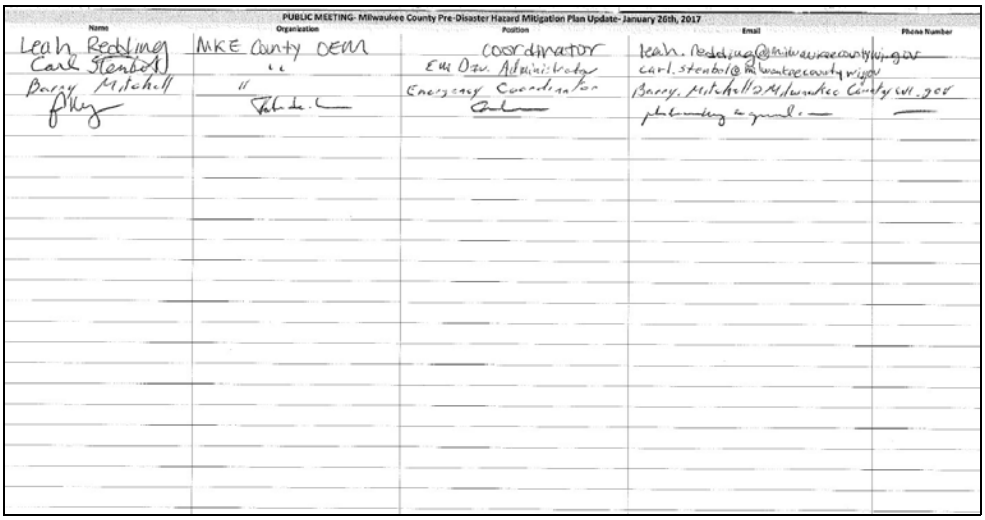
BRIDGETOWER MEDIA

- Sign-in sheet:



PUBLIC MEETING- Milwaukee County Pre-Disaster Hazard Mitigation Plan Update- January 26th, 2017

Name	Organization	Position	Email	Phone Number
Leah Redding	MKE County OEM	Coordinator	leah.redding@milwaukeecountywi.gov	
Carl Stenbol	"	EM Div. Administrator	carl.stenbol@milwaukeecountywi.gov	
Barry Mitchell	"	Emergency Coordinator	Barry.Mitchell2@Milwaukee County WI.gov	

- **Handout Used in Public Meeting:** Executive Summary

4.27 Appendix C: Mitigation Project Examples

Published 12/10/2015 11:17 by Daiko Abe

Purpose: The following handout was provided to Steering Committee members, agency/organization representatives, and members of the public to solicit additional mitigation actions for the 2016 update.

Instructions: Please adapt the following examples to the mitigation needs of your jurisdiction and/or organization. These are only **examples**, and does not represent an all-inclusive list of potential actions.

Mitigation planning is best accomplished from a multi-hazard perspective. Reducing the level of risk involving one natural or technological hazard may increase the risk of damage from another hazard. Consequently, it is important to consider that some mitigation alternatives may not be viable given a particular set of hazard conditions.

ALL HAZARDS

MOUs and Agreements

Local governments should establish mutual aid agreements for utility and communications systems, including 9-1-1. Mutual aid or interagency agreements have value for preventing or responding to other hazard or emergency situations, as fire and police departments often do.

- Establish Mutual-Aid Memorandum of Understandings (MOUs) and agreements with key organizations [List the Organization]

Planning and Preparedness

- Continue to improve the Waukesha County Hazard Mitigation Plan through annual reviews and incorporation of incident lessons learned
- Conduct annual review of the Waukesha County Emergency Operations Plan
- Perform Continuity of Operations planning to identify critical functions, essential personnel, vital resources, and critical infrastructure within the county that is necessary to maintain public safety and services
- Expand the community cross-section and membership of the Local Emergency Planning Committee and research methods to increase its role within the county emergency management program.
- Once a community is familiar with the location of its hazardous areas; it may adopt a land use plan, or modify an existing land use plan to:
    - Encourage greater development restrictions on the property.
    - Guide developments away from hazardous areas
    - Reduce density in the hazardous area
- Site Emergency Plans or Emergency Action Plans: Communities can encourage development and testing of internal emergency plans and procedures, including COOP planning, by businesses and other organizations. Communities should develop and test site emergency plans for schools, factories, office buildings, correctional facilities, recreation areas, and other similar facilities.
- Real estate disclosure: Real estate disclosure laws are important because they force a seller to advise a potential buyer about pre-existing conditions. This allows buyers to make more informed decisions about the potential risks involved in owning property, such as whether a property is located in a floodplain or if it had been previously damaged from flood water or any other type of hazard condition.
- Family Disaster Plans and Supply Kits: Communities can encourage residents to prepare themselves by stocking up with necessary items and planning for how family members should respond if any of a number of possible emergency or disaster events strike.

Warning, Public Information and Education

- Enhance awareness and preparedness of residents through CERT and facilitate community training requests for emergency preparedness education
- Continue to enhance emergency preparedness information available to citizens and visitors through the county website and community outreach opportunities
- Make available “new resident” packets to inform residents of potential hazards and threats, and to inform them of warning and outreach tools that are available in the County.
- Develop a multi-faceted public awareness campaign to increase citizen enrollment in the Waukesha County Emergency Alert System.
- Continue to enhance the communication network related to the delay or closure of county facilities and roadways.
- Install electronic warning signage and permanent road closure barriers on key highways [List Highway or Road]
- Increase use of weather radio announcements to enhance the redundancy of public information delivery in severe weather situations throughout the county.
- Develop season-specific fliers to address hazards and ways each resident (or part-time residents) can mitigate their own risks and mail to residents with their water/utility bill.
- Update [insert community] Website with Emergency Information
- Communities can encourage the use of National Oceanic and Atmospheric Administration (NOAA) weather radios among their residents. NOAA Weather Radio continuously broadcasts National Weather Service forecasts, warnings and other crucial weather information. NOAA Weather Radio also provides direct warnings to the public for natural, man-made, or technological hazards, and it is the primary trigger for activating our country’s Emergency Alert System (EAS) on commercial radio, television, and cable systems.

NATURAL HAZARDS

Drought

- Support state and local tax credits for the installation of water-conserving plumbing and other devices as retrofits.
- Develop water conservation plans, preferably on a watershed basis, that includes emergency conservation measures or directives and the triggers for implementation of each measure or directive.

Severe Temperatures

- Ensure that local plans are in place to manage extreme heat/cold events, especially should power outages accompany the extreme temperature event.
- Ensure that local communities have adequate shelter facilities with properly trained coordinators and/or managers that can address the needs of at-risk populations such as the elderly, the homeless, the disabled and families.
- Ensure that local communities have an adequate monitoring system for housebound at-risk populations.
- Bury water/sewer lines deeper under the streets to prevent frozen main lines
- Install SCADA monitoring on City Water and Sewer Systems

Winter Storms

- Ensure local plans include preparation for and management of the response to winter storm events and especially long-term disruption of power supplies and transportation infrastructure.
- To the extent practical, utilities should be designed and built to resist damage and loss of service during winter storm events, such as placing line underground where appropriate.
- Improve the traffic control on rural roads that are subject to snow drifting and white-out driving conditions.
- Family and Traveler Emergency Preparedness: A local or state government can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards.
- Driver Safety: Safety strategies for severe weather events can be included in driver education classes and materials.
- Animal Protection: Farmers and other animal custodians should plan for addressing livestock or other animal needs.
- Snow Fences: Using snow fences or “living snow fences” (rows of trees or other vegetation) can limit blowing and drifting of snow over critical roadway segments.

Tornado, Winds, Hail, Lightning and Severe Thunderstorms

- Identify hazard notification systems that are device-neutral or do not require a personal device to receive warnings.
- Obtain increased funding (or continued funding) for stand-alone safe rooms, safe rooms linked to schools and communities facilities, and community shelters to prevent the future loss of life.
- Require manufactured homes to use tie-downs with anchors [If applicable]
- Establish severe weather protective areas within county parks and open space.
- Develop a sign retrofitting or new sign program to decrease their vulnerability to wind hazards.
- Surge Protectors and Lightning Protection: Surge protection can be installed on critical electronic equipment. Lightning protection devices and methods, such as lightning rods and grounding, can be installed on a community's communications infrastructure and other critical facilities.
- Construction Standards and Techniques: To strengthen public and private structures against severe wind damage, communities can require or encourage wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles. Also, architectural design can make roofs less susceptible to uplift.
- Temporary Debris Disposal: Temporary debris disposal sites can be protected by fencing and/or located away from populated areas.
- Tree Management: Tree pruning near power lines can reduce the potential for trees falling on and breaking power lines.

Flooding

Ninety percent of federal disaster declarations are for flood events. Response and recovery costs can be extremely high, so where risks are apparent it makes sense to take actions that prevent damage from occurring. If flood damage cannot be fully prevented, there may be mitigation techniques that lessen the damage. Flooding addressed in this section can be from high ground water, overland flooding from rivers or streams, or from a dam failure.

- Support the update of out-of-date flood insurance maps, if applicable.
- Support federal action to develop and disseminate maps that show flood hazards under future conditions such as increased impervious area upstream and potential effects of climate change. To the extent practicable, maps should predict the extent of flooding at least 50 years into the future.
- Consider additional stream gauges, especially in communities with repetitive flood events or repetitive (flood) loss structures.
- Relocate, elevate, and/or floodproof flood-prone property – especially those properties identified as historically or culturally significant to the community.
- Maintain dry-access roads by elevating them above the base flood elevation [if applicable]
- Roads are needed to get people and goods from place to place. In addition to planning for traffic control during floods, there are various construction and placement factors to consider when building roads. To maintain dry access, roads should be elevated above the base flood elevation. However, if a road creates a barrier it can cause water to pond. Where ponding is problematic, drainage and flow may be addressed by making changes to culvert size and placement. In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage but also stabilization or armoring of vulnerable shoulders or embankments.
- Develop an integrated strategic flood warning plan that addresses the repair, repositioning, or upgrade of existing flood warning systems.
- Conduct channel stabilization, improvement, and restoration in [insert] to allow greater drainage and water flow capacity.
- Provide a public education program to inform residents about mitigation measures and means for them to protect themselves and their property during a flood.
- Land with structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development.
- Zoning Ordinance Adoption or Amendments: Examples of zoning methods that affect flood hazard mitigation include: 1) adopting ordinances that limit development in the floodplain; 2) limiting the density of developments in the floodplain; and 3) requiring that floodplains be kept as open space.
- Subdivision Ordinances or Amendments: Subdivision design standards can require elevation data collection during the platting process. Lots may be required to have buildable space above the base flood elevation.
- Building Code Adoption or Amendments: Requirements for building design standards and enforcement include the following possibilities: 1) that a residential structure be elevated; and 2) that a non-residential structure be elevated or floodproofed.
- Conservation Easements: Conservation easements may be used to protect environmentally significant portions of parcels from development. They do not restrict all use of the land. Rather, they direct development to areas of land that are not environmentally significant.
- Purchase of Easement/Development Rights: Compensating an owner for partial rights, such as easement or development rights, can prevent a property from being developed contrary to a community's plan to maintain open space. This may apply to undeveloped land generally or to farmland in particular.
- Stormwater Management Ordinances or Amendments: Stormwater ordinances may regulate development in upland areas in order to reduce stormwater run-off. Examples of erosion control techniques that may be employed within a watershed area include proper bank stabilization with sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.
- Storm Drainage Systems: Flood mitigation can involve installing, re-routing, or increasing the capacity of a storm drainage system that may involve detention and retention ponds, drainage easements, or creeks and streams. It can include separation of storm and sanitary sewerage systems as well as higher engineering standards for drain and sewer capacity.
- Drainage System Maintenance: At most times, a drainage system will do its job and move water to intended areas. However, if a system is not maintained, erosion, material dumping, or deterioration of man-made reinforcement materials may reduce the carrying capacity of a stream. Therefore, regular maintenance, such as sediment and debris clearance, is needed so that the stream may carry out its design function. Also important is detection and prevention/discouragement of discharges into storm-water/sewer systems from home footing drains, downspouts or sump pumps.
- Multi-Jurisdiction Cooperation Within Watershed: Forming a regional watershed council helps bring together resources for comprehensive analysis, planning, decision-making, and cooperation.
- Post-Disaster Recovery Ordinance: A post-disaster recovery ordinance regulates repair activity, generally depending on property location. It prepares a community to respond to a disaster event in an orderly fashion by requiring citizens to: 1) obtain permits for repairs, 2) refrain from making repairs, or 3) make repairs using standard methods.
- Hazardous and Buoyant Material Protection: Containers of hazardous materials such as petroleum or chemicals should not be located in a flood hazard area. If such a location is necessary, hazardous material containers need to be anchored, because the contents can contaminate water and multiply the damaging effects of flooding by causing fires or explosions, or by otherwise making structures unusable. Also, buoyant materials should be anchored, because if they float downstream, they may cause additional damage to buildings or bridges or may plug a stream resulting in higher flood heights.
- Manufactured Homes: Manufactured or mobile homes should be elevated above the base flood elevation and anchored, or more preferably, kept out of the floodplain.

anchored, or more preferably, kept out of the floodplain.
- Back-up Generators: A community may consider back-up generators for pumping and lift stations in sanitary sewer systems, along with other measures (e.g., alarms, meters, remote controls, and switchgear upgrades).
- Basement Backflow Prevention: Depending on its infrastructure capabilities, a community may encourage the use of check valves, sump pumps, and backflow prevention devices in homes and buildings.

Earthquakes

- Local mapping of fault zones and liquefaction areas as a part of larger all-hazards mapping efforts.
- Local retrofit programs that use best engineering standards for structures located in seismic zones.
- Recognize the potential of earthquake-induced landslides in land-use and development plans.
- Require that local plans and codes in seismically-active areas include identification of fault zones, fault setbacks and seismic construction standards that are specific to the seismic risks faced (e.g. liquefaction vs. bedrock movement.)
- Seek grant funding and tax incentives to encourage the appropriate buy-out or retrofit of unprotected structures in seismically-active areas.
- Improve the structural integrity of essential facilities [Identify the facility]
- School Survey Procedures: Schools are critical facilities not only because of the special population they accommodate, but also because they are often identified as shelter sites for a community. Due to this sheltering role, it is essential that these buildings function after a seismic event. A community can develop a survey procedure and guidance document to inventory structural and non-structural hazards in and near school buildings. Survey results can be used to determine mitigation priorities that can be incorporated into capital improvement plans.
- Buildings as Structural Hazards: Homeowners and businesses can take simple measures to strengthen their buildings before the next earthquake. Bracing walls and bolting sill plates to the foundation are examples. Non-reinforced masonry buildings and non-ductile concrete facilities are particularly vulnerable to ground shaking. These buildings should be strengthened and retrofitted against future seismic events.
- Non-Structural Hazards: Many injuries in earthquakes are caused by nonstructural hazards, such as attachments to buildings. These include lighting fixtures, windows (glass), pictures, tall bookcases, computers, ornamental decorations on the outside of the buildings (like parapets), gas lines, etc. Activities that can reduce the risk of injury and damage include: anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, and anchoring and bracing propane tanks and gas cylinders.
- Bridge Strengthening: State and local highway departments should review construction plans for all bridges to determine their susceptibility to collapse. Problem bridges should be retrofitted.

Wildfires

- Continue to develop and require standards for homes and other structures in the wildland-urban interface—that emphasizes fire-safe construction.
- Recognize the importance and value of vegetation management (“defensible space”) in the wildland-urban interface in rural and urbanizing areas and encourage the development of incentives for creating and maintaining defensible spaces around at-risk structures, such as using the Firewise Communities program.
- Require that planning include multiple and adequate ingress and egress routes to vulnerable areas.
- Increase the number of Fire Wise Communities in the County.
- Conduct forest mitigation procedures to reduce the amount of fuel loading especially in areas that have a high residential population.
- Improve rural roads to ensure that emergency vehicles can provide a quick response to keep Wildland Fires small.
- Roads and driveways should be kept accessible to emergency vehicles and fire equipment. Driveways should be relatively straight and flat, with at least some open spaces to turn. Bridges should be strong enough to support emergency vehicles, with clearance wide and high enough for two-way traffic and emergency vehicle access. Addresses should be visible from the road, and keys to gates around property should be provided to the local fire department.
- Spotters: Early detection of wildfires, while fires are smaller, can help make fire fighting more successful. Detection can be accomplished by fire spotters who work from either towers or planes.
- Establish a large scale evacuation plan of the wildland urban interface (WUI) including a mass sheltering plan for such an incident.
- Provide for public education forums to teach residents how to build “eye-pleasing” defensible space into their property.
- Conduct an analysis identifying areas in the county that may benefit from the installation of cisterns or hydrants to provide water delivery during firefighting operations.

MANMADE HAZARDS

Power/Utility Failure

Public utilities are critical infrastructure for any community. The potential for failure needs to be reviewed, and inadequacies need to be addressed.

- Obtain Generators for Critical Infrastructure: A community may consider burying electric and telephone lines, where possible, to resist damage from severe winds, lightning, ice, and other hazards.
- System Redundancies: One place where redundancies are recommended is in utility and communications systems, especially lifeline systems, e.g., essential public utilities. The intention is that if one system fails, the other shadow system can take over.
- Lightning Protection: Electrical and communications systems should be protected from lightning strikes.
- Tree Trimming: Tree trimming and maintenance is important for preventing limb breakage and for safeguarding nearby utility lines. A model measure would be to establish a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public right-of-ways.
- Digging Hotlines: Most, if not all, states have a utility damage prevention hotline that people can call before digging.
- Vulnerable Populations: Communities can develop programs/networks for contacting and assisting elderly or homebound persons during periods of infrastructure failure.

Hazardous Materials Release (HAZMAT)

- Conduct a hazardous materials flow study for high volume road and rail ways within the county.
- Increase the number of personnel trained as HAZMAT technicians and specialists to elevate the County’s response capability.
- Public Awareness and Worker Education: The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, provides an infrastructure at the state and local levels to plan for chemical emergencies. Facilities that store, use, or release certain chemicals may be subject to reporting requirements. Reported information is publicly available so that interested parties may become informed about potentially dangerous chemicals in their community. Employers must also communicate the hazards of workplace chemicals and ensure that workers receive education and training.
- Industrial Site Buffering: Hazardous material exposure can be prevented or reduced by separation and buffering between industrial areas and other land uses. Industrial areas should be located away from schools, nursing homes, hospitals, and other facilities with large or vulnerable populations.

4.28 Appendix D: Federal Funding Sources and Programs

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Many local governments are in a quandary to implement measures to secure and protect property with today's economic constraints. Many programs, including FEMA's Pre-Disaster Mitigation Program and the Hazard Mitigation Grant Program, are the victims of budget cuts. DHS' 2006 Emergency Management Performance Grants – Program Guidance and Application Kit states that "emergency managers at all levels should leverage all available funding and resources from multiple sources wherever possible…(and)…should not restrict their activities to only Federal funding to achieve the goals outlined within their strategies. Rather, special attention should be given to leveraging relevant funding sources and resources that support"… mitigation activities.[1] In addition to federal programs, the State homeland security and preparedness programs and resources may be available to meet the objectives outlined in the All-Hazard Mitigation Plan. This section outlines potential funding sources.

FEDERAL PROGRAMS AND FUNDING

DHS: FEMA

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) administered by the Federal Emergency Management Agency (FEMA) provides grants to State, tribal, and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster.

Pre-Disaster Mitigation Program

Funding for the Pre-Disaster Mitigation (PDM) program is provided through the National Pre-Disaster Mitigation Fund to assist State, tribal, territorial and local governments in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program. The PDM program was allocated $30,000,000 in FY 2015. Project priorities are:

Mitigation planning and project sub-applications

Flood Mitigation Assistance Grant Program

The Flood Mitigation Assistance (FMA) Grant Program provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). According to the FY 2015 Flood Mitigation Assistance (FMA) Grant Program Fact Sheet, $150,000,000 is available to States, Tribal, Territorial, and local governments. FEMA will prioritize eligible planning and project sub-applications as follows:

Mitigation planning sub-applications consistent with 44 CFR Part 201 up to a maximum of $100,000 federal share per applicant.

Projects that mitigate at least 50 percent of structures that meet definition part (b)(ii) of a Severe Repetitive Loss (SRL) property: At least 2 separate NFIP claim payments have been made with the cumulative amount of such claims exceeding the market value of the insured structure.

Project sub-applications that mitigate at least 50 percent of structures that meet the definition of a Repetitive Loss (RL) property: Have incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event.

Projects that mitigate at least 50 percent of structures meet definition part (b)(i) of a SRL property: 4 or more separate

NFIP claims payments have been made with the amount of each claim exceeding $5,000, and with the cumulative amount of claims payments exceeding $20,000.

Projects that will reduce the risk profile in communities through mitigation of the largest number of contiguous NFIP-insured properties.

Repetitive Flood Claims and Severe Repetitive Loss Grant Program

The Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) grant programs were authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). According to FEMA, “The SRL Grant Program makes funding available for a variety of flood mitigation activities. Under this program, FEMA provides funds to state and local governments to make offers of assistance to NFIP-insured SRL residential property owners for mitigation projects that reduce future flood losses through:

Acquisition or relocation of at-risk structures and conversion of the property to open space;

Elevation of existing structures; or Dry floodproofing of historic properties.

SRL mitigation grants are provided to eligible applicant states/tribes/territories that, in turn, provide subgrants to local governments or communities. The applicant must have a FEMA-approved mitigation program in place that includes SRL properties” (Guidance for Severe Repetitive Loss Properties, 2011). According to FEMA, “RFC funds may only be used to mitigate structures that are located within a state or community that is participating in the NFIP that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program because they cannot provide the non-federal cost share, or do not have the capacity to manage the activities” (fema.gov).

Mitigation Technical Assistance Program

There are three major mitigation technical assistance programs that provide technical support to state/local communities, FEMA Regional and Headquarters Mitigation staff in support of mitigation initiatives. These programs include the Hazard Mitigation Technical Assistance Program, the National Earthquake Technical Assistance Program, and the Wind and Water Technical Assistance Program. They provide the technical support that is necessary to mitigate against potential loss of lives and minimize the amount of damage as a result of a natural disaster.

Staffing for Adequate Fire and Emergency Response Grant Program

The goal of the Staffing for Adequate Fire and Emergency Response (SAFER) Grant Program is to assist local fire departments with staffing and deployment capabilities in order to respond to emergencies, and assure that communities have adequate protection from fire and fire-related hazards. For FY 2015, an estimated $340,000,000 is set aside to assist fire departments in achieving the SAFER goal. There are two program priorities: to hire firefighters, and to recruit and retain volunteer firefighters.

Fire Prevention and Safety Grant Program

The Fire Prevention and Safety (FP&S) Grant Program had $34,000,000 available in FY 2014 in support of two activities: fire prevention and safety (including general education/awareness, code enforcement/awareness, fire & arson investigation, and national/state/regional programs and studies) and research and development (including clinical studies, technology and product development, database system development, dissemination and implementation research, and preliminary studies).

Homeland Security Grant Program

Comprised of three interconnected grant programs, the Homeland Security Grant Program (HSGP) seeks to support the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal, which is “A

secure a resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that post the greatest risk." The HSGP grant programs are the State Homeland Security Program (SHSP), the Urban Areas Security Initiative (UASI), and Operation Stonegarden (OPSG).

State Homeland Security Program

In FY 2015, $402,000,000 was allocated to the State Homeland Security Program (SHSP). Although only states and territories can apply for SHSP funds, the program is directed at supporting States, Tribes, and local governments to address high-priority preparedness gaps identified in the Threat and Hazard Identification and Risk Assessment (THIRA) with relation to terrorism. Award methodology is based on the minimum amounts as legislatively mandated (0.35% of total funds for states, Washington D.C., and Puerto Rico and 0.08% of total funds for American Samoa, Guam, the Northern Mariana Islands and the U.S. Virgin Islands), DHS' risk methodology, and the anticipated effectiveness of proposed projects.

Operation Stonegarden

Operation Stonegarden (OPSG) is designed to support cooperation and coordination between Customs and Border Protection (CBP), the United States Border Patrol (USBP), and local, Tribal, territorial, State, and Federal law enforcement agencies. In FY 2015, $55,000,000 is allocated to this program. States and territories that border Canada, Mexico, or international waters are eligible. Counties and federally-recognized Tribal governments within those states are eligible to apply for funds through their State Administrative Agency (SAA).

Cooperating Technical Partners Program

The Cooperating Technical Partners (CTP) Program seeks to strengthen and increase the effectiveness of the National Flood Insurance Program (NFIP) through fostering relationships among all levels of government to reduce flood losses and promote community resiliency. The total funding for Region 4 in FY 2015 was $12,973,272. The main focus in FY 2015 for the CTP program is to support the mission and objectives of FEMA's Risk MAP (Mapping, Assessment, and Planning) program.

Emergency Management Performance Grant

In FY 2015, $350,100,000 was allocated to the Emergency Management Performance Grant (EMPG). This program is designed to assist state, local, territorial, and tribal governments to prepare for all hazards. The State Administrative Agency (SAA) or Emergency Management Agency (EMA) can apply for the funding. All 50 states, Washington D.C., and Puerto Rico will receive at least 0.75% of total funding. American Samoa, Guam Northern Mariana Island and the U.S. Virgin Island will each receive at least 0.25% of total funding. The balance will be distributed on a population-share basis.

Homeland Security National Training Program Continuing Training Grants Program

The Homeland Security National Training Program Continuing Training Grants Program (HSNTP/CTG) had $11,521,000 for FY 2015 to be used for training focused on cybersecurity, hazardous materials, countering violent extremism, and rural training. Eligible entities (including state, local, tribal, and territorial entities) must have existing programs or demonstrate expertise relevant to the focus areas.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Immunization Research, Demonstration, Public Information and Education Grants

The Immunization Research, Demonstration, Public Information and Education Grant program assists States, political subdivisions of States, and other public and private nonprofit entities to conduct research, demonstration projects, and provide public information on vaccine-preventable diseases and conditions. Project funds may be used for the costs associated with organizing and conducting these projects, and in certain circumstances, for purchasing vaccine. Requests for direct assistance (i.e., "in lieu of cash") for personnel, vaccines, and other forms of direct assistance will be considered. Funds may not be used to supplant existing immunization program activities.

Immunization Grants

Immunization Grants assist States and communities in establishing and maintaining preventive health service programs to immunize individuals against vaccine-preventable diseases (including measles, rubella, poliomyelitis, diphtheria, pertussis, tetanus, hepatitis B, hepatitis A, varicella, mumps, haemophilus influenza type b, influenza, and pneumococcal pneumonia). Grant funds may be used for costs associated with planning, organizing, and conducting immunization programs directed toward vaccine-preventable diseases and for the purchase of vaccine; and for the implementation of other program elements, such as assessment of the problem; surveillance and outbreak control; information and education; adequate notification of the risks and benefits of immunization; compliance with compulsory school immunization laws; vaccine storage, supply, and delivery; citizen participation; and use of volunteers. Vaccine will be available "in lieu of cash" if requested by the applicants. Requests for personnel and other items "in lieu of cash" will also be considered. Vaccine purchased with grant funds may be provided to private practitioners who agree not to charge for vaccine. Grant funds may be used to supplement (not substitute for) existing immunization services and operations provided by a State or locality.

DEPARTMENT OF THE INTERIOR

River, Trail, and Conservation Assistance Program

The goal of this program is to work with community groups and local and State governments to conserve rivers, preserve open space, and develop trails and greenways; with the goal of helping communities achieve on-the-ground conservation successes for their projects.

ENVIRONMENTAL PROTECTION AGENCY

Wetland Program Development Grants

The Wetland Program Development Grants are designed to assist state, tribal, and local government agencies in building their wetland management programs. Grant funds can be used to develop new or refine existing wetland protection, management or restoration programs. The types of projects funded through this program are very diverse. In the past, states, tribes and local governments have pursued a wide range of activities from very broad policy or regulatory projects, to development of specific technical approaches/methods for wetland health or restoration.

Nonpoint Source Implementation Grants – 319 Program

Through its 319 program, EPA provides formula grants to the states and tribes to implement nonpoint source projects and programs in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution reduction projects can be used to protect source water areas and the general quality of water resources in a watershed. Examples of previously funded projects include installation of best management practices (BMPs) for animal waste; design and implementation of BMP systems for stream, lake, and estuary watersheds; basinwide landowner education programs; and lake projects previously funded under the CWA section 314 Clean Lakes Program. For FY 2014, tribal base grants were from $30,000 to $50,000, and competitive grant awards could be up to $100,000.

Watershed Organizations

EPA recognizes that strong and committed watershed organizations and local governments are necessary partners to achieve the goals of the Clean Water Act and improve our nation's water quality. To support these local efforts, the EPA is working to: build the capacity of watershed organizations to develop and implement sustainable funding plans to obtain achieve environmental results; and, build the capacity of private and public funders to channel their resources towards good watershed initiatives.

US DEPARTMENT OF AGRICULTURE

Emergency Watershed Protection Program

The USDA Natural Resources Conservation Service's (NRCS) Emergency Watershed Protection (EWP) Program helps

protect lives and property threatened by natural disasters such as floods, hurricanes, tornadoes, droughts, and wildfires. There are two parts of the program: EWP - Recovery and EWP - Floodplain Easement (FPE).

EWP – Recovery: The EWP Program is a recovery effort program aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance, but must be represented by a project sponsor that must be a legal subdivision of the State, such as a city, county, township or conservation district, and Native American Tribes or Tribal governments. NRCS may pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP – Floodplain Easement: Privately-owned lands or lands owned by local and state governments may be eligible for participation in EWP-FPE. To be eligible, lands must meet one of the following criteria:

Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years.

Other lands within the floodplain are eligible, provided the lands would contribute to the restoration of the flood storage and flow, provide for control of erosion, or that would improve the practical management of the floodplain easement Lands that would be inundated or adversely impacted as a result of a dam breach.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Community Development Block Grant Program

The Department of Housing and Urban Development sponsors this program, intended to develop viable communities by providing decent housing and a suitable living environment and by expanding economic opportunities primarily for persons of low and moderate income. Recipients, which include principal cities of Metropolitan Statistical Areas (MSAs), other metropolitan cities with populations of at least 50,000, and qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities), may initiate activities directed toward neighborhood revitalization, economic development, and provision of improved community facilities and services. Specific activities may include public services, acquisition of real property, relocation and demolition, rehabilitation of structures, and provision of public facilities and improvements, such as new or improved water and sewer facilities.

[1] “The Subcommittee on Economic Development, Public Buildings, & Emergency Management Hearing on The National Preparedness System: What are we preparing for?” ; April 14, 2005. http://www.house.gov/transportation/pbed/04-14-05/04-14-05memo.html

4.29 Appendix E: Benefit-Cost Analysis Guidance

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Benefit-Cost Analysis is an important mechanism used among local, state, tribal, and federal governments in evaluating hazard mitigation projects. It is a critical part of the hazard mitigation planning process for project development. As part of mitigation project development, strategies in the All Hazard Mitigation Plan should be assessed using a FEMA/DHS approved benefit cost method. This should be done for all projects including ones not intended to be funded by FEMA/DHS grants. This is critical to ensure that all funds, regardless of their source, are appropriately considered. The County does have funds available for mitigation projects, but they are not unlimited, and projects must demonstrate that the benefit is worth the cost.

Benefit-cost analysis compares the benefits and costs of a proposed hazard mitigation project. For example, the benefit of a tornado shelter is the reduction of injury and loss of life. This benefit is monetized using Federal guidelines for injury and loss of life. The costs considered are those necessary to implement and maintain the specific mitigation project under evaluation. The two, benefit and cost, can then be compared.

Costs are generally well determined for specific projects for which engineering design studies have been completed. Benefits, however, must be estimated probabilistically because they depend on the improved performance of the building or facility to future hazard events, the timing and severity of which are random variables. The benefits calculated by the program are expected annual benefits, which are estimated over the useful lifetime of the mitigation project. To account for the time value of money, a net present value calculation must be performed. This calculation is done automatically in the program, using the discount rate and project useful lifetime entered by the user. Results of benefit-cost calculations are presented two ways: first, the benefit-cost ratio (benefits divided by costs) and second, the net benefits (benefits minus costs).

To estimate future damages (and the benefits of avoiding them), the probabilities of future events must be considered. This profoundly affects whether or not a proposed hazard mitigation project is cost effective. Mitigation may not be cost-effective even though a particular facility experienced great damage in a past event due to an event with a low probability of occurrence (i.e., a 500- or 1000-year event). Conversely, mitigation may be cost effective even though the particular facility experienced little or no damage in a past event, due to a higher probability of occurrence.

Technical guidelines developed by FEMA for performing an approved Benefit-Cost Analysis are provided in the June, 2009 FEMA publication “Final BCA Reference Guide”, which can be found online at https://www.fema.gov/media-library/assets/documents/18870. An outline is available below:

FEMA’s Benefit-Cost Analysis (BCA) program

FEMA’s Benefit-Cost Analysis (BCA) program is a key mechanism for evaluating certain hazard mitigation projects to determine eligibility and assist in Federal funding decisions. The FEMA BCA program is comprised of methodologies and software for a range of major natural hazards.

To be eligible for Federal funding assistance, a BCA should show that the project is cost effective and will reduce future damages and losses from natural disasters. Mitigation projects can include: construction projects, education programs, publications or videos, building code enhancements, and mitigation planning activities. A reduction in losses or prevention of future damages is the benefit of the project.

Cost, as it relates to mitigation, is the price to develop and maintain a mitigation project. The project cost estimate, as used in the FEMA mitigation grant guidance, includes all costs associated with the proposed mitigation project, and represents the best estimated costs for the activity.

Estimates are required for the following cost item categories:

- Anticipated cash and in-kind Federal match
- Equipment
- Labor
- Materials
- Subcontract costs

Other costs are those that do not fall neatly into one of these categories, but must be delineated in the BCA if applicable to the project. The FEMA BCA tool utilizes a six-step cost-estimating methodology:

- Step 1: develop an estimate of pre-construction or non-construction costs
- Step 2: develop an estimate of construction costs
- Step 3: develop an estimate of ancillary costs
- Step 4: develop an estimate of annual maintenance costs
- Step 5: adjust the estimate to account for project timing and whether the data is current
- Step 6: review and confirm the cost estimate

The following descriptions cover each hazard type and potential mitigation projects associated with each.

Damage Frequency Approach (DFA)

This module is applicable to any natural hazard as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a result of the events. The advantage of the DFA module is its flexibility—it can be used for a wide range of hazards including flood, landslides, snow/ice storms, and earthquake mitigation for utility projects. The module requires historical damage data for two or more events and typically provides results that are less accurate than those from the Full Data BCA modules.

Tornado

A tornado is a violent, rotating, funnel-shaped cloud that extends from a thunderstorm to the ground, with winds that can reach 300 miles per hour. A tornado is among the most destructive forces of nature. A tornado is classified by the Enhanced Fujita (EF) Scale, which not only correlates wind speeds with damage, but also takes into account the quality and type of structure that has been damaged to estimate wind speeds. The EF Scale is from EF0 (weakest) to EF5 (strongest).

The Tornado Safe Room module is used for projects providing safe room mitigation for high-wind events, and is used only to evaluate the life safety benefits of the mitigation project. Safe room projects are for tornadoes only.

Wildfire

The Wildland/Urban Interface (WUI) module takes into account LANDFIRE data, timber costs, fire suppression costs, and project effectiveness. WUI fires are essentially wildfires with additional fuel load from structures.

Possible projects include:

- Defensible Space Activities
  - Clearing out all combustibles
  - Minimizing the volume of vegetation
  - Replacing flammable vegetation with less-flammable species
- Hazardous Fuels Reduction Activities
  - Vegetation thinning or reduction of flammable vegetative materials for the protection of life and property
    - Slash removal
    - Vegetation clearing or thinning
    - Vegetation management
    - Vegetation removal

        - Vertical clearance of tree branches
- Ignition-Resistant Construction Activities
    - Involves the use of non-combustible materials and technologies on new and existing structures

Flood

A flood is a partial or complete inundation of normally dry land areas from:

- Overland flow of a lake, river, stream, creek, slough, ditch, or the ocean
- The unusual and rapid accumulation of rainfall runoff or snowmelt
- Mudflows or the collapse of shoreline land

Floods are the most common and most costly of all natural disasters. In fact, most communities throughout the United States will experience some flooding. The Flood module utilizes Flood Insurance Study (FIS) data to establish risk, while providing the most accurate BCA results. This module takes into account probabilities of flooding; building type and associated damages; and the costs of contents, displacement, and loss of function.

Possible projects include:

- Acquisition/ Demolition
- Acquisition/ Relocation
- Dry floodproofing
- Elevation
- Minor localized flood reduction projects including culverts, floodgates, minor floodwall systems, and stormwater management activities.
- Mitigation reconstruction

FEMA will only consider a subapplication for an ignition-resistant construction project when the property owner has previously created defensible space and agreed to maintain the space, or the subapplication includes both the defensible space and ignition-resistant construction project as part of the same project subapplication.

4.30 Appendix F: Acronyms and Definitions

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ADA American Disabilities Act
ASFPM Association of State Floodplain Managers
BCA Benefit Cost Analysis
BCR Benefit Cost Ratio
BMPs Best Management Practices
CBP Customs and Border Protection
CDBG Community Development Block Grant
CFR Code of Federal Regulations
CRS Community Rating System
CTP Cooperating Technical Partners
DFO Disaster Field Office
DMA2K Disaster Mitigation Act of 2000
DNR Department of Natural Resources
DOT Department of Transportation
EA Environmental Assessment
EMPG Emergency Management Performance Grant
EOC Emergency Operations Center
EPA Environmental Protection Agency
EWP Emergency Watershed Protection
FCO Federal Coordinating Officer
FEMA Federal Emergency Management Agency
FIA Flood Insurance Administration
FIRM Flood Insurance Rate Map
FIS Flood Insurance Study
FMA Flood Mitigation Assistance
FP&S Fire Prevention and Safety
GIS Geographic Information System
HAZUS
HMPG Hazard Mitigation Grant Program
HMTAP Hazard Mitigation Technical Assistance Program
HSGP Homeland Security Grant Program
HUD Housing and Urban Development
IA Individual Assistance
IAP Incident Action Plan
IBC International Building Code
ICC Increased Cost of Compliance
ICS Incident Command System
LCA Local Capability Assessment
MOU Memorandum of Understanding
MSAs Metropolitan Statistical Areas
NEPA National Environmental Policy Act
NFIP National Flood Insurance Program
NFIRA National Flood Insurance Reform Act
NRCS Natural Resources Conservation Service
OMB Office of Management and Budget
OPSG Operation Stonegarden
PA Public Assistance
PAO Public Assistance Officer
PDA Preliminary Damage Assessment
PDM Pre-Disaster Mitigation

PDM-C Pre-Disaster Mitigation Competitive
RFC Repetitive Flood Claims
RL Repetitive Loss
RLP Repetitive Loss Property
RLR Repetitive Loss Report
SAFER Staffing for Adequate Fire and Emergency Response
SFHA Special Flood Hazard Area
SHMO State Hazard Mitigation Officer
SHMP State Hazard Mitigation Plan
SHS State Historical Society
SHSP State Homeland Security Program
SRL Severe Repetitive Loss
THIRA Threat and Hazard Identification and Risk Assessment
UASI Urban Areas Security Initiative
UDC Uniform Dwelling Code
USBP United States Border Patrol
USDA U. S. Department of Agriculture
UW-EXT University of Wisconsin – Extension
WEM Wisconsin Emergency Management
WIVOAD Wisconsin Volunteer Organizations Active in Disasters