Hazard Mitigation Plan

Waupaca County, Wisconsin

Plan Update – February 2021

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Acronyms

ACE	Army Corps of Engineers
ADA	Americans with Disabilities Act
ARC	American Red Cross
ARES	Amateur Radio Emergency Services
ASCS	Agriculture Stabilization and Conservation Service
ASL	Above Sea Level
ASPR	Assistant Secretary for Preparedness and Response
BMP	Best Management Practices
CAD	Computer Aided Dispatch
CAFO	Concentrated Animal Feeding Operation
CAR	Community-at-Risk
CBRNE	Chemical, Biological, Radiological, Nuclear, or Explosive
CDBG	Community Development Block Grant
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
CI	City
CO	County
COAD	Community Organizations Active in Disaster
CTH	County Highway
CWPP	Community Wildfire Protection Plan
DATCP	Department of Agriculture, Trade, and Consumer Protection
DFIRM	Digital Flood Insurance Rate Map
DHS	U.S. Department of Homeland Security
DNR	Wisconsin Department of Natural Resources
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DPW	Departments of Public Works
DTM	Digital Terrain Maps
E	Estimated
EAP	Emergency Assistance Program or Emergency Action Plan
EF	Enhanced Fujita Scale
EG	Estimated Gust
EHS	Extremely Hazardous Substance
EM	Emergency Management
EMS	Emergency Medical Services
EMT	Emergency Medical Technician

EOC	Emergency Operations Center
EOP	Emergency Operating Procedure
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
F	Fahrenheit or Fujita Scale
FCC	Federal Communications Commission
FCIC	Federal Crop Insurance Corporation
FD	Fire Department
FEMA	Federal Emergency Management Agency
FIRMS	Flood Rate Insurance Maps
FMA	Flood Mitigation Assistance
FOIA	Freedom of Information Act
FOUO	For Official Use Only
FSA	Farm Service Agency
FVWQPA	Fox Valley Water Quality Planning Agency
GIS	Geographic Information System
HazMat	Hazardous Materials
HazMit	Hazard Mitigation
HAZUS	Hazards United States
HAZUS-MH	Hazards United States Multihazard
HMGP	Hazard Mitigation Grant Program
HUD	U.S. Department of Housing and Urban Development
HVA	Hazard Vulnerability Analysis
HVAC	Heating, Ventilation, and Air Conditioning
HWY	Highway
ICS	Incident Command System
K	Thousand
LE	Law Enforcement
LEPC	Local Emergency Planning Committee
LIDAR	Laser Imaging Detection and Ranging
LPDM	Lagrangian particle dispersion
LWM	Land and Water Management Department
M	Million (if $) or Measured
MABAS	Mutual Aid Box Alarm System
MAP	FEMA’s Risk Mapping, Assessment, and Planning
MCD	Municipal Civil Division
MG	Measured Gust
MHz	Megahertz
MMI	Modified Mercalli Intensity Scale

MOU	Memorandum of Understanding
MPH	Miles per Hour
MSDS	Material Safety Data Sheet
NASF	National Association of State Foresters
NFIA	National Flood Insurance Act
NFIF	National Flood Insurance Fund
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NIDIS	National Integrated Drought Information System
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
NPS	Non-Point Source
NRCS	Natural Resources Conservation Service
NRP	National Response Plan
NWS	National Weather Service
OJA	Office of Justice Assistance
PA	Public Address (System)
PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration
PH	Public Health
PL	Public Law
POW	Plan of Work
RACES	Radio Amateur Civil Emergency Service
RES1	Single Family Dwelling
RES2	Manufactured Housing
RFC	Repetitive Flood Claims
SARA	Superfund Amendments and Reauthorization Act
SBA	Small Business Administration
SMART	Spatial Management, Analysis and Resource Tracking
SPI	Standardized Precipitation Index
SRL	Severe Repetitive Loss
STH	State Highway
SWAT	Special Weapons and Tactics
TN	Township
UASI	Urban Area Security Initiative
UC	Unified Command
UCAR	University Corporation for Atmospheric Research

USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UW	University of Wisconsin
VHF	Very High Frequency
VI	Village
VOAD	Voluntary Organizations Active in Disaster
WCMP	Winnebago Comprehensive Management Plan
WDNR	Wisconsin Department of Natural Resources
WEM	Wisconsin Emergency Management
WISP	Wisconsin Irrigation Scheduling Program
WUI	Wildland-Urban Interface

Introduction and Background

This Hazard Mitigation Plan is intended to provide strategies for reducing susceptibility to future damage to public and private infrastructure in the county. The Waupaca County Emergency Management Office applied for and received assistance from the Hazard Mitigation Grant Program (HMGP) in 2012 and applied for and received a hazard mitigation update planning grant in 2019. This grant program is sponsored by the U.S. Department of Homeland Security - Federal Emergency Management Agency (FEMA) and is administered by the Wisconsin Department of Military Affairs - Wisconsin Emergency Management (WEM). The procedures used in preparing this plan are based on guidance provided by FEMA and 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. Federal Emergency Management Agency (FEMA) rules for implementing Section 409 are in 44 CFR Part 206 Subpart M.

Section 409 states that the county is obligated to try to reduce damage susceptibility to 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 Waupaca 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 Waupaca 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 Waupaca County Hazard Mitigation Plan provides background information on Waupaca 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.

Previous Planning Efforts and Legal Basis

The Waupaca County Office of Emergency Management has incorporated a hazard vulnerability analysis (HVA) that identifies all likely natural hazards that might or have occurred within the county into this plan; it is based on the State of Wisconsin's HVA.

There have also been plans and ordinances completed by individual Waupaca County departments or municipalities, some of these were used as reference materials for this plan, including:

Waupaca County [1]

[1] http://www.co.waupaca.wi.us/departments/government_departments/county_clerk/waupaca_county_code_of_ordinances.php#outer-87

Chapter 13	Licenses and Permits
Chapter 25	Construction and Effect of Ordinances
Chapter 32	Shoreland Ordinance
Chapter 34	Zoning Ordinance
Chapter 36	2013 Floodplain Ordinance
Chapter 37	Subdivision Ordinance
Chapter 38	Non-Metallic Mining
Chapter 43	Nonmetallic Mining
Chapter 45	Year 2030 Comprehensive Plan

City of Clintonville [2]

Chapter 12	Licenses and Permits
Chapter 14	Building Code
Chapter 17	Zoning Code
Chapter 18	Shoreland, Wetland and Floodplain Zoning Code
Chapter 19	Subdivision and Platting
Chapter 26	Historic Preservation

City of Manawa [3]

Chapter 24	Comprehensive Plan
Chapter 106	Building Construction
Chapter 136	Erosion Control
Chapter 184	Licenses and Permits
Chapter 197	Mining, Nonmetallic
Chapter 206	Mobile Homes
Chapter 300	Floodplain Zoning
Chapter 301	Shoreland-Wetland Zoning
Chapter 302	Subdivision of Land
Chapter 303	Zoning

City of Marion [4]

Chapter 282	Building Construction
Chapter 423	Mining, Nonmetallic
Chapter 430	Mobile Homes
Chapter 592	Comprehensive Plan
Chapter 596	Floodplain Zoning
Chapter 608	Shoreland-Wetland Zoning
Chapter 614	Subdivision of Land
Chapter 625	Zoning

[2] http://www.clintonvillewi.org/government/common_council/municipal_code
[3] https://www.ecode360.com/MA1680
[4] https://www.ecode360.com/MA3078

City of New London [5]

Chapter 12	Licenses and Permits
Chapter 14	Building Code
Chapter 16	Floodplain Zoning Code
Chapter 17	Zoning Code
Chapter 18	Subdivision and Platting
Chapter 21	Shoreland-Wetland Zoning Code

City of Waupaca [6]

Chapter 12	Licenses and Permits
Chapter 14	Building Code
Chapter 17	Zoning Code
Chapter 18	Subdivision and Platting
Chapter 20	Floodplain Zoning Ordinance
Chapter 21	Shoreland-Wetland Zoning Code
Chapter 25	Construction and Effect of Ordinances

City of Weyauwega [7]

Chapter 210	Building Construction
Chapter 230	Construction Site Erosion Control and Stormwater Management
Chapter 287	Historic Preservation
Chapter 340	Mining, Nonmetallic
Chapter 349	Mobile Homes
Chapter 500	Comprehensive Plan
Chapter 505	Floodplain Zoning
Chapter 515	Shoreland-Wetland Zoning
Chapter 520	Subdivision of Land
Chapter 530	Zoning

Town of Caledonia [8]

Title VIII 8.1	Comprehensive Planning
Title VIII 8.2	Building Regulations
Title VIII 8.3	Historic Preservation
Title VIII 8.5	Land Development and Developers Agreements
Title VIII 8.6	Land Division
Title VIII 8.7	Zoning
Appendix A	Comprehensive Plan and Zoning Maps
Chapter 34	Waupaca County Zoning Ordinance

[5] http://www.newlondonwi.org/departments/municipal_code.php
[6] https://library.municode.com/wi/waupaca/codes/code_of_ordinances
[7] https://www.ecode360.com/we2856
[8] http://www.townofcaledonia.com/ordinances

Chapter 36	Waupaca County Floodplain Ordinance
Chapter 37	Waupaca County Subdivision Ordinance

Town of Dayton [9]

Chapter 18	Buildings and Building Regulations
Chapter 34	Planning and Zoning

Town of Dupont [10]

5-17-2011	Zoning Ordinance

Town of Farmington [11] [12]

Ordinance 1-5-93	Building Code
Ordinance 6-18-18	Ordinance to Adopt and Amendment to the Comprehensive Plan
Ordinance 08-07-07	Year 2030 Comprehensive Plan
Ordinance 07-19-99	Land Division
Resolution 5-17-98-A	Stormwater Management

Town of Fremont [13]

Chapter 04	Building Regulations
Chapter 06	Subdivision Ordinance
Chapter 09	Comprehensive Plan
Chapter 15	Zoning Ordinance

Town of Harrison

Chapter 103	Buildings and Building Regulations
Chapter 105	Construction Site Erosion Control Zoning
Chapter 107	Mobile Homes and Mobile Home Communities
Chapter 113	Stormwater Management and Illicit Discharge
Chapter 115	Land Division
Chapter 117	Zoning

Town of Iola [14]

Ordinance 18-02	Ordinance Adopting an Amendment to the Comprehensive Plan

[9] https://library.municode.com/wi/dayton/codes/code_of_ordinances
[10] https://www.townofdupont.org/ordinances/
[11] https://www.farmington-waupaca.com/ordinances
[12] https://www.farmington-waupaca.com/resolutions
[13] https://www.townfremont.com/ordinances/
[14] https://townofiola.com/ordinances-and-resolutions/

Resolution 18-02	Resolution Approving an Amendment to the Comprehensive Plan

Town of Lind [15]

Ordinance 60	Land Division

Town of Mukwa [16]

Ordinance 4-06	Comprehensive Plan Adoption
Ordinance 0107	Land Division Subdivision and Amendment
Ordinance 1-09	Nonmetallic Mine Ordinance
Ordinance 2-16	Adopt Amendment Comprehensive Plan
Ordinance 1-18	Adopt Amendment Comprehensive Plan
Resolution 60-1-11	County Zoning Ordinance Approval
Resolution 72-4-15	Adopting Waupaca County All Hazards Mitigation Plan

Town of Wyoming [17]

Resolution 1-2011	Adopt Waupaca County Zoning Ordinance
Ordinance 04-2014	Land Division Ordinance

Village of Fremont [18]

Chapter 229	Building Construction
Chapter 353	Licenses and Permits
Chapter 382	Mobile Homes and Mobile Home Parks
Chapter 524	Comprehensive Plan
Chapter 535	Floodplain Zoning
Chapter 552	Subdivision of Land
Chapter 560	Zoning

The Towns of Bear Creek, Larrabee, Matteson, Scandinavia, St. Lawrence, Waupaca and Weyauwega; and the Villages of Embarrass, Ogdensburg and Scandinavia have no online ordinances.

[15] http://townoflind.org/policies-and-ordinances/
[16] http://www.mukwa.us/Ordinances.html
[17] http://www.townwyoming.com/ordinancesresolutions
[18] https://www.ecode360.com/FR3036

The Towns of Helvetia,[19] Lebanon,[20] Little Wolf,[21] Royalton,[22] and Union[23]; and the Villages of Big Falls [24] and Iola [25] have no relevant ordinances available online.

The local hazard vulnerability analysis serves as the starting point for the hazard mitigation plan. Other data on historical events is gathered from the National Weather Service's storm report database[26], recent news reports, local resources (e.g., website, local community ordinances, and local plans such as the comprehensive plan and storm water management plans), the FEMA Region V mitigation survey, and from the memories of the local planning team members. Team members are presented with this educational background data and asked to rank their concern (likelihood of future occurrences and amount of disruption/damage should it occur) on a five-point scale (very high, high, medium, low, very low). From that, team members, members of the community, survey respondents, and other planning participants are asked to determine hazard mitigation strategies that might benefit their communities. Local existing plans are referenced again at this time, with the members and authors of these plans (e.g., comprehensive, stormwater management) serving as core members of the workgroup committee. The selected mitigation strategies are recorded and detailed in each chapter as well as in the table in Appendix E.

Mitigation strategies are reviewed over the five years of the plan's life by the leadership staff from the applicable departments (e.g., Emergency Management, Sheriff's Office/Communications, Highway, Land and Water Management, Planning and Parks) with the elected leaders from the jurisdictions to triage projects and determine what can and should be done within the planning period. These options are usually discussed in open meetings prior to implementation, as required by Wisconsin state law. The determining factor for most projects is obviously budget availability. The units of government have several options for funding implementation including grants, special taxing authority (for the project and/or any matching funds), general-purpose revenue from existing budgets, and regulatory authority, which can be used to require that an individual or business complete the project using their funds. The

[19] http://townofhelvetia.com/information/ordinances.html
[20] http://townoflebanon.com/ordinances
[21] http://www.townoflittlewolf.com/
[22] http://royaltontownship-waupaca-co.com/
[23] http://townofunionwaupacacounty.com/
[24] http://villageofbigfalls.com/permits_and_ordinances
[25] https://www.iolavillage.com/
[26] https://www.ncdc.noaa.gov/stormevents/

units of government use or improve, if necessary, the mechanisms described above to ensure the implementation of hazard mitigation ideas.

Plan Preparation, Adoption, and Maintenance

The Waupaca County Emergency Management Director contracted with Emergency Planning, Training and Exercise Consulting (EPTEC, Inc.) to draft this plan. A Hazard Mitigation Committee was organized to oversee the completion of this plan. The committee members include:

- Andrew Carlin, Waupaca County Emergency Management
- Eric Halverson, Waupaca County Emergency Management
- Dave Mattes, City of Marion
- David Tichinel, City of Clintonville
- Chad Hoerth, City of New London
- Dan Anzia, City of New London
- Jeremy Schroeder, City of Weyauwega
- John Francis, Waupaca County Parks
- Steven Call, Town of Lind
- Dan Herzberg, City of Marion
- Sharon Eveland, City of Clintonville
- Kray Brown, City of Clintonville
- Dick Koeppen, Waupaca County
- Lenora Borchardt, EPTEC, Inc. (Contractor)

An informational brochure was created and copies were distributed throughout the community at local community gathering points such as municipal halls, libraries, etc. Meetings were held with chief elected officials from the municipalities to explain and gather input regarding the program (e.g., previous occurrences, mitigation strategies.) The FEMA Region V survey was sent to every Waupaca County city, village and town clerk for distribution to the elected officials for discussion, review and completion. Key county departments (e.g., planning, zoning, highway, Sheriff's) also received the survey with a request for completion; the completed

county and municipal surveys were compiled and the results, along with the cover letter, are in Appendix G.

The committee was scheduled to meet several times to evaluate and incorporate input from local officials and then to review and provide input on the progress of the plan. Unfortunately, due to COVID restrictions, only the first meeting was held in person. After state and federal guidance was received on approved methods of meeting, phone calls with the municipalities were completed to gather the remaining information. A public notice was placed in the newspaper to invite members of the public, local officials, academia and business and industry leaders to review the plan. A working draft of the plan was distributed to the County Emergency Management Directors from Marathon, Outagamie, Portage, Shawano, Waushara, and Winnebago Counties. Comments received were reviewed and incorporated into the plan as appropriate. A copy of the mitigation brochure and a list of meeting dates and informational sessions to gather public and official input can be viewed in Appendix G.

The Waupaca County Hazard Mitigation Plan Workgroup reviewed the past events records (generally gathered from the National Weather Service) and a consensus was reached on the anticipated probability of future events. This probability was designated as “very high”, “high”, “medium”, “low”, or “very low” by the workgroup based on their evaluation and experience with the data.

The hazard mitigation strategies from the previous version of this plan were reviewed and progress is reported in Appendix D. The workgroup also, after reviewing the draft plan, selected the potential mitigation projects, which are listed in Appendix E (Summary of Mitigation Strategies) and discussed in more detail in each chapter’s Hazard Mitigation Strategies section. The workgroup participants were given the *Mitigation Ideas: Possible Mitigation Measures by Hazard Type* (Mitigation Ideas, FEMA-R5, 9/02) booklet as an aid to generating ideas. All of the ideas generated during the workgroup meetings were incorporated into the plan and can be found in the Hazard Mitigation Strategies section of each chapter and are summarized in Appendix E. Based on the information collected, each of these projects was assigned a “very high”, “high”, “medium”, “low”, or “very low” priority based on the workgroup’s internal consensus assessment during a discussion of the balances of risk, reward, cost effectiveness (cost benefit), and likelihood of local will and funding (local or grant) to complete the strategy.

The municipal leaders were briefed regarding the need to formally adopt this plan as a prerequisite for future mitigation funding eligibility. A draft was sent to Wisconsin Emergency Management (WEM) for review and tentative approval. Based on WEM's comments, a final draft plan was completed and was forwarded to FEMA for determination of approvability. Once deemed approvable by FEMA, a general meeting was held to review the plan with members of the public, local officials, academia and business and industry leaders. Information and adoption paperwork was provided to the municipal leaders advising them of the need to formally adopt this plan as a prerequisite for future mitigation funding eligibility.

A resolution was passed by the Waupaca County Board of Supervisors; Cities of Clintonville, Manawa, Marion, New London, Waupaca, and Weyauwega; the Villages of Big Falls, Embarrass, Fremont, Iola, Ogdensburg, and Scandinavia; and the Towns of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, Scandinavia, Union, Weyauwega, and Wyoming. The Towns of Larrabee, St. Lawrence, and Waupaca did not independently adopt the plan but, as towns, may participate in hazard mitigation projects with the county. Scanned copies of the adoption resolutions can be found in Appendix C. The final plan has been submitted to WEM for review and certification and notice of acceptance has been received of FEMA plan approval as of xxx.

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 Waupaca 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 process for integrating hazard mitigation actions into other planning mechanisms will be led by the County Emergency Management Director. As he receives information between the five-year update periods (e.g., comprehensive or capital improvement plans) that might be included, it will be added to Appendix H: Inter-Revision Updates. Waupaca County Emergency Management maintains responsibility and is the point of contact for all activities (e.g., monitoring, updating, and evaluating the

effectiveness) relating to this plan. Municipalities can contact the County Emergency Management Director to add updated local information to Appendix H at any time. Furthermore, the County Emergency Management Director will include in the Plan-of-Work activities program the distribution of an annual letter and media press release that reaches out to the plan's stakeholders (county offices, municipalities, the public, etc.). The communications will inquire whether there are any new elements for the mitigation plan as well as asking if there are any plans (new or updates) in which the mitigation plan can and/or will be used as a source plan. Comments will be received and discussed at an annual publicly-noticed open meeting of the county's Emergency Management committee. Note that after a disaster, the Emergency Management committee may also meet to discuss mitigation strategies that might be applicable. These same stakeholders will be invited to fully participate in the five-year plan update, which will be detailed in the updated plan documents and will fully conform to FEMA's requirements.

During the plan's lifecycle, the county and incorporated municipalities will consider the strategies listed in Appendix E as they annually prioritize "regular" maintenance projects, as they set their annual budgets, after a disaster period and as grants become available that might help off-set the costs of some of the strategies listed within the plan. The latter will be instigated by notice of these opportunities by the County Emergency Management Director. These projects will be reported in the annual letter to the County Emergency Management Director. The Director will keep and compile the inter-revision data for inclusion in the five-year update, which will be coordinated through County Emergency Management beginning at least 18 months prior to expiration and at which time they will report on their progress towards meeting the hazard mitigation goals. The update will bring together many of the same workgroup members as well as any new stakeholders (e.g., elected officials, businesses, academia, members of the public) who respond to the invitation to participate and have an interest in mitigation planning.

The plan participants also recognize this document as an important planning tool within the community and will use this plan as a reference as they complete other related planning. The county Emergency Management Director, the Waupaca County Land and Water Conservation and Planning and Zoning Departments will use this plan as they update the Waupaca County Comprehensive Plan as well as community ordinances such as zoning, shoreland, floodplain, wetland, etc., and in other stand-alone plans such as

those for park and recreation, sustainability, and farmland preservation and will refer to it as they are involved in the planning and other preparedness activities of their municipalities.

Many of these plans are on a regular updating cycle and as they come up for renewal, emergency management will be notified and provide any relevant planning materials (from the hazard mitigation plan and any additional information received since the plan's approval). Municipalities with planning departments have also committed to referring to the mitigation plan in their zoning updates, flood and shoreland planning, and in their comprehensive plans. After this plan has passed its reviews from Wisconsin Emergency Management (WEM) and the Federal Emergency Management Agency (FEMA) and is approved, the County Planning Department and the municipalities will receive a copy. They have committed to using and referring to the mitigation plan as they complete their regularly scheduled reviews and updates of the aforementioned plans. Waupaca County Emergency Management will also refer to this plan in their emergency preparedness activities.

Physical Characteristics of Waupaca County

General Community Introduction

Waupaca County was established by legislative act on February 17, 1851. Prior to the white man settling this area, it was occupied by the Menominee Indian Tribe. Two popular ideas for the origin of the name Waupaca are that it came from Chief Wa-puka, which means "watching", or from the Indian words "Waubuck Seba", which means "pale or clear water".

Waupaca County was located on the southern boundary of the great northern pine forests so the lumber industry grew quite rapidly. Because the county is located in the "tension zone" between the northern forests and the southern oak savanna and prairies, biological diversity is tremendous. The big timber was eliminated quite rapidly. The first sawmill was established in 1848, and the first furrow turned for agricultural purposes in 1849. Agriculture became important to the early economy, with the best farms located in the natural oak forest openings. Dairy cattle began to dominate the agricultural activities; however, during the late 1800s the Waupaca County potato was known for its exceptional quality in the Chicago market.[27]

Plan Area

Waupaca County covers approximately 764 square miles or approximately 489,000 acres with rivers, streams and lakes accounting for about 89 square miles of the total.[28] Waupaca County is home to approximately 52,128 people.[29]

The majority of Waupaca County lies within the Central Plain geographical province and the Northern Highland geographical province in the northwest corner. The Central Plain of Wisconsin is a crescent-shaped belt covering about 13,000 square miles. All of it is floored by the weak Cambrian sandstone, except in the northwest where the removal of the sandstone has exposed the underlying Keweenawan lavas over a small area. The surface elevation ranges from 1,242 feet in the western part of the crescent to 785 feet in the

[27] Waupaca County Land and Water Resource Management Plan, 2012
[28] Waupaca County Countywide EPCRA Strategic/Hazardous Materials Plan
[29] https://www.census.gov/quickfacts/fact/table/waupacacountywisconsin,US/PST045219

central part of the plain and 685 feet near the eastern end of the lowland. The general slope is very gradual.

All the characteristics of the sandstone plain are normal to an inner lowland of a belted plain. The name inner lowland is used in connection with slightly dissected coastal plains. Where uplift takes place in a coastal plain, made up of alternate layers of weak and resistant rock which dip gently toward the ocean, it will be carved by streams and the weather.[30]

The Northern Highland belongs to a great upland area that stretches northward in Canada to Labrador and Hudson Bay. It has a strong southward slope and, as the highland is shield-shaped and gently arches, it also has east and west components of slope. The slant of a medial line from the northern to the southern border is less than six feet to the mile. The portion of the Northern Highland in the area of Wisconsin glaciation forms a striking contract with the Driftless Area. There is no residual soil. Instead, there is a transported, glacial soil. Rapids and waterfalls are abundant in the streams. There are large undrained inter-stream areas. Lakes and swamps are found everywhere. The drainage pattern is most irregular, resembling nothing systematic, as is perfectly normal for so youthful a drainage system. Three principal sorts of topographic forms are found: (a) the terminal or recessional moraines, (b) the ground moraine, and (c) the outwash deposits. In various parts of the Northern Highland the thickness of the glacial material in terminal moraines varies from 75 to 100 feet. It has a probable maximum of 350 feet in the Wisconsin Valley moraine north of Merrill, Lincoln County, and perhaps as much as 500 or 600 feet west of Ashland. The material is variably unassorted till (as it is deposited directly by the melting ice) or stratified sand and gravel. The till, or boulder clay, is made up of fine clay, sand, and subangular, striated boulders of various sorts. The stratified sand and gravel is material carried by streams from the melting glacier and is, therefore, assorted. The surface form of the terminal and recessional moraines is sometimes a smooth, broad-topped ridge, sometimes a hilly mass of knobs and kettles, the latter often containing lakes and small swamps.[31]

Waupaca County is bordered on the east by Outagamie County, on the south by Waushara County, on the west by Portage County, on the north by Shawano County, on the southeast by Winnebago County, and on the northwest by Marathon County.

[30] http://www.wisconline.com/wisconsin/geoprovinces/centralplain.html
[31] http://www.wisconline.com/wisconsin/geoprovinces/northernhighland.html

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. Waupaca County contains the Cities of Clintonville, Manawa, Marion, New London, Waupaca, and Weyauwega; the Villages of Big Falls, Embarrass, Fremont, Iola, Ogdensburg, and Scandinavia; and the Towns of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, Scandinavia, St. Lawrence, Union, Waupaca, Weyauwega, and Wyoming. See Appendix A for a map of Waupaca County. The county and all municipalities except for the Towns of Larrabee, St. Lawrence, and Waupaca did not independently adopt the plan but, as towns, may participate in hazard mitigation projects with the county. Copies of the adoptions can be found in Appendix C.

Geology

Waupaca County is covered by Pleistocene till and glaciolacustrine (lake), glaciofluvial (stream), and eolian (wind) deposits. In the northern three-quarters of the county these deposits overlie Precambrian crystalline rocks; in the remainder, they overlie sandstone of Cambrian age and, to a minor extent, dolomite of the Prairie du Chien Group of Ordovician age. The deposits of Pleistocene age, particularly outwash, are the principal sources of ground water except in those areas where the saturated thickness is slight or the permeability low. The sandstone of Cambrian age is an important aquifer in the southeastern part of the county. The crystalline rocks of Precambrian age yield little water except from fractures, joints, and weathered zones, and they are a source of water only in areas where better aquifers are absent.[32]

Early Proterozoic Rhyolite covers 12 % of the county's surface. The rhyolite layer contains ash-flow tuffs and interbedded volcaniclastic sedimentary rocks and cogenetic granite. Ordovician Prairie du Chien Group consists of dolomite with some sandstone and shale, includes Shakopee and Oneota Formations, and covers only 0.4% of the county. Wolf River Granite (Middle Proterozoic), a red, coarse-grained rapakivi granite consisting of large (1-3 cm) ovoid alkali feldspar sporadically mantled by plagioclase, interstitial plagioclase, quartz, biotite, hornblende, and ilmenite, covers approximately 23% of Waupaca County. Waupaca Granite, also Middle Proterozoic,

[32] https://pubs.er.usgs.gov/publication/wsp1669U

covers 25 % of the area. Waupaca Granite contains 70-80 percent coarse (1.5-5 cm) ovoid alkali feldspars mantled by plagioclase, coarse anhedral quartz, and interstitial hornblende and biotite. Red River Granite (Middle Proterozoic) covers almost 12% of the county. Red River Granite contains alkali feldspar phenocrysts (0.5-2 cm), subordinate plagioclase and quartz, and rare clusters of biotite with or without hornblende. Undivided Cambrian covers the remaining 28 % of the county. This undivided Cambrian layer consists of sandstone with some dolomite and shale and includes Trempealeau, Tunnel City, and Elk Mound Formations. [33]

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 is 295 miles, giving a total area of 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-fourth 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

[33] https://mrdata.usgs.gov/geology/state/fips-unit.php?code=f55135

Mississippi River bluffs rise 230 to 650 feet.[34]

Waupaca County is located in east central Wisconsin approximately midway between Green Bay and Stevens Point. The county encompasses approximately 760 square miles of which about 17 square miles is surface water, 420 square miles is farmland, 202 square miles is forested, and 97 square miles is wetland, leaving about 24 square miles designated as urban area that includes six cities and six villages. The county has adopted land use controls to ensure logical development within the county, including the protection of environmentally sensitive areas.[35] Waupaca County is bordered to the north by Shawano County, to the east by Outagamie County, on the southeast by Winnebago and Waushara Counties, to the west by Portage County, and on the northwest by Marathon County.[36]

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 39°F in the north to approximately 50°F in the south, with statewide extreme records of 114°F (Wisconsin Dells, 7/13/1936) and -55°F (Couderay, 2/2/1996 and 2/4/1996). During more than half of the winters, temperatures fall to -40°F or lower and almost every winter temperatures of -30°F or colder are reported from northern stations. Summer temperatures above 90°F average two to four days in northern counties, including Waupaca County, and about 14 days in southern districts. During marked cool outbreaks in summer months, the central lowlands occasionally report freezing temperatures.

[34] http://www.uwex.edu/sco/state.html
[35] http://www.co.waupaca.wi.us/landinformation/Home.aspx
[36] http://en.wikipedia.org/wiki/Waupaca_County,_Wisconsin

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. 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.

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. [37]

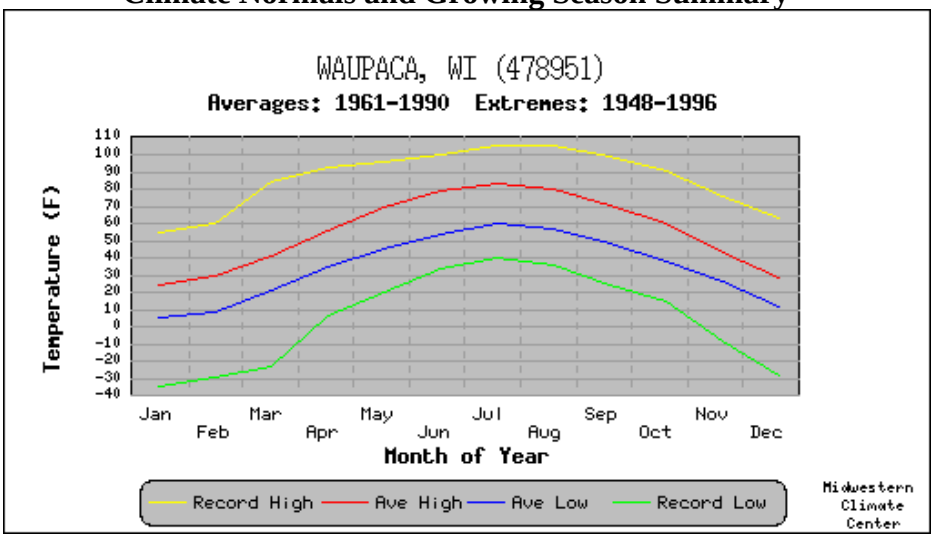
The average growing season is defined as the number of days following the last 32°F freeze in the spring through the beginning of fall. Waupaca County's growing season averages 145 days.[38]

[37] http://www.aos.wisc.edu/~sco/
[38] http://www.wisconline.com/counties/waupaca/climate.html

Climate Normals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ave Daily High (F°)	24.0	29.0	40.3	55.9	69.4	78.2	83.0	79.7	70.6	59.3	42.9	28.4
Ave Daily Low (F°)	4.7	8.1	21.1	34.0	44.7	53.7	59.2	56.6	48.2	37.9	25.7	11.5
Growing Degree Days	0	1	25	142	340	502	640	574	367	176	31	2
Heating Degree Days	1569	1302	1063	600	280	67	10	30	176	508	921	1395
Cooling Degree Days	0	0	0	0	35	97	199	129	11	0	0	0
Ave Precipitation (")	1.18	1.04	2.26	2.79	3.78	3.73	4.01	3.76	4.07	2.46	2.20	1.54
Ave Snowfall (")	10.8	7.5	9.5	1.6	0.1	0.0	0.0	0.0	0.0	0.2	3.9	12.3

Data from the weather station at Waupaca, latitude 43°01' N, longitude 88°14' W, elevation 860 ft. [39]

Climate Normals and Growing Season Summary[40]



In 2012, the Wisconsin Department of Health Services (DHS), Bureau of Environmental and Occupational Health (BEOH) was awarded a grant to study and prepare for anticipated climatic effects

[39] http://www.wisconline.com/counties/waupaca/climate.html
[40] http://www.wisconline.com/counties/waupaca/climate.html

of the public's health. The Wisconsin Climate and Health Profile Report highlights evidence-based data related to extreme weather events, corresponding health outcomes and the development of projects and best practices to adapt to and prepare for future extreme weather events.

Over the past 60 years Wisconsin has become warmer and wetter, especially during the winter months. Evidence and research drawn from the Wisconsin Initiative on Climate Change Impacts (WICCI) suggest that climate-sensitive human health impacts will likely be affected by precipitation changes, heat extremes, drought, winter weather changes, disease vectors, surface water and groundwater. Those most vulnerable to these changes include the very young, elderly, persons with chronic disease (e.g., asthma), persons of low socio-economic status, persons with mental health issues and those who are socially isolated.

Possible impacts during the four seasons include:

- Spring - More frequent and intense rain events may lead to more flooding with health impacts such as stress and mental health disorders; foodborne and waterborne illnesses; injuries; drowning; and death.
- Summer - Southern Wisconsin may experience approximately 28 more days exceeding 90 degrees Fahrenheit. Health impacts can include heat stress, respiratory disease, allergic reactions and death.
- Fall - Extended periods of warming could case more drought with health impacts including water and food insecurity; respiratory distress; allergic reactions; and death.
- Winter - Warmer winters might cause more ice, sleet and rain. Health impacts may include traffic accidents, power outages, injuries and death.[41]

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

[41] *Wisconsin Climate and Health Profile Report*, 2014, WI Department of Health Services, Bureau of Environmental and Occupational Health http://www.dhs.wisconsin.gov/publications/P0/P00709.pdf

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.

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.[42]

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.[43] The winter period normally lacks infiltration because of frozen ground.

Groundwater resources constitute an extremely valuable element of the natural resource base of Waupaca County. The groundwater reservoir not only sustains lake levels and provides the base flow of streams in the county but also comprises a major source of water for domestic, municipal, and industrial water users. Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality.

Within Waupaca County, there are 240 lakes and numerous rivers and streams. Waupaca County has more lakes than any other county in East Central Wisconsin.[44] Major bodies of water include Partridge Lake, White Lake, Wolf River, Little Wolf River, Embarrass River, Pigeon River, Waupaca River, Crystal River, and the Chain of Lakes

[42] http://www.uwex.edu/sco/state.html
[43] DeVaul, 1967
[44] Waupaca County Outdoor Recreation Plan 2008

System. There are two major watersheds in Waupaca County. Streams flow into Lake Michigan.

Wisconsin is a state with a large quantity of groundwater. Groundwater in Waupaca County is generally of very good quality and there have not been any groundwater quality concerns in the majority of the county.

In Waupaca County, lake levels and base stream flows are directly related to local ground water supplies. In the western portion of the county, most of the ground water supply is found close to the surface as a result of a shallow mantle of bedrock. This region contains many spring seeps. Depending on the rate of discharge and topography of the immediate area, the ground water may discharge into a stream or accumulate in ponds or marshes. Ground water seepage is largely responsible for the abundance of trout streams found in this part of the county.[45]

Land to the east and especially along the west bank of the Wolf River contains many artesian wells. While not contributing significantly to the volume of surface water lakes and streams, these springs are valuable in maintaining the large number of marshes and wetlands present in this area.[46]

Ground water in the eastern portion of the county is generally deeper and less available. A larger percentage of the precipitation runs off so the ground water recharge is much slower.[47]

All of the ground water in the county is from local precipitation that infiltrates through the soil to recharge the aquifers. Contamination risks from land use practices are the greatest threat to ground water resources. Potential point source contamination originates from old unregulated landfills, underground fuel storage tanks, private septic systems, livestock manure handling and storage, septic disposal, and excessive agricultural fertilization. These risks are most prevalent in the western portion of the county where infiltration is greatest. Vegetable crops are grown on approximately 5% of the cropland in this region. Vegetable crops require large amounts of fertilizer and irrigation water, which results in the potential for ground water contamination.[48]

[45] Waupaca County Land and Water Resource Management Plan, 2012
[46] Waupaca County Land and Water Resource Management Plan, 2012
[47] Waupaca County Land and Water Resource Management Plan, 2012
[48] Waupaca County Land and Water Resource Management Plan, 2012

Land use decisions can have impacts on groundwater, as anything that is spilled or spread on the ground can impact the quality. As a result, pollution is a very real threat to the county's water supplies.

Waupaca County obtains all of its domestic drinking water from groundwater sources, including both municipal and private wells. Recharge of the County's aquifers is derived almost entirely from locally occurring precipitation, giving our citizens control over, and responsibility for, their groundwater. Ways to protect groundwater include:

- Wellhead Protection Plans and Ordinances: Wellhead protection plans are developed to achieve groundwater pollution prevention measures within public water supply wellhead areas. A wellhead protection plan uses public involvement to delineate the wellhead protection area, inventory potential groundwater contamination sources, and manage the wellhead protection area. All new municipal wells are required to have a wellhead protection plan. A wellhead protection ordinance is a zoning ordinance that implements the wellhead protection plan by controlling land uses in the wellhead protection area.

- Animal Waste Management Ordinances: Most Wisconsin counties have adopted an animal waste management ordinance that applies to all unincorporated areas of the county (areas outside of city and village boundaries). While the purposes of such ordinances vary among counties, a key purpose is often to protect the groundwater and surface water resources. This is accomplished by regulations such as:

    - Permitting of animal waste storage facilities;
    - Permitting of new and expanding feedlots;
    - Nutrient management;
    - Prohibiting:
        - Overflow of manure storage structures;
        - Unconfined manure stacking or piling within areas adjacent to stream banks, lakeshores, and in drainage channels;
        - Direct runoff from feedlots or stored manure to waters of the state;

- Unlimited livestock access to waters of the state where high concentrations of animals prevent adequate sod cover maintenance.

- Nitrate - Aquifers that are close to the land surface have limited natural protection which makes them vulnerable to pollution.

  In 2006, the Wisconsin DNR and DATCP reported that NO_3-N is the most widespread groundwater contaminant in Wisconsin and that the nitrate problem is increasing both in extent and severity with 80% of nitrate inputs originate from manure spreading, agricultural fertilizers, and legume cropping systems. Septic systems can also be a significant nitrate source in densely populated areas, areas where fractured bedrock is near the surface, or areas with coarse-textured soils. Additionally, concentrations of NO_3-N in private wells frequently exceed the drinking water limit. For example, in 2005 11.6% of 48,818 private wells exceeded the nitrate limit.

  Land use affects nitrate concentrations in groundwater with a study of over 35,000 private well samples being three times more likely to be unsafe to drink due to high nitrate in agricultural areas, especially those with sandy areas/highly permeable soils, than in forested areas. Groundwater with high nitrate from agricultural lands is more also more likely to contain pesticides than groundwater with low nitrate levels.

  - Pesticides - A pesticide is any substance used to kill, control or repel pests or to prevent the damage that pests may cause. Included in the broad term “pesticide” are herbicides to control weeds, insecticides to control insects, and fungicides to control fungi and molds. Pesticides are used by businesses and homeowners as well as by farmers, but figures for the amounts and specific types of pesticides used are not generally available on a county-by-county basis. A 2005 report indicates that approximately 13 million pounds of pesticides are applied to major agricultural crops in Wisconsin each year, including over 8.5 million pounds of herbicides, 315,000 pounds of insecticides, one million pounds of fungicides, and 3 million pounds of other chemicals (this last category applied mainly to potatoes). The report also shows that

herbicides are used on 100% of carrots for processing, 99% of potatoes, 98% of cucumbers for processing, 98% of soybeans, 97% of field corn, 89% of snap beans for processing, 87% of sweet corn, and 84% of green peas for processing. Insecticides are used on 97% of potatoes, 96% of carrots, and 88% of apples. Fungicides are used on 99% of potatoes, 88% of carrots, and 89% of apples.

- Arsenic - Arsenic is an element that occurs naturally in some of Wisconsin's aquifers and may contaminate well water drawn from those aquifers. It is a particular problem in parts of the Fox River valley of northeastern Wisconsin. However, arsenic has been detected in wells in every county in Wisconsin, and arsenic concentrations greater than the drinking water limit of 10 µg/L (micrograms per liter, or parts per billion) have been documented in 51 of Wisconsin's 72 counties.

- Contaminated Groundwater and/or Soil - Properties that were or are contaminated with hazardous substances can be found using the WDNR's Bureau for Remediation and Redevelopment Tracking System (BRRTS).[49] Waupaca County has four open leaking underground storage tanks (LUST) sites which has contaminated soil and/or groundwater with petroleum, which includes toxic and cancer-causing substances. However, given time, petroleum contamination naturally breaks down in the environment. There are five environmental repair (ERP) sites which are sites other than LUSTs that have contaminated soil and/or groundwater. Examples include industrial spills or dumping, buried containers of hazardous substances, and closed landfills that have caused contamination. There are no open spill sites.

- Concentrated Animal Feeding Operations (CAFO) - There are three concentrated animal feeding operation (i.e., greater than 1,000 animal units) in Waupaca County.[50] CAFOs are required under their Wisconsin Pollutant

[49] https://dnr.wi.gov/topic/Brownfields/botw.html
[50] https://dnr.wi.gov/topic/AgBusiness/data/CAFO/cafo_cty.asp?CountyChoice=Waupaca&Submit=Submit

Discharge Elimination System (WPDES) permits to practice proper manure management and ensure that adverse impacts to water quality do not occur. Permit applicants must submit detailed information about the operation, a manure management plan, plans and specifications for all manure storage facilities, and a completed environmental analysis questionnaire. Once a WPDES CAFO permit is issued, operators must comply with the terms of the permit by following approved construction specifications and manure spreading plans, conducting a monitoring and inspection program, and providing annual reports. Other potential groundwater contaminants from agriculture include fertilizers and pesticides. Large amounts of nitrogen fertilizers are used when fields are planted continuously with corn, and they can leach into groundwater as nitrate.[51]

- Licensed Landfills and Superfund Sites – There is one licensed landfill and no Superfund sites in Waupaca County.[52, 53] In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as the Superfund law. The Superfund law created a tax on the chemical and petroleum industries, which went into a trust fund to help pay for cleaning up abandoned or uncontrolled waste sites. The U.S. Environmental Protection Agency (EPA) administers the Superfund trust fund and works closely with state and local governments and tribal groups to remediate sites that may endanger public health or the environment. The contamination at many of these sites was created years ago when environmental regulations were virtually nonexistent and companies dumped or emitted hazardous materials freely into the environment. Years later the threat to humans and the ecosystems remains so great that the sites need to be remediated.

[51] https://dnr.wi.gov/topic/AgBusiness/CAFO/
[52] https://dnr.wi.gov/topic/waste/documents/faclists/WisLic_SWLandfills_byCnty_withWaste.pdf
[53] https://dnr.wi.gov/files/PDF/pubs/rr/RR005.pdf

Since much of this contamination was caused many years ago, it can be hard to find the parties responsible, or the parties responsible may be unwilling or unable to pay for the cleanup. In these cases, the Superfund trust fund can be used to pay for most of the cleanup process. States must pay for a portion of such cleanups. CERCLA also provides EPA with enforcement tools to compel those responsible for causing the contamination to pay for the cleanup, including the issuance of administrative orders. If the trust fund is used, then EPA and the state may go to court to recover their expenditures from those who are responsible.

- Cleanup -
  - Petroleum Environmental Cleanup Fund Award - The Petroleum Environmental Cleanup Fund Award (PECFA) program was created in response to enactment of federal regulations requiring release prevention from underground storage tanks and cleanup of existing contamination from those tanks. PECFA is a reimbursement program returning a portion of incurred remedial cleanup costs to owners of eligible petroleum product systems, including home heating oil systems. This program is scheduled to end June 30, 2020; however, liability for clean-up does not end when the program expires. As of June 30, 2004, $13,906,133 has been reimbursed by the PECFA fund to clean up 119 petroleum-contaminated sites in Waupaca County. [54]
  - Nitrate Removal Systems – No municipal water systems in Waupaca County have spent money to reduce nitrate levels. As of 2005, over 20 municipal water systems in Wisconsin have spent over $24 million reducing nitrate concentrations in municipal water systems.

[54] https://docs.legis.wisconsin.gov/misc/lfb/informational_papers/january_2005/0059_petroleum_environmental_cleanup_fund_award_pecfa_program_informational_paper_59.pdf

WDNR's Outstanding and Exceptional Resource Waters Program provides a designation for Wisconsin's cleanest waters. An outstanding resource water is defined as a lake or stream that has excellent water quality, high recreational and aesthetic value, high quality fishing and is free from point source or non-point source pollution. An exceptional resource water is defined as a stream that exhibits the same high quality resource values as an outstanding resource water but that may be impacted by point source pollution or that may have the potential for future discharge from a small sewer community. Outstanding and exceptional resource waters in Waupaca County are:[55]

- Emmons Creek: All
- Graham Lake: All
- Griffin Creek: All
- Jackson Creek: All
- Leer Creek: All
- N. Branch Little Wolf River: All above S18 T25N R11E
- North Lake: All
- Peterson Creek: All
- Radley Creek: To junction with Crystal River
- Sannes Creek: All
- Spaulding Creek: All
- Trout Creek: To Hwy. 161
- Whitcomb Creek: All
- Allen Creek: All
- Austin Creek: All above town road in S31 T21N R12E
- Bailey Creek: All
- Basteen Creek: To outlet of Ogdensburg Pond
- Blake Brook: From junction N and S branches to Hwy. 161

[55] http://dnr.wi.gov/topic/SurfaceWater/oerw/orwerw_county.pdf

- Comet Creek: All
- Doty Creek: All
- Embarrass River: All
- Flume Creek: All above east section line S32 T25N R11E
- Hyde Creek: All
- Jones Creek: All
- Little Wolf River: From junction with Wolf River upstream to Manawa Dam
- Mack Creek: All
- McLean Creek: All
- Murry Creek: All
- N Branch Blake Brook: All
- Naylor Creek: All
- Olson Creek: All
- S. Branch Blake Brook: All
- S. Branch Pigeon River: Above Keller Lake
- Stenson Creek: All
- Waupaca River: To Hwy. 54

Twelve watersheds are contained completely or partially within Waupaca County and are explained in greater detail in the Flooding and Dam Failure chapter of this plan.

Soil Types

Soil is formed by the interaction of outside processes on deposited geologic materials. The characteristics of a soil are determined by the physical and mineralogical composition of the parent material, the climate in the area, the plant and animal life in and on the soil, the relief, and the length of time the processes of soil development have acted on the soil material. [56]

[56] Waupaca County Land and Water Resource Management Plan, 2012

The parent material in Waupaca County consists of windblown sand, water-laid deposits, organic material, and glacial drift. Glacial drift can be further divided into till and outwash. Till is unsorted glacial debris composed of clay, silt, sand, gravel, and boulders. The eastern half of the county is either glacial till or water-laid deposits in former glacial lakes. The western portion of the county was formed by the melt waters of the receding ice masses depositing sand and gravel in the form of stream terraces, eskers, kames, and outwash plains.

There are 61 different soil types found throughout Waupaca County. These are grouped into six major soil associations that have distinctive soil patterns, relief, and drainage features. The Waupaca County Soil Survey contains detailed descriptions of each soil type, including information on suitability and limitations for various types of land use and land management. The Waupaca County Land and Water Conservation Department extensively uses soil information and related data in determining cropland erosion estimates and sediment load calculations.

A Waupaca County soil survey, the “Soil Survey of Waupaca County, Wisconsin,” was prepared by the Natural Resources Conservation Service and can provide very specific details on the county’s soil types. [57]

Wetlands

According to the Wisconsin Department of Natural Resources, Waupaca County has approximately 112,761 acres of wetlands (approximately 23.5% of its total area). This is 2.1% of the total statewide acreage of wetlands.

From the sedge meadows of southern Wisconsin to the spruce bogs in the north, wetlands cover a wide array of landscapes. They share in common the ability to support aquatic or "water loving" plants, and provide habitat for more species of plants and animals than any other type of landscape in Wisconsin. Habitat is not their only functional value. Wetlands can also store water to prevent flooding, purify water, protect lake and stream shores from eroding, and provide recreational opportunities for wildlife watchers, anglers, hunters, and boaters.[58]

[57] https://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=WI
[58] https://dnr.wi.gov/topic/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 (hydrophytic vegetation).
- Soils indicative of wet conditions (hydric soils).

Figuring out what is or is not a wetland can be extremely confusing if you only associate “wetlands” with the presence of water. It is possible that a property could have standing water for a portion of the year and still not be a wetland and it is also possible that a true wetland with all three of the above characteristics may never have water present above the land surface.

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.

There are two main levels of jurisdiction (often overlapping) concerning wetlands in Waupaca County are the Wisconsin Department of Natural Resources and municipal zoning agencies. The Zoning Department has jurisdiction over wetlands in county zoning plans while wetlands within city or village boundaries are also subject to the appropriate municipality's regulations.

Land Use

According to the Waupaca County Land and Water Resource Management Plan, agriculture, recreation, and manufacturing are the driving forces in the economy of Waupaca County. These three entities also shape the land use trends. Agriculture remains steadfast as the predominant land use in the county. Recreation and urban development are expected to put unrelenting and growing pressure on the county's natural resource base. Urban development in the riparian zone of both streams and lakes has increased disproportionately when compared to other areas. Development in the near shore zone of public waterways results in increased impairment of natural resources due to the impacts associated with construction site erosion, increased volume of runoff, and polluted runoff.

Land use plans are designed to help control the type and direction of growth. Waupaca County resource managers will continue to develop and attempt to implement land use plans. Planning efforts will address the following resource management issues:

- Preservation of farmland
- Open spaces
- Wetlands
- Wooded areas
- Green belts between ecosystems

The Wisconsin Department of Natural Resources has identified four state natural areas within Waupaca County including:

Jackson Creek Woods [59]

Jackson Creek Woods supports both northern wet-mesic and northern mesic forest situated along the bank of Jackson Creek, a tributary of the Little Wolf River. The wet-mesic forest is dominated by white cedar with white pine, black ash, hemlock, red maple, white spruce and black spruce. The herbaceous layer is comprised of yellow bluebead lily, three-leaved goldthread, large-leaf aster, wild sarsaparilla, naked miterwort, rough-leaved goldenrod, and Canada mayflower. On the slopes above the creek is a mesic forest growing on glacial till. Sugar maple, hemlock, and red oak dominate the forest. Eastern hop-hornbean, sugar maple, balsam fir, and green ash are common sapling species. The groundlayer supports Pennsylvania sedge, Peck's sedge, Virginia waterleaf, wild geranium, pointed tick-trefoil, bloodroot, sharp-lobed hepatica, false Solomon's seal, blue cohosh, poke milkweed, and large-flowered trillium. Jackson Creek Woods is owned by the DNR and was designated a State Natural Area in 2008.

Keller Whitcomb Creek Woods [60]

[59] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=573
[60] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=158

Situated in a depression of glacial till, Keller Whitcomb Creek Woods features a diversity of natural communities on undulating topography. It encompasses the headwaters of Whitcomb Creek, a sandy bottomed, fast-flowing Class I trout stream with naturally reproducing brown and brook trout. The stream receives abundant water from tributary spring runs that line the bank. Springy pockets in low areas near the stream support a wet-mesic forest dominated by white cedar with black ash, balsam fir, red maple, and white pine. Upland edges have a greater canopy diversity including yellow birch, white birch, and hemlock. The ground layer is diverse with more than 18 species of fern. Other plant species include wild sarsaparilla, evergreen sedge, three-leaved goldthread, cinnamon fern, naked miterwort, Canada bunchberry, and yellow bluebead lily. Also present is a good quality northern dry-mesic forest of white and red pine along with red and white oak. Understory species include early low blueberry, maple-leaved Viburnum, alternate-leaved dogwood, gaywings, Canada mayflower, partridgeberry, and American starflower. The area is rich in wildlife. Of interest are winter wren, veery, and raven. Other animals include a diverse assemblage of passerines, ruffed grouse, red fox, and occasional waterfowl and mink. Keller Whitcomb Creek Woods is owned by the DNR and was designated a State Natural Area in 1980.

Little Wolf River [61]

Little Wolf River contains an unaltered stretch of the Little Wolf River and its springs, seeps, and tributaries that traverse the area. A narrow corridor of floodplain sedge meadow and black ash swamp flanks the river. At this location, the Little Wolf River is a high quality trout stream running fast and clear. The site also harbors an unfragmented block of northern wet-mesic forest dominated by white cedar with balsam fir, yellow birch, hemlock, and American elm. Numerous large boulders are strewn about the area. The ground flora is lush and dense with several species more typical of southern

[61] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=388

Wisconsin forested communities. Common species include lady fern, bulblet fern, Jack-in-the-pulpit, wild sarsaparilla, Michigan lily, alpine enchanter's nightshade, and several sedges. Tag alder and black ash saplings are abundant in the tall shrub layer while swamp dewberry dominates the lower shrub layer. An elevated island of northern mesic forest contains large hemlock (up to 24" diameter), red oak, and yellow birch. The uplands to the west are dominated by hemlock with white pine, yellow birch, and some red oak. Red elderberry and raspberry dominate the shrub layer. Old cut and burned hemlock stumps indicate the area may have been impacted during the original logging era but is regenerating well today. Birds include broad-winged hawk, great-horned owl, great blue heron, black-billed cuckoo, ovenbird, and winter wren. The property was donated to the DNR from Jerry and Jill Martin. Little Wolf River is owned by the DNR and was designated a State Natural Area in 2002.

Mud Lake Bog [62]

Mud Lake Bog features 30-acre undisturbed and undeveloped alkaline bog lake surrounded by a large northern mesic forest. The shallow, muck bottom lake lies in a well-defined basin and is fed by springs with an east side outlet leading to the Little Wolf River one mile to the south. Yellow and white water-lilies occur across the open water and a fringe zone of quaking sedge mat is best developed on the northwest corner of the lake. Behind the narrow mat is a more stabilized bog zone containing black spruce and tamarack with a sphagnum and ericaceous understory including leather-leaf and bog-rosemary. Some white pine is also present. An abrupt 15-foot rise marks the boundary between the bog and surrounding second growth northern mesic forest, which affords excellent protection to the lake and wetland. Mallards and blue-winged teal nest in the area while other migrating waterfowl use the area for resting. Mud Lake Bog is owned by the DNR and was designated a State Natural Area in 1977.

Mud Lake - Radley Creek Savanna [63]

[62] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=141
[63] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=224

Mud Lake is a shallow, hard water lake in a wilderness setting - having no access or human-made developments. The lake covers nearly eleven acres and is only three feet deep. The water is clear and quite fertile, with the major sources being seepage and springs. There is no inlet, but the lake does have a short outlet to Radley Creek. Wild rice dominates the emergent aquatics. Surrounding the lake is a forest of tamarack and poison sumac. The absence of black spruce makes this site very unusual for this locality. The understory is rich in northern wet forest herbs; sundew and pitcher plant are especially numerous. To the north the land rises into an open forest dominated by white and bur oaks, which has several groundlayer species that are more typical of prairie. Mud Lake-Radley Creek Savanna is owned by the DNR and was designated a State Natural Area in 1989.

Mukwa Bottomland Forest [64]

Located along the lower Wolf River, Mukwa Bottomland Forest is a diverse southern wet-mesic forest in the floodplain of the Wolf River. Although dominated by silver maple and swamp white oak, small numbers of American elm persist. The trees vary in size from saplings to an occasional specimen more than 30 inches in diameter at breast height. Areas with smaller trees appear quite natural with no evidence of past logging or grazing. Additional tree species include red elm, black ash, green ash, basswood, bur oak, hackberry, cottonwood, willows, and red maple. The understory has mostly buttonbush and prickly ash as shrubs; the herbaceous layer is dominated by wood nettle but also has Canadian honewort, moneywort, northern bugleweed, tall coneflower, woodland phlox, carrion flower, and bristly greenbriar. The topography is uneven, the site having been dissected by many old channels and fluctuating water levels. Mukwa Bottomland Forest is owned by the DNR and was designated a State Natural Area in 1980.

[64] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=159

Myklebust Lake [65]

Mykelbust Lake features a deep, 20-acre marl-bottomed lake with an undeveloped shoreline and exceptionally clear water provided by numerous springs. A narrow wetland fringe of bur-reed and hard-stemmed bulrush surrounds the lake and along the one-half mile outlet stream which flows into the South Branch of the Little Wolf River. Wild celery and water star-grass inhabit the high quality, swift current of the outlet and the macro-algae Chara is abundant on the lake bottom. The lake's macrophyte community is diverse and contains emergent aquatics such as white water-lily, bull-head pond-lily, arrowhead, flowering rush, wild rice, seven-angle pipewort, quillwort and several pondweeds. A northern wet forest of tamarack, red maple, and elm borders the outlet stream and contains a diverse understory of bog birch, poison sumac, and shrubby cinquefoil with rush aster, Kalm's lobelia, and nodding lady's tresses. A 2-acre black spruce bog is found in the southeast corner while the east shore contains a small stand of large white pine, some more than two feet in diameter. The remainder of the uplands is a mixture of second-growth northern hardwoods. The lake supports an excellent northern pike, largemouth bass, and panfish fishery. Teal and wood ducks frequent the stream. Myklebust Lake is owned by the DNR and was designated a State Natural Area in 1982.

Pope Lake [66]

Pope Lake is a 14-acre undeveloped lake with a diversity of aquatic vegetation. It is the only undeveloped water body in the heavily developed Chain-o-Lakes. The marl-bottomed hard water lake has a maximum depth of 40 feet and contains chara, spatterdock, wild celery, and a good variety of pondweeds. Most of the adjacent wetlands are a northern wet forest of tamarack, poison sumac, and

[65] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=179
[66] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=194

winterberry, but alder thicket is also found along the channels and the lake shore. Several upland islands support a northern dry-mesic forest of white pine and white and red oaks. Common bird species found near the lake are green-backed heron, great blue heron, sora, great crested flycatcher, eastern wood peewee, black capped chickadee, and American goldfinch. Pope Lake is owned by the DNR and was designated a State Natural Area in 1984.

Poppy's Rock [67]

Poppy's Rock is a Precambrian granitic rock outcrop, sculptured by glaciers that harbors an unusual assemblage of plant species. The rock contains several features created by the scouring of rocks and ice including chattermarks, striations, crescentric gouges, and surface glazing. Vegetation is varied and changes with exposure, inclination, and humus accumulation. Bare rock supports a diverse assemblage of lichens, spikemoss, and mosses. Crevices with accumulated humus harbor many plants with prairie affinities including big and little blue-stem, prairie coreopsis, white wild indigo, bird's-foot violet, prairie alumroot, and lead-plant. Larger areas of accumulated humus harbor trees. On the upper slopes are red cedar, black oak, and jack and white pines. The north slope is dominated by red maple, big-tooth aspen, and quaking aspen. Shagbark hickory, red maple, and black and white oaks dominate the lower south slope and the base of the outcrop. At the western end is a small area of white pine. Common animals include woodchuck, raccoon, opossum, porcupine, and red fox. The site has a history of incompatible human use that has resulted in vandalism, litter, and plant theft. Poppy's Rock is owned by Lawrence University and was designated a State Natural Area in 1966.

Skunk and Foster Lakes [68]

[67] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=43
[68] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=312

Skunk and Foster Lakes State Natural Area features a cluster of five undeveloped glacial pothole lakes located in pitted outwash moraine topography surrounded by second-growth forest of paper birch, white pine, red maple, elm, white and red oak. A small amount of tamarack is also present along the lowland edges of the lakes, as well as a thin marsh edge of red osier dogwood, alder, and sedge-cat-tail community. Some open hilltop areas contain remnant prairie species. The 11-acre Skunk Lake is a deep, hard water marl lake with very clear water fed by seepages and springs. A wetland dominated by cat-tails and bulrush surrounds the lake and a navigable channel connects it to Foster Lake, a 7-acre shallow, hard water, muck-bottom lake. The lake is ringed with cat-tails and arrowhead with numerous submerged aquatics. Surrounding the lakes is second-growth northern dry-mesic forest with sugar maple, red oak, big-tooth aspen, paper birch, and white oak. The topography is uneven with numerous glacial erratics strewn about. Grenlie Lake is a small, clear, hard water lake fed by seepage and springs and a small inlet from an adjacent marsh. The south side of the lake has a shallow bay with a small island and a small bog is also present. Aquatic flora of the lakes includes common and Illinois pondweed, northern water-nymph, white water-lily, and common bladderwort. Aquatic fauna includes bluegill, pumpkinseed, northern pike, perch, and largemouth bass. Skunk and Foster Lakes is owned by the DNR and was designated a State Natural Area in 1996.

Tellock's Hill Woods [69]

Tellock's Hill Woods is an old-growth northern mesic forest on the north-facing slope of a drumlin. The drumlin, a hill with a streamlined ovoid shape formed by advancing glacial ice, has an unusual sandstone core exposed in a deep ravine. On the gentle north-facing slope is a relatively undisturbed beech-maple forest with a nearly complete canopy cover. Other species include hemlock and basswood. The groundlayer is rich with an abundance of spring ephemerals and woodland wildflowers such as spring beauty, Dutchman's-breeches, blue cohosh, large-flowered

[69] https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=101

trillium, nodding wake robin, downy yellow violet, maidenhair fern, false rue anemone, and rosy twisted stalk. The steeper northern slope is strewn with large boulders and wooded with nearly pure hemlock although sugar maple and an occasional yellow birch are present. The understory is sparse due to the near complete shading of the hemlock. The lower and more level bottomlands at the hill's base contain ash and elm with irregularly spaced, low wet areas. Yellow-throated vireo, ovenbird, wood thrush, pileated woodpecker, and broad-winged hawk are common inhabitants of the forest. Tellock's Hill Woods is owned by the DNR and was designated a State Natural Area in 1972.

Vegetation

Maple, hemlock, and yellow birch dominate the northeast half of the county. The southwest part of the county is oak savanna next to white and red pine.[70]

[70] http://www.wisconline.com/counties/waupaca/index.html

Demographics

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 establishing trading and military posts in the name of France and the Jesuits attempting 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 Native American tribes relinquished their homeland and were moved to the country west of the Mississippi.

In the spring of 1849, Capt. Augustus Hill Sr. from New Hampshire, along with his sons Col. John Wilkes Chandler and Samuel Slade Chandler, arrived in Waupaca County in search of land to claim. They settled along the Waupaca River in Section 35 of Waupaca Township in the area that is now the Waupaca Airport. Their settlement became known as the "Chandler Settlement”.

A few weeks later, in June of 1849, five Vermonters arrived in Waupaca County. They were E.C. Sessions, Martin Burnhams, William Hibbard, Joseph Hibbard and Mr. Pratt. The five men started out on foot from Sheboygan looking for the "Indian Lands" that had been publicized as available for settlement after a Federal Treaty in 1848. They traveled along the east and north side of Lake Winnebago and then on to the current location of the village of Weyauwega. There they met Native Americans who told them about the Waupaca River and a wonderful place to the west with "The Falls" and beautiful clear lakes. They traveled up the Waupaca River to "The Falls" and claimed land and soon built homesteads.

Other settlers soon followed and the growth of the young village was steady. Mills were built along the Waupaca and Crystal Rivers as early as 1849. Waupaca County was created by the State Legislature on February 17, 1851.[71] In 1852, a Post Office was established and the settlement at "The Falls" was officially named "Waupaca". The first businesses were flour mills, lumber mills, and general stores. Voters decided to establish Waupaca as the County Seat and a courthouse was built. The village of Waupaca was incorporated on May 4, 1857. Many new businesses started and many new settlers came, all contributing to the growth of the city. Railroad tracks were laid and the first train arrived in Waupaca on Sept. 28, 1871. The railroad brought new opportunities for commerce and growth. [72]

Slight boundary changes were made until the present 22 townships were established in 1891.[73] In the early 1900s, tourism became important to the area and many hotels and lodges were established in the City of Waupaca and along the Chain O' Lakes. An Electric Trolley Line was completed to transport tourists from the City of Waupaca out to the Chain O' Lakes resorts in the early 1900s. In the mid-1900s, industry in Waupaca grew, with companies such as the Madison Silo Company, Cary Manufacturing, and the Waupaca Foundry being established.[74]

Population

In the 2010 U.S. Census, the county was home to 52,410 people and according to the 1 July 2019 U.S. Census Bureau estimate, [75] there were 50,990 people residing in Waupaca County for a decrease of 2.7%.

According to the 2015-2019 U.S. census estimate, there were 22,305 households in Waupaca County with an average of 2.23 people per household. These estimates also indicate that the median household income was $58,693 and that the per capita income was $32,000. Approximately 8.8% of the people live below the poverty line. The 2019 census estimate indicated that there were approximately 26,005 housing units within the county as of 1 July.

[71] https://www.co.waupaca.wi.us/departments/land_information/index.php
[72] https://www.waupacahistoricalsociety.org/history-of-waupaca
[73] https://www.co.waupaca.wi.us/departments/land_information/index.php
[74] https://www.waupacahistoricalsociety.org/history-of-waupaca
[75] https://www.census.gov/quickfacts/fact/dashboard/waupacacountywisconsin,US/PST045219

According to the U.S. Census report, the majority of people in Waupaca County reported that they were white (96.8%) with 94.0% stating they were white alone. People of Hispanic or Latino origin were counted as a subcategory of those reporting that they were white. Those reporting as two or more races were 1.2%. American Indians account for 0.8% of the population of Waupaca County. Black or African American alone was 0.5% and Asian alone was 0.6%.

Other miscellaneous demographic information reported by the census bureau is detailed below. These figures identify potential needs for special consideration in a disaster response or in recovery operation planning and implementation.

- People under 5 years old: 5.0%
- People under 18 years old: 20.2%
- People over 65 years old: 21.3%
- Females: 49.3%
- Foreign born: 2.1%
- People with a disability, under 65 years old: 10.1%

Waupaca County contains the Cities of Clintonville, Manawa, Marion, New London, Waupaca, and Weyauwega; the Villages of Big Falls, Embarrass, Fremont, Iola, Ogdensburg, and Scandinavia; and the Towns of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, Scandinavia, St. Lawrence, Union, Waupaca, Weyauwega, and Wyoming.

Transportation Network

Waupaca County has a good transportation network. Federal, state, and county roads connect the population centers. A map in Appendix A shows the various roads in the county.

The county is served by two federal highways: U.S. 10 and U.S. 45 and eight state highways: STH 22, STH 49, STH 54, STH 76, STH 96, STH 110, STH 156, and STH 161, which provide a total of 197 miles of access. U.S. 45 runs north to south through the northeast portion of the county. U.S. 10 runs east to west through the southern portion of the county. STH 22 runs north to south through the north-central and southeastern corner of the county. STH 49 runs north to south through the western portion of the county. STH 54 runs

east to west through the middle portion of the county. STH 76 runs for a short distance in the far east-central edge of the county. STH 96 runs east to west through the southeast corner of the county. STH 110 runs north to south through the center of the county. STH 156 runs through the far northeast corner of the county. STH 161 runs from the east central edge to the center of the county. The county also maintains an additional 342 miles of its own highway system. In addition to the federal, state, and county highways there are approximately 1,110 miles of townships roads.

Waupaca County has maintained these roads along with others to provide a safe and efficient transportation system. With continued maintenance, these roads will continue to serve the population effectively.

Airports, aviation, and aviation-related industries play a significant role in the economic success of many Wisconsin communities. There are three public airports located in Waupaca County:

- Waupaca Municipal Airport, City of Waupaca
- Central County Airport, Village of Ogdensburg
- Clintonville Municipal Airport, City of Clintonville

Land Use and Development Trends

Waupaca County is primarily a rural community in the east-central portion of the state. The county has some natural areas that will not be developed and some rural farming areas as well as light manufacturing and other primarily service businesses that have chosen to locate in the area.

The county has been experiencing slow growth on par with other demographically similar Wisconsin counties since the economic “Great Recession” that began in 2008, which has halted growth and actually constricted the community activity in some areas. As of the time of this plan, it is expected that growth trends will mirror the recovery of the general national, state and regional economy, which is difficult to predict at this time.

Permitting for construction projects is managed by incorporated municipalities (i.e., cities and villages) for projects within their own boundaries; Waupaca County permits development for unincorporated areas (i.e., the towns).

Current land use is variable and includes residential, commercial, industrial, agricultural, wetlands, woodlands and unused rural/open lands. The Wisconsin Department of Revenue (WDOR) tax assessment data classifies the land use in Waupaca County as follows:

- *Agricultural (Includes WDOR categories of Forest, Agricultural Forest and Other)* - Lands devoted primarily to agriculture, small-scale agricultural forestation and lands that are producing, or are capable of producing, commercial forest products (as defined by State of Wisconsin Statute 70.05) and other supporting activities. Also includes lands containing dwelling units and related improvements associated with agricultural use. This category does not include forests or woods that are in parks or that are not being forested under WDOR definitions.
- *Residential* - Lands containing dwelling units and related improvements not associated with agricultural use.
- *Commercial* - Lands, including improvements, devoted primarily to commercial operations, including, but not limited to dining, lodging, and retail sales establishments.
- *Manufacturing* - Lands, including improvements, devoted primarily to manufacturing and industrial operations, including, but not limited to, assembling, processing, and fabricating.
- *Undeveloped* - Lands generally unfit for any of the aforementioned uses, including, but not limited to, parks, hunting grounds, wetlands, ponds, gravel pits, and road rights of way.

Land Uses Changes Based on 2020 WDOR Waupaca County Tax Assessment Data[76]

[76] https://www.revenue.wi.gov/SLFReportsassessor/2020socwaupaca.PDF

Land Use Category	2019 Equalized Value	2020 Equalized Value	Percent Change
Agricultural	$29,493,300	$30,738,200	4%
Agricultural Forest	$63,987,500	$64,414,500	1%
Forest	$168,487,500	$170,936,900	1%
Residential	$3,162,932,400	$3,262,550,700	3%
Commercial	$448,297,000	$465,822,900	4%
Manufacturing	$139,056,200	$141,287,500	2%
Undeveloped	$61,057,400	$60,540,100	-1%
Other	$188,421,100	$191,296,600	2%
Total	**$4,261,732,400**	**$4,387,587,400**	**3%**

Public Safety Support

Medical

The Waupaca 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. Waupaca County communities are served by a complete range of health facilities and health professionals. These health care facilities will coordinate with responding agencies to ensure the best use 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.

Ambulance Service

Waupaca County relies on a mix of volunteer, paid-on-call and paid staff to provide pre-hospital emergency medical services to its service areas. See the EMS Districts Map in Appendix A for district boundary details. The following departments provide ambulance service in Waupaca County: [77]

- **Belle Plaine EMS** - License Level: Emergency Medical Responder

[77] https://www.dhs.wisconsin.gov/ems/provider/waupaca.htm

- **Clintonville Area Ambulance Service** - License Level: Paramedic with Critical Care Endorsement
- **Fremont-Wolf River EMS Ltd.** - License Level: Advanced Emergency Medical Technician
- **Iola Ambulance Service -** License Level: Advanced Emergency Medical Technician
- **King Fire Department First Responders** - License Level: Emergency Medical Responder
- **Manawa Rural Ambulance** - License Level: Advanced Emergency Medical Technician
- **Marion Area First Responders** - License Level: Emergency Medical Responder
- **New London First Responders** - License Level: Emergency Medical Responder
- **Northwest First Responders** - License Level: Emergency Medical Responder
- **Ogdensburg-St. Lawrence Fire and Rescue** - License Level: Emergency Medical Responder
- **Pella First Responders** - License Level: Emergency Medical Responder
- **Waupaca Area First Responders** - License Level: Emergency Medical Responder

Each of these departments provides monthly training to their staff and they participate in periodically scheduled disaster exercises with area hospitals, other emergency medical services, law enforcement, fire services and emergency management.

Fire Service

There are 15 fire departments that serve areas in Waupaca County [78] which are staffed by volunteer firefighters who attend regularly-scheduled trainings. The locations of each fire station and fire service areas can be found in Appendix A.

- Dupont Volunteer Fire Department

[78] https://beta.firedepartment.net/directory/wisconsin/waupaca-county/

- Embarrass Volunteer Fire Department
- Fremont-Wolf River Fire Department
- Iola and Rural Volunteer Fire Department
- King Fire Department
- Manawa Rural Fire Department
- Marion Fire Department
- New London Fire Department
- Ogdensburg/St. Lawrence Fire Department
- Pella Township Fire Department
- Scandinavia Volunteer Fire Department
- Tustin Volunteer Fire Department
- Waupaca Area Fire District
- West Bloomfield Fire Department
- Weyauwega Area Fire District

Law Enforcement

Several departments in Waupaca County are responsible for law enforcement duties within the county. The Cities of Marion, Manawa, Clintonville, Waupaca, Weyauwega and New London; and the Villages of Iola, Ogdensburg and Fremont have their own police officers. The Waupaca County Sheriff's Department provides deputies for the rest of the county. Also, the Wisconsin State Patrol provides limited coverage from their North Central Region office in Wausau. [79] Municipalities with departments are listed below:

- Clintonville Police Department
- Fremont Police Department
- Iola Police Department
- Manawa Police Department
- Marion Police Department
- New London Police Department
- Waupaca Police Department

[79] http://wisconsindot.gov/Documents/about-wisdot/who-we-are/dsp/dsp-regions-map.pdf

- Weyauwega Police Department

See the Law Enforcement Districts Map in Appendix A for district boundary details.

Special Teams

The Waupaca County Hazardous Materials Team currently covers all areas of the county. The Team Leader and all members have completed EPA 165.15 and maintained competency in required areas as set forth by SARA Title III, CFR 29, CFR 29, CFR 40, CFR 49 and NFPA 471. The team is on call 24 hours a day, responding to calls in Waupaca County.

Hazardous materials response is also performed by Type II and Type III Teams.[80] Wisconsin Emergency Management contracts and manages twenty-two Regional Hazardous Materials Response Teams. The teams are divided into Task Forces: Northeast Task Force, Northwest Task Force, Southeast Task Force and the Southwest Task Force. These Task Forces are then divided into Type I, Type II and Type III teams, all with complimentary capabilities and training requirements.

The Wisconsin Hazardous Materials Response System may be activated for an incident involving a hazardous materials spill, leak, explosion, injury or the potential of immediate threat to life, the environment, or property. The Wisconsin Hazardous Materials Response system responds to the most serious of spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies.

Archaeological and Historical Resources

The National Register of Historic Places also includes a listing of locations in Waupaca County. [81] As mitigation projects are considered, the county is committed to ensuring that archaeological and historical sites are preserved.

[80] http://emergencymanagement.wi.gov/training/docs/Regional_Hazardous_Materials_Resp_Teams_Map.pdf
[81] https://nationalregisterofhistoricplaces.com/wi/waupaca/state.html

Historic Sites		
Historic Site Name	Address	Municipality
Browne Law Office	202 E. Union St.	Waupaca
Clintonville Post Office	2 North Main St.	Clintonville
Commandant's Residence Home	Off WI 22	Farmington
Crescent Roller Mills	213 Oborn St.	Waupaca
Danes Hall	303 N. Main St.	Waupaca
Delong, Henry and Elizabeth, House	509 W Fulton Street	Waupaca
Halfway House	Potts Ave.	Dayton
Hansen, Jens, Wagon and Carriage Shop	117 E. Fulton St.	Waupaca
Jensen, Matt and Lena, House	501 W Fulton Street	Waupaca
Kasper, Philip H., Cheese Factory	W of Bear Creek on WI 22	Union
Lake Street Historic District	Portions of East Lake, Jefferson, South Division, South State and South Main streets	Waupaca
Main Street Historic District	roughly along S and N Main streets, from W Union to Granite Street	Waupaca
Mead Bank	215 Jefferson Street	Waupaca
Mumbrue-Penney House	404 S Main Street	Waupaca
Old Hospital	Off WI 22	Farmington
Olfson, Peter and Jessie, House	415 Granite Street	Waupaca
Rural on the Crystal Historic District	Roughly bounded by Arbor St., Rapley St., Rural Rd., and Cleghorn St.	Dayton
Sanders Site (47WP26 and 47WP70)	Address Restricted	Fremont
Shearer-Cristy House	315 E. Lake St.	Waupaca
Veterans Cottages Historic District	Off WI 22	Farmington
Veterans Home Chapel	Off WI 22	Farmington
Waupaca Free Public Library	321 S. Main St.	Waupaca
Waupaca Post Office	306 South Main St.	Waupaca

Historic Sites		
Historic Site Name	Address	Municipality
Wipf, J. & C., Mills	280 N. Main St.	Iola

The Wisconsin Historical Society maintains a list of archaeological sites and cemeteries known as the Archaeological Site Inventory Database (ASI); this list is available to governmental agencies upon request. These sites cover an extended period of time, and include campsites/villages/communities, cabins/homesteads, sugar mapling sites, cemetery/burial/ mounds, trading/fur posts, mill/sawmills and kilns.

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.

Hazard Analysis and Previous Mitigation Projects

The following sections identify those hazards that have occurred or could occur in Waupaca 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. More detailed and specific analyses will be conducted as projects are identified for inclusion in grant applications. As part of the application process, the methodology of data collection and future development patterns will be addressed. Estimates of potential dollar losses and the methodology used to arrive at those estimates will also be described during this application process.

Wisconsin Emergency Management (WEM) completed and regularly updates the State Hazard Mitigation Plan, which was last revised in October, 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.

For this plan the Waupaca County Hazard Mitigation Plan Workgroup reviewed past events records and an internal workgroup consensus was reached on the anticipated probability of future events, as well as the severity of the effects of those events. The probabilities and severities in the table below are designated as “very high,” “high,” “medium,” “low” or “very low” by the workgroup based on their evaluation and experience with the data.

The workgroup understands that historical weather data provided by the National Weather Service does not include events which may adversely affect their communities but fall below the reporting thresholds. However, each weather event was analyzed for historic frequency and averages over the last 25 years and is noted within each section. Additionally, a table with this information is included in Appendix B Frequency of Occurrence.

Event Type	Probability of Occurrence	Likelihood of Damage	Misc. Notes
Drought/Dust Storm	Drought- Medium Dust – Low	Cropland – High Dust – Low	Sandy land is higher
Earthquake	Very Low	Low	
Fire – Forest & Wildfire	High	Medium*	*High for Weyauwega by train tracks – a lot of houses there
Flood – Flash Flood & River Flood	Flash – High River - High	Flash – High River - High	
Flood – Dam Failure	All dams are medium to low except one high risk property and only 2 houses downstream.	Low/Medium	Pigeon River (Clintonville) Dam is being repaired; will be low/medium severity.
Severe Temperature	Cold – High Hot - Low	Cold – High Hot - Low	*Cold severity high, possible roads buckling
Hail	High	Low	
Lightning	Medium	High	
Thunderstorm Wind	High	High	
Tornado	Low	High	
Winter Storm (Snow & Ice)	High	High	
Utility Failure	Electric – High Natural Gas – Low Water – Very Low Sewer – Low	Electric – High Natural Gas – High (especially in winter) Water – High Sewer - High	

The emphasis in the following sections is on mitigation activities for each hazard as a major component of overall emergency management. Mitigation or prevention activities reduce the degree of long-term risk to human life and property from natural and man-made hazards. The cooperation of government, academia, the private sector, and volunteer agencies is essential in mitigation efforts. The Waupaca County Emergency Management Office is committed to working with municipalities and the private sector to ensure that county mitigation information is shared and it is incorporated into their planning as appropriate.

Each community will be given a copy of the plan to use as a reference during their own preparedness activities (i.e., planning, training, permitting, zoning). Communities that have their own comprehensive plan will reference this mitigation plan and its contents in the next scheduled plan update. Municipalities that do not have comprehensive plans either are under the purview of and request assistance from the Waupaca County Planning and Zoning Department or have their own planning departments. Members of the County Planning and Zoning Department and municipal planning departments were included on the Hazard Mitigation Workgroup and are aware of the benefits and requirements to using this plan as they go about their preparedness activities.

Waupaca County and its municipalities have a history of identifying, planning, and completing hazard mitigation projects including these (listed below), which received supplemental funding. It was also noted by the workgroup that there are several opportunities for grant funding from various federal and state resources including:[82]

Community Development Block Grant (CDBG) - The U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Recovery Assistance provides flexible grants to help cities, counties and states recover from Presidentially-declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. In response to disasters, Congress may appropriate additional funding for the CDBG program as disaster recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG Disaster Recovery assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources. Disaster Recovery grants often supplement the disaster

[82] https://dma.wi.gov/DMA/divisions/wem/mitigation/docs/HazardMitigationPlan/Appendix_C-Mitigation_Grants2.pdf

programs of FEMA, the SBA and the U.S. Army Corps of Engineers (i.e., these funds can be used for the local matching requirement of other federal grants).[83]

CDBG Emergency Assistance Program (EAP) Projects:

- EAP #09-01 Shawano and Waupaca Counties ($287,000) – Dam repairs

It was noted by the workgroup that there are several opportunities for grant funding from various federal and state resources including:

- **HMGP -** The Hazard Mitigation Grant Program (HMGP) is authorized by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended. The key purpose of HMGP is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster. HMGP is available, when authorized under the Presidential major disaster declaration, in the areas of the state requested by the governor.[84]
- **PDM -** The Pre-Disaster Mitigation (PDM) program is authorized by Section 203 of the Stafford Act, 42 U.S.C. 5133. The PDM program is designed to assist States, Territories, Indian Tribal governments, and local communities to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding from future major disaster declarations.[85]
    - PDM Projects Funded in the State
        - 2002 WEM All $15,520 Technical assistance Personnel, travel, and supplies
        - 2003 WEM All $32,834 Technical assistance Personnel, travel, and supplies
        - 2003C WEM All $176,812 Technical assistance Personnel, travel, and supplies

[83] http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/drsi
[84] http://www.fema.gov/hazard-mitigation-grant-program
[85] http://www.fema.gov/pre-disaster-mitigation-grant-program

- 2005C State of Wisconsin All $182,010 Development of structure inventory database
- 2005C WEM All $88,480 Technical assistance Personnel, travel, and supplies
- 2006C WEM All $22,141 Technical assistance Personnel, travel, and supplies
- 2007C WEM All $70,092 Technical assistance Personnel, travel, and supplies
- 2008C WEM All $23,897 Technical assistance Personnel, travel, and supplies
- 2008C WEM $18,906 Technical assistance LPDM; personnel, travel, and supplies
- 2009C WEM All $25,579 Technical assistance Personnel, travel, and supplies
- 2010C WEM All $47,859 Technical assistance Personnel, travel, and supplies

  - PDM Plans Funded in the State
    - 2005C Waupaca County Waupaca $ - New County withdrew
    - 2007C WEM All $402,574 Update Agreement with UW for HAZUS flood risk assessment

- **FMA -** The Flood Mitigation Assistance (FMA) program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). Targeting Repetitive Loss Properties and Severe Repetitive Loss properties, this program has the goal of reducing flood damages to individual properties for which one or more claim payments for losses have been made under flood insurance coverage and that will result in the greatest savings to the National Flood Insurance Fund (NFIF) in the shortest period of time.[86]

  - Flood Mitigation Assistance (FMA) Projects Funded in the State
    - 2003 WEM All $16,320 Technical support for applicants Personnel, travel, supplies
    - 2005 WEM All $11,464 Technical assistance to subgrantees Personnel, travel, supplies

[86] http://www.fema.gov/flood-mitigation-assistance-program

  - 2007 WEM All $4,020 Technical assistance to subgrantees Personnel, travel, supplies
  - 2010 WEM All $8,994 Technical assistance to subgrantees Personnel, travel, supplies

- **SRL** - The Severe Repetitive Loss (SRL) program is authorized by Section 1361A of the NFIA has the goal of reducing flood damages to residential properties that have experienced severe repetitive losses under flood insurance coverage and that will result in the greatest amount of savings to the NFIF in the shortest period of time.[87]

- **RFC -** The Repetitive Flood Claims (RFC) grant program was 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). Up to $10 million is available annually for the Federal Emergency Management Agency (FEMA) to provide RFC funds to assist states and communities to reduce flood damages to insured properties that have had one or more claims to the National Flood Insurance Program (NFIP). FEMA may contribute up to 100 percent of the total amount approved under the RFC grant award to implement approved activities, if the applicant has demonstrated that the proposed activities cannot be funded under the FFMA program. [88]

- **406 Mitigation** – The Public Assistance-Section 406 Mitigation Funding may be considered by FEMA in a federal disaster declaration to fund mitigation measures to a public facility damaged by the event that enhance the facility's ability to resist similar damage in future events. This funding is authorized under Section 406 of The Robert T. Stafford Disaster Relief and Emergency Assistance Act and provides discretionary authority to fund mitigation measures in conjunction with the repair of the disaster-damaged facilities, which usually present themselves during the repair efforts. The mitigation measures must be related to eligible disaster-related damages and must directly reduce the potential for future, similar disaster damages to the eligible facility. This work is performed on the parts of the facility that were actually damaged by the disaster and the mitigation provides protection from subsequent events. Mitigation measures must be determined to be cost-effective, technically feasible, and in compliance with statutory, regulatory, and executive order requirements. In addition, the measure cannot cause a negative

[87] http://www.fema.gov/severe-repetitive-loss-program
[88] http://www.fema.gov/repetitive-flood-claims-program

impact to the facility's operation, surrounding areas, or susceptibility to damage from another hazard.[89]

- **Municipal Flood Control Grant Program -** This Wisconsin Department of Natural Resources (DNR) grant is available to all cities, villages, towns, tribes and metropolitan sewerage districts. Assistance is provided with items such as the acquisition of property, vacant land, structure removal, flood proofing, administrative support, and others.[90] Waupaca County municipalities have not received any municipal flood control grants.
- **Dam Removal Grant Program -** This Wisconsin DNR grant is available to all cities, villages, towns, tribes, and metropolitan sewerage districts and provides 100% of eligible project costs up to a maximum of $50,000 to remove a dam. Assistance is provided with items such as: the acquisition of property, vacant land, structure removal, flood-proofing, administrative support, and others.[91] Waupaca County has not received any dam removal grants.

[89] http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/hazard-mitigation-funding-under-section-406-0
[90] http://dnr.wi.gov/Aid/MunFloodControl.html
[91] http://dnr.wi.gov/aid/damremoval.html

All Hazards

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 Waupaca 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 of the mitigation planning committee were:

- **Objective 1:** To preserve life and minimize the potential for injuries or death.
- **Objective 2:** To preserve and enhance the quality of life throughout Waupaca County by identifying potential property damage risks and recommending appropriate mitigation strategies to minimize potential property damage.
- **Objective 3:** To promote countywide planning that avoids transferring the risk from one community to an adjacent community, where appropriate.
- **Objective 4:** To identify potential funding sources for mitigation projects and form the basis for FEMA project grant applications.

Vulnerability

Perhaps the largest risk that falls under the all-hazards banner is the continuing challenge of securing funding to keep up with the rapid technological changes and advances in the public safety communications infrastructure. When departments cannot communicate with each other, they cannot be effectively coordinated in a disaster which could cause potential delays in providing critical services to citizens in need.

Also, it is a continuing challenge to ensure that emergency services can notify the public in a timely manner. Because of the nature of modern society, adequate notification requires multiple outlets but managing the usage, cost, and updates of these systems is an ongoing project for all communities.

Hazard Mitigation Strategies

In general, most of the projects that can be done with current budgetary dollars are not capital improvement projects and are not very expensive. Projects that require significant capital outlays are, for the most part, grant-dependent. Since the profile (e.g., economic, geographic) of an area may change between the identification of a project in this plan and the availability of grant funds, projects will be identified within the plan and be slated for detailed study and analysis at such time as grants become available. The detailed study will identify the types and numbers of existing and future structures, the potential dollar losses to vulnerable structures and the lead agency or department who will manage the project. At that point, grant-eligible projects will be evaluated using the appropriate grant criteria for factors such as:

- Overall benefit to the community
- Economic feasibility (i.e., a cost-benefit analysis)
- Compliance with environmental, social justice and other laws

The hazard mitigation strategies listed below are not “bricks and mortar” changes. Rather, they are enhancements to computer and radio equipment and plans that allow better communication with the public in times of crisis and therefore do not reduce effects for existing or future buildings and infrastructure.

Public Alert and Notification

Public alert and notification plans are vital in a time of crisis to reduce property damage and human casualties. An advance plan allows the appropriate authorities to perform their emergency duties in an efficient manner. Waupaca County will maintain the following:

- Facilities, systems and procedures to activate warning and communication capabilities
- Systems to support communications, including:
  - Sirens to warn the public
  - Telephone and radio to notify public personnel
  - Local television, radio and newspaper to spread warning information
  - Local law enforcement, fire and rescue communications
  - An emergency communications center

Waupaca County Emergency Management Department receives and distributes warning information to the public and emergency services agencies.

During an emergency, the general public receives information by sirens, NOAA weather radio, local broadcast or printed media, door-to-door notification by emergency services personnel, and/or the CodeRED™ system. It should be noted that the ability to use the NOAA weather radio system for an expanded list of emergency messages is a positive move that makes this alert and warning tool even more valuable. As a result, Waupaca County will continue to promote increased use of these radios, as well as the CodeRED™ System, among the public. The county emergency management office will also support similar campaigns sponsored by the National Weather Service. The City of Waupaca will continue to promote use of the radios on its website, Facebook, and utility bills.

The City of Waupaca also uses the county's CodeRED™.

Waupaca County should be capable of the following:

- Disseminate emergency warning and notification to the public though its county-wide warning systems,
- Support emergency management operations,

- Provide adequate warning and communication systems, and
- Plan for alternative means and resources in the event of a warning or communication system breakdown.

Waupaca County will prepare facilities, systems and procedures to activate warning and communication. During an emergency, Waupaca County will deliver prompt and accurate warnings to businesses and residents.

Website

The county Emergency Management office has a website which is used to provide information/links to disaster-specific information from FEMA, American Red Cross, Wisconsin Emergency Management, etc. They will regularly review the content of their website to ensure that important information and links are available. The county will also look for ways to publicize the website so that community members will know what valuable information is there.

Other municipalities in the county either currently maintain similar web pages or will be working to develop them. They will be regularly reviewed and updated as needed.

Tornado Sirens/Emergency Facilities

As technology improves and additional funding is made available, Waupaca County Emergency Management and the county's municipalities will consider updating and improving tornado sirens and other emergency facilities and equipment. Currently, each municipality activates their own sirens. The City of Waupaca's sirens can be activated by the city, as well as the county. The county is looking into the possibility of obtaining solar chargers; and they are considering installing external power panels or generators for the Emergency Operations Center (EOC), life stations, sirens and wells.

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.

Agricultural drought in a Wisconsin corn field in 2012.

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 Waupaca 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 Waupaca County. This assertion is further bolstered by the fact that there is very little irrigation done within the county and that the soils in Waupaca 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.

Physical Characteristics

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 online. [92]

2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to 1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2.0 and less	Extremely dry

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

[92] https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/indices/spi/div#select-form
[93] https://drought.unl.edu/ranchplan/DroughtBasics/WeatherandDrought/MeasuringDrought.aspx

unpredictable and may also be localized, making it difficult to determine probability with any accuracy.

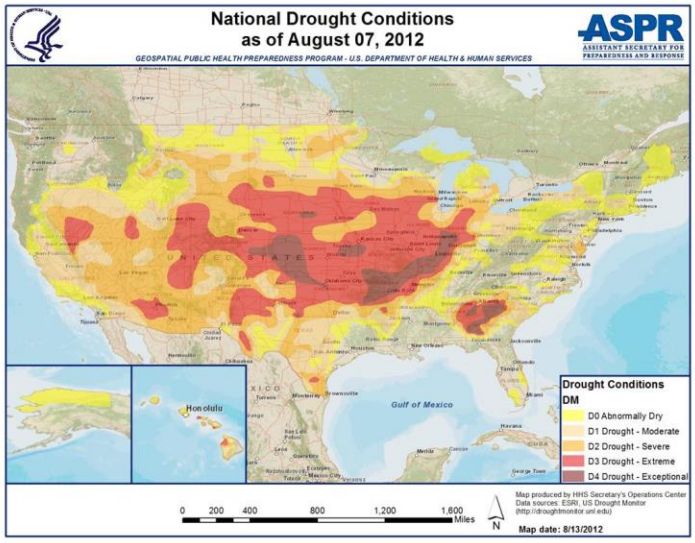
Drought conditions may vary from below-normal precipitation for a few weeks to a severe lack of normal precipitation for several months. Drought primarily affects agricultural areas because the amount and timing of rainfall has a significant impact on crop production. The severity of a drought cannot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

Frequency of Occurrence

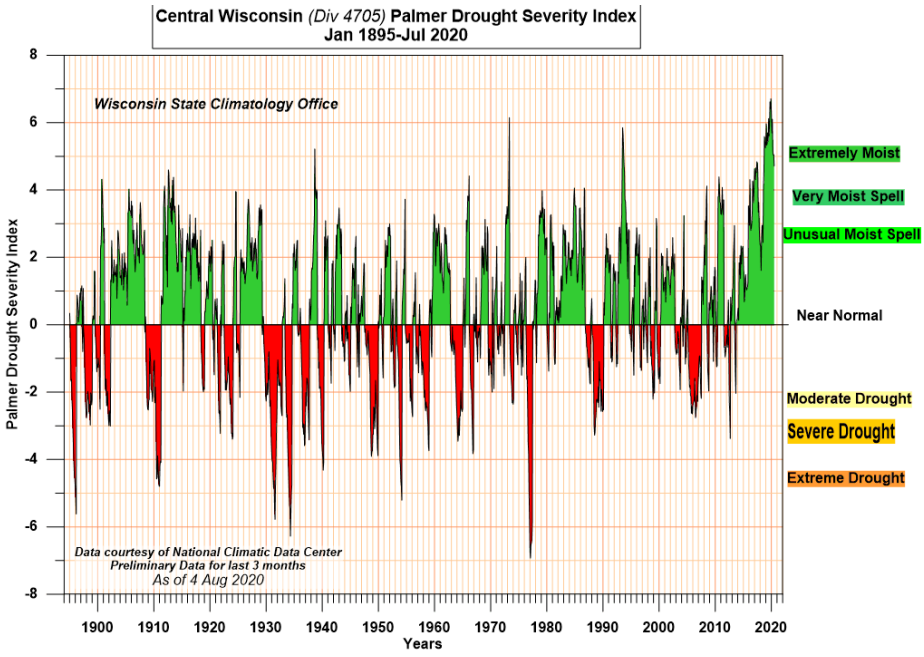
Drought is a relatively common phenomenon in Wisconsin and has occurred statewide in 1895, 1910, 1939, 1948, 1958, 1976, 1988, 1992, 2003, 2005 and 2012. The 1976 drought received a Presidential Emergency Declaration with damage to 64 Wisconsin counties, including Waupaca. Estimated losses of $624 million primarily affected the agricultural sector. Reports show that Waupaca County was as affected as the rest of the state in this drought, receiving money for emergency feed programs for livestock and for increased fire protection of its wilderness areas. It should be noted that only 19% ($119,434,924) of this loss was compensated by any federal program.

The 2012 heat wave resulted in significant droughts across more the half the country as well as increases in heat related illnesses and deaths. Although July, 2019 was the hottest month in U.S. history, conditions in July, 2012 caused severe drought conditions that eclipsed the record set during the heart of the Dust Bowl in 1936. The worst of the heat was in the Midwest, the Plains, and along the Eastern Seaboard. Most of the contiguous US had record and near-record warmth for the seven-month period, except the Pacific Northwest, which was near average. The August 7, 2012 Drought Monitor map shows 52.27% of the United States and Puerto Rico in moderate drought or worse with Waupaca County in the D2 – Severe Drought category.[94]

[94] 2012 Heat & Drought Federal Report, HHS ESF 8, UPDATE #2, U.S. Department of Health and Human Services, Assistant Secretary for Preparedness and Response



The Palmer Index chart for the years between January, 1895 and July, 2020 in Central Wisconsin, which includes Waupaca County, follows:[95]



[95] http://www.aos.wisc.edu/~sco/clim-watch/graphics/pdsi-ts-05-l.gif

As can be seen from the frequency table above, Waupaca County regularly experiences drought to at least a moderate level two to three times every ten years. While drought is a regular occurrence, it is generally very difficult to predict with any accuracy but according to the Wisconsin Hazard Mitigation Plan, "the NWS and National Integrated Drought Information System (NIDIS) are improving methodology to accurately forecast drought conditions. Both organizations use a combination of current and historical precipitation, streamflow, ground water, and crop data to perform short-term and long-term forecasts."[96]

On July 15, 2005, the Governor declared a drought emergency for the entire state of Wisconsin. This declaration, the first since August 2003, allowed farmers access to additional water for crop irrigation. The summer of 2012 was also extremely hot and dry across much of the United States, including Wisconsin. A table showing the drought events recorded by the National Weather Service for Waupaca County can be found in Appendix B.

Considering past occurrences, it can be surmised that Waupaca County has a medium probability of drought occurrence in the future. The probability of dust storm and damages due to dust storms would be low. Over the past 25 years a drought has occurred 10 times for an average of less than one time per year.

Vulnerability

Droughts and dust storms could impact Waupaca County disproportionately because approximately 35 - 53% of the land area is used for agricultural activities.[97] 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. The concern for agricultural losses due to drought is difficult to estimate because each incident will impact the county differently based on the length of the drought, when it occurs in the planting season, and which crops were planted in affected locations in that particular season but one can see, by looking at the agricultural statistics listed below, that this sector is an important part

[96] State of Wisconsin Hazard Mitigation Plan
[97] Waupaca County (draft) Farmland Preservation Plan 2013

of the Waupaca County economy and that the losses could be considerable:

- Average size of farms: 177 acres
- Average value of agricultural products sold per farm: $61,675
- Average value of crops sold per acre for harvested cropland: $124.05
- The value of livestock, poultry, and their products as a percentage of the total market value of agricultural products sold: 79.07%
- Harvested cropland as a percentage of land in farms: 58.80%
- Average number of cattle and calves per 100 acres of all land in farms: 23.18
- Corn for grain: 45,961 harvested acres
- All wheat for grain: 1,157 harvested acres
- Soybeans for beans: 17,477 harvested acres
- Vegetables: 3,672 harvested acres
- Land in orchards: 58 acres[98]

Drought is also a major risk factor for wildfire and 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 the municipal 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 Waupaca County, the population that lives outside of the cities and villages are generally on well water. There could also be a safety risk during dust storms if they are severe enough to reduce the visibility of the roadways for drivers.

[98] http://www.city-data.com/county/Waupaca_County-WI.html

Hazard Mitigation Strategies

The goal of drought and dust storm mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events.

Some Waupaca County communities have adopted water usage regulations during drought conditions but in general, mitigation strategies for periods of drought include:

- Providing information to farmers via website links and brochures regarding water conservation measures that can be employed during a drought. This information is currently available and is updated as needed.
- Prepare/publicize water usage regulations for non-farm areas during a drought. This information is currently available and is updated as needed.

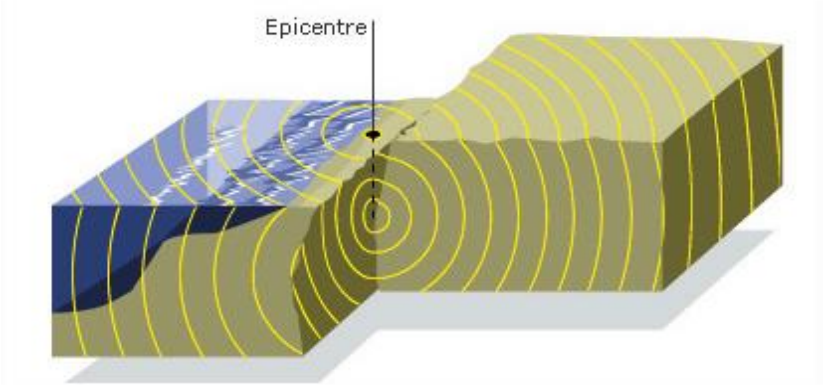
Waupaca County farmers can contact the University of Wisconsin – Extension Office and the Department of Agriculture Stabilization and Conservation Service (ASCS) for information and guidance related to drought. Various federal and state publications are available regarding ground water movement, the hydrologic cycle and irrigation methods. These agencies are also the lead agencies for obtaining emergency food and water supplies for agricultural use and for providing information regarding crop insurance.

Municipalities and the county will work together to ensure that drought considerations are included in emergency plans and will provide emergency information to homeowners as needed.

The hazard mitigation strategies listed above primarily involve providing information on water conservation measures to farmers and the public. Water conservation will ensure that the resource is available for critical residential, business, and agricultural uses (e.g., drinking, food irrigation, manufacturing, firefighting), and good farming practices may help prevent erosion of the rich topsoil found in Waupaca County. Since drought and dust storms are not hazards that affect buildings or traditional infrastructure (e.g., bridges, culverts) these strategies did not need to be designed to reduce damages to existing or future buildings and infrastructure.

Earthquakes

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).[99]



Physical Characteristics

Earthquakes can strike without warning and may range in intensity from slight tremors to great shocks. They can last from a few seconds to over five minutes and they may also occur as a series of tremors over a period of several days. The actual movement of the ground during an earthquake is seldom the direct cause of injury or death. Casualties usually result from falling objects and debris because the shocks have shaken, damaged or demolished buildings and other structures. Movement may trigger fires, dam failures, landslides or releases of hazardous materials that compound an earthquake's disastrous effect.

Earthquakes are measured by two principle methods: seismographs and human judgment. The seismograph measures the magnitude of an earthquake and interprets the amount of energy released on the Richter Scale, a logarithmic scale with no upper limit. For example, an earthquake measuring 6.0 on the Richter Scale is ten times more powerful than a 5.0 and 100 times more powerful than a 4.0. This is a measure of the absolute size or strength of an earthquake and does not consider the effect at any specific location. The Modified

[99] http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/earthquake_guide.pdf

Mercalli Intensity (MMI) Scale measures the strength of a shock at a particular location (i.e., intensity).

A third less often used way of measuring an earthquake's severity involves comparing its acceleration to the normal acceleration caused by the force of gravity. The acceleration due to gravity, often noted "g," is equal to 9.8 meters per second. Peak Ground Acceleration (PGA) measures the rate of change of motion relative to the rate of acceleration due to gravity and is expressed as a percentage. These three scales can be roughly correlated, as expressed in the table that follows:[100]

Earthquake PGA, Magnitude and Intensity Comparison Table			
PGA [%g]	**Magnitude [Richter]**	**Intensity [MMI]**	**Description [MMI]**
<0.17	1.0 - 3.0	I	I. Not felt except by a very few under especially favorable conditions.
0.17 - 1.4	3.0 - 3.9	II - III	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.
1.4 - 9.2	4.0 - 4.9	IV - V	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 cars rock noticeably. V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2 - 34	5.0 - 5.9	VI - VII	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.
34 - 124	6.0 - 6.9	VII - IX	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.
>124	7.0 and higher	VIII or higher	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.

[100] Wald, Quitoriano, Heaton and Kanamori, 1999

Most of Wisconsin's occurrences have not been severe, with only one registering above 5.0 on the Richter Scale.

Frequency of Occurrence

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. 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.

Date	Location	Latitude North	Longitude West	Maximum Intensity	Magnitude
10/12/1899	Kenosha	42° 34'	87° 50'	II	3.0
3/13/1905	Marinette	45° 08'	87° 40'	V	3.8
4/22/1906	Shorewood	43° 03'	87° 55'	II	3.0
4/24/1906	Milwaukee	43° 03'	87° 55'	III	--
1/10/1907	Marinette	45° 08'	87° 40'	III	--
5/26/1909	Beloit	42° 30'	89° 00'	VII	5.1 (max)
10/7/1914	Madison	43° 05'	89° 23'	IV	3.8
5/31/1916	Madison	43° 05'	89° 21'	II	3.0
7/7/1922	Fond du Lac	43° 47'	88° 29'	V	3.6
10/18/1931	Madison	43° 05'	89° 23'	III	3.4
12/6/1933	Stoughton	42° 54'	89° 15'	IV	3.5
11/7/1938	Dubuque	42° 30'	90° 43'	II	3.0
11/7/1938	Dubuque	42° 30'	90° 43'	II	3.0
11/7/1938	Dubuque	42° 30'	90° 43'	II	3.0
2/9/1943	Thunder Mountain	45° 11'	88° 10'	III	3.2
5/6/1947	Milwaukee	43° 00'	87° 55'	V	4.0
1/15/1948	Lake Mendota	43° 09'	89° 41'	IV	3.8
7/18/1956	Oostburg	43° 37'	87°45'	IV	3.8
7/18/1956	Oostburg	43° 37'	87°45'	IV	3.8
10/13/1956	South Milwaukee	42° 55'	87°52'	IV	3.8
1/8/1957	Beaver Dam	42° 32'	98°48'	IV	3.6
2/28/1979	Bill Cross Rapids	45° 13'	89°46'	--	<1.0 MoLg
1/9/1981	Madison	43° 05'	87°55'	II	--
3/13/1981	Madison	43° 37'	87°45'	II	--
6/12/1981	Oxford	43° 52'	89°39'	IV-V	--
2/12/1987	Milwaukee	42° 95'	87°84'	IV-V	--
2/12/1987	Milwaukee	43° 19'	87°28'	IV-V	--
6/28/2004	Troy Grove, IL	41° 46'	88°91'	IV	4.2

A 2012 article published in the Milwaukee Journal-Sentinel discussed an incident in Waupaca County that was not an earthquake as traditionally discussed and understood. This episode is highlighted in this plan because it was widely reported in the state:[101]

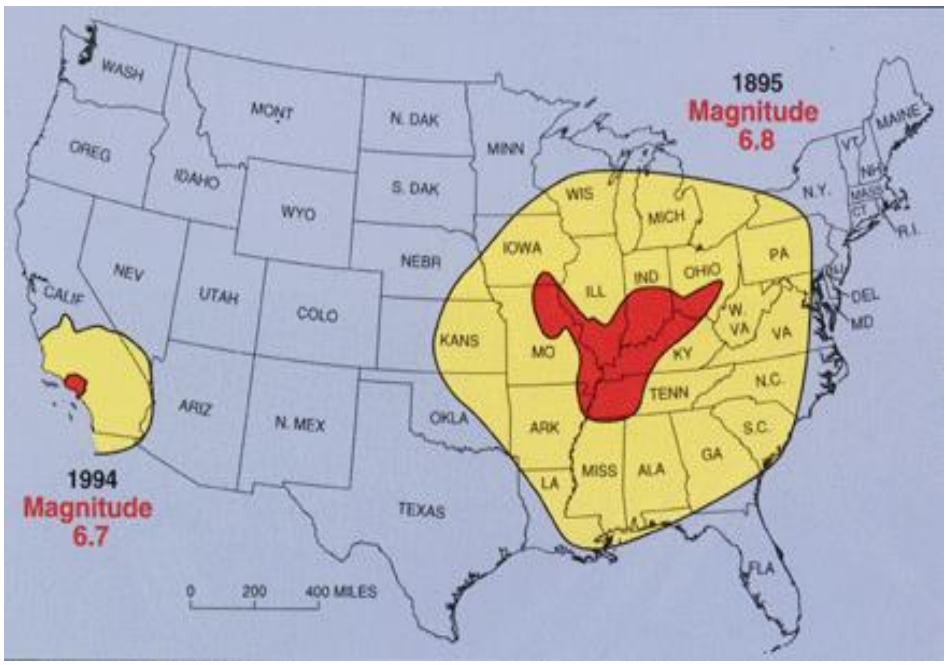
> *A 1.5-magnitude earthquake was recorded at 12:15 a.m. March 20 beneath Clintonville, according to the National Earthquake Information Center. The center is operated by the U.S. Geological Survey.*
>
> *The U.S. Geological Survey said several days of booms and vibrations that rattled windows and nerves last week likely were caused by a swarm of small earthquakes.*
>
> *Scientists at the Wisconsin Geological and Natural History Survey in Madison said the low-intensity seismic activity could have been produced by a phenomenon known as postglacial rebounding.*
>
> *Granite bedrock beneath eastern Waupaca County is slowly adjusting to a great weight being lifted off it when the last glacier melted more than 10,000 years ago. As the granite stretches, rising only a few millimeters a year, it can crack to relieve pressure, according to David Hart, a geophysicist at the Wisconsin Geological and Natural History Survey.*
>
> *As it cracks, one piece slides or shifts places, releasing enough energy to create a seismic wave that rises to the surface.*
>
> *There is no known geologic fault beneath central Wisconsin so the postglacial rebounding is the only thing stretching the bedrock crust in the state, Hart said.*

This phenomenon was widely reported in local, state, and national news and drew interest from the public.

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

[101] http://www.jsonline.com/news/wisconsin/rumbling-booming-resumes-in-clintonville-6e4p9o8-144653925.html

8.3 magnitude earthquake at the New Madrid Fault, however, would cause only minor damage in Wisconsin, and only in the southeastern corner of the state. At this time it is not possible to predict the exact date, duration, or magnitude of an earthquake.



As seen on the map in Appendix A, the earthquake threat to Waupaca County is considered very low (the 50-year acceleration probability is 4%). 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 low.

Vulnerability

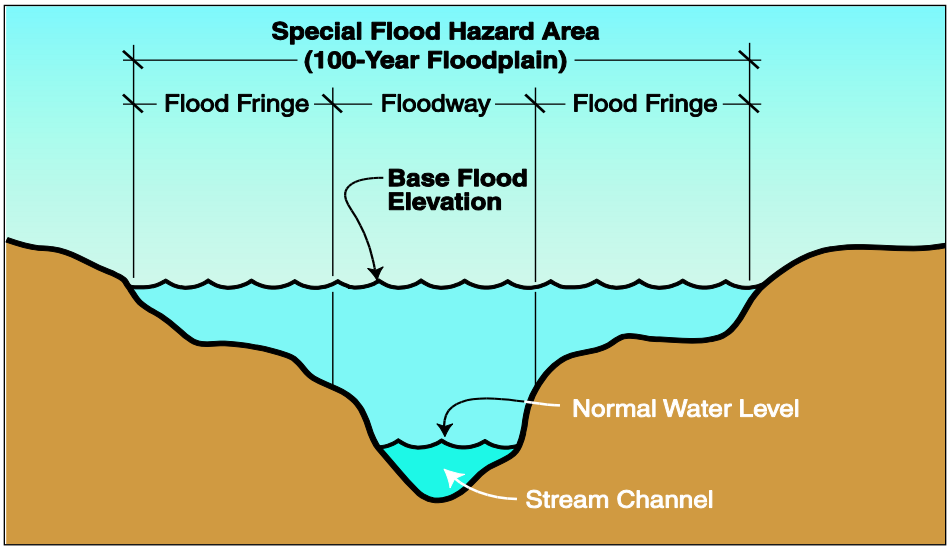
Any impact in the community from earthquake would likely be due to a few broken windows and personal effects that fell in the earthquake. The damage to critical infrastructure and buildings would be negligible although there could be indirect effects from any unlikely losses to the electrical grid, transportation routes/goods shipments and pipelines.

Hazard Mitigation Strategies

Since Waupaca County is not likely to suffer directly from a severe earthquake, the community impacts are not considered significant and mitigation planning for this hazard is not necessary. If there is ever a need, obviously emergency resources will be mobilized but the goal for this section of the plan is therefore to educate on the low risks of earthquake damage in Waupaca County.

Flooding and Dam Failure

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.[102]



Floods are common in the United States, including Wisconsin, and are considered natural events that are hazardous only when adversely affecting people and property.

Physical Characteristics

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.

[102] FEMA, August 2001

Flooding that occurs in the spring due to snow melt or during a period of heavy rain is characterized by a slow buildup of flow and velocity in rivers and streams over a period of days. This buildup continues until the river or stream overflows its banks, for as long as a week or two, then slowly recedes. Generally the timing and location of this type of flooding is fairly predictable and allows ample time for evacuation of people and property.

For prediction and warning purposes, floods are classified by the National Weather Service into two types: those that develop and crest over a period of approximately six hours or more and those that crest more quickly. The former are referred to as "floods" and the latter as "flash floods". Flash flooding occurs solely from surface run-off that results from intense rainfall. Flash flooding occurs less frequently in Wisconsin than flooding associated with spring snow melt but it is unpredictable.

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.

Terms commonly used when referring to flooding are "100-year flood" and "flood plain". A "100-year flood" is defined as the flood water level that can be expected to occur or to be exceeded in magnitude in any given year.

Flood Probability Terms Table[103]

Flood Recurrence Intervals	Percent Chance of Occurrence Annually
10 year	10.0%
50 year	2.0%
100 year	1.0%
500 year	0.2%

The Wisconsin Department of Natural Resource (DNR), working with local zoning offices, has designated flood plain areas as those places where there is the greatest potential for flooding. 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

[103] State of Wisconsin Hazard Mitigation Plan, 4-28.

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.

The Wisconsin DNR database lists the following small, uncontrolled agricultural dams included in Waupaca County: [104]

Dam Official Name (Popular Name)*	Size	Latitude	Longitude	Owner Type	Waterway Name (Downstream City)
BIG FALLS	LARGE	44.6194941	-89.0150796	Village	LITTLE WOLF RIVER
MARION	LARGE	44.67286	-88.88822	City	NORTH BRANCH PIGEON RIVER
KELLER	LARGE	44.6422117	-88.9784951	County	SOUTH BRANCH PIGEON RIVER
CLINTONVILLE	LARGE	44.62327	-88.76194	City	
MANAWA	LARGE	44.4661067	-88.919182	City	LITTLE WOLF RIVER
OGDENSBURG	LARGE	44.453974	-89.0330353	Village	
FELT MILL	LARGE	44.3435615	-89.0706497	Private	
LIGHTING PLANT	LARGE	44.3629916	-89.0865754	Private	
HARTMAN CREEK NUMBER FIVE	LARGE	44.3254843	-89.2168674	DNR	
IOLA	LARGE	44.5093617	-89.1304328	Village	
SCANDINAVIA	LARGE	44.4579062	-89.1480029	Village	

[104] https://dnr.wi.gov/damsafety/damSearch.aspx

Dam Official Name (Popular Name)*	Size	Latitude	Longitude	Owner Type	Waterway Name (Downstream City)
HARTMAN CREEK NUMBER ONE	LARGE	44.3260232	-89.2020899	DNR	HARTMAN CREEK
WEYAUWEGA	LARGE	44.3246383	-88.9336467	Private	WAUPACA RIVER
WHITE LAKE	LARGE	44.3736256	-88.9168805	County	WHITE LAKE
NORTHLAND	SMALL	44.596045	-89.208727	County	SOUTH BRANCH LITTLE WOLF
CRYSTAL	LARGE	44.3192011	-89.1098593	County	
RURAL	SMALL	44.312806	-89.1594662	Private	CRYSTAL RIVER
PLANING MILL (FALGATTER)	SMALL	44.355847	-89075876	Private	WAUPACA RIVER
AULD AND ROHRER	SMALL	44.6766022	-88.6836814	Private	
COTEY	SMALL	44.5389452	-89.0244461	Private	UNNAMED CREEK
ALLEN CREEK 2	SMALL	44.330073	-89.210498	DNR	ALLEN CREEK
PETERSON MILL	SMALL	44.4435061	-88.9466344	Private	PETERSON CREEK
NELSON MILL POND	SMALL	44.2738977	-89.2200956	Private	MURRY CREEK
GRENLIE	SMALL	44.430388	-89.205446	DNR	GRENLIE LAKE
HARTMAN CREEK 3	SMALL	44.325539	-89.209365	DNR	OUTLET TO HARTMAN LAKE
HARTMAN CREEK 2	SMALL	44.325554	-89.209059	DNR	BYPASS TO HARTMAN CREEK
RASMUSSEN, HARRY	SMALL	44.397038	-89.0630307	Private	UNNAMED CREEK
BONNELL, JOHN	SMALL	44.3289698	-88.9751052	Private	WAUPACA RIVER
MCKELLIPS, ROGER	SMALL	44.3495528	-88.8846302	Private	UNNAMED CREEK
CEDAR CREEK	SMALL	44.40886	-88.78341	Private	CEDAR CREEK
ROSENBACKER	SMALL	44.3814291	-89.1787867	Private	UNNAMED CREEK
SHERMAN MILL	SMALL	44.375542	-89.215970	Private	WAUPACA RIVER
BUCKBEE	N/A	44.648678	-88.834634	Private	S. BRANCH PIGEON RIVER
ROYALTON	N/A	44.412385	-88.864730	Unknown	LITTLE WOLF RIVER
MEIKLJOHN	N/A	44.418882	-88.902312	Unknown	LITTLE WOLF RIVER
NOHRS	N/A	44.635836	-88.899746	Private	S. BRANCH PIGEON RIVER
SYMCO	SMALL	44.513560	-88.904842	Private	LITTLE WOLF RIVER

Dam Official Name (Popular Name)*	Size	Latitude	Longitude	Owner Type	Waterway Name (Downstream City)
ANDERSON	SMALL	44.599764	-89.204073	Private	S. BRANCH LITTLE WOLF RIVER
BRICK YARD	SMALL	44.344071	-89.044964	Private	WAUPACA RIVER
HATTON	SMALL	44.270733	-88.985212	Private	WALLA WALLA CREEK
COBB TOWN	SMALL	44.375061	-89.215929	Private	WAUPACA RIVER
WAUPACA CITY	N/A	44.360487	-89.083500	City	WAUPACA RIVER
KINNEY LAKE DAM		44.6592426	-88.960842	County	KINNEY LAKE
HWY 10 WETLAND RESOTRATION	N/A	44.334440	-88.943518	County	WAUPACA CO. FARM DITCH
WAUPACA LAND CONSERVATION DI	SMALL	44.2431743	-89.1815296	County	
MATTHES	SMALL	44.6214639	-89.2139035	Private	
ROHAN-LOWNEY	SMALL	44.531398	-88.7717706	County	UNNAMED
WAUPACA INDUSTRIAL PARK	SMALL	44.356019	-89.030077	City	UNNAMED
VERKUILEN #1 WOODS	SMALL	44.5430236	-88.9785998	Private	UNNAMED
VERKUILEN #2 NORTH	SMALL	44.5426874	-88.9764623	Private	UNNAMED
VERKUILEN #3 MIDDLE	SMALL	44.5394365	-88.9758395	Private	UNNAMED
VERKUILEN #4 SOUTH	SMALL	44.5391194	-88.9758302	Private	UNNAMED
SCHOMMER	SMALL	44.419394	-89.187374	Private	UNNAMED
YOUNG	SMALL	44.537356	-88.754236	Private	UNNAMED TRIB TO SILVER CREEK
DUNLAVY	SMALL	44.544323	-88.825461	Private	BLACK CREEK TRIBUTARY
CORNELIUS	SMALL	44.34999	-89.0084855	Private	UNNAMED
STEINBERG	SMALL	44.32194	-88.7837746	Private	UNNAMED
O'CONNOR NW	SMALL	44.65128	-88.7313447	Private	UNNAMED
O'CONNOR SW	SMALL	44.64846	-88.7248734	Private	UNNAMED
O'CONNOR POND	SMALL	44.64702	-88.7253374	Private	UNNAMED
KIRCHNER	SMALL	44.61759	-88.8013227	Private	UNNAMED
FOUNTAIN DALE FARMS	SMALL	44.46989	-88.9823108	Private	UNNAMED
ZANDER	SMALL	44.49628	-88.94869	Private	UNNAMED

Dam Official Name (Popular Name)*	Size	Latitude	Longitude	Owner Type	Waterway Name (Downstream City)
BUCK LAKES OUTLET #1	SMALL	44.63232	-88.96522	Private	TRIBUTARY TO S BRANCH PIGEON RIVER
BUCK LAKES NORTH #2	SMALL	44.6313	-88.96513	Private	TRIBUTARY TO S BRANCH PIGEON RIVER
BUCK LAKES SOUTH #3	SMALL	44.63068	-88.96623	Private	TRIBUTARY TO S BRANCH PIGEON RIVER
BUCK LAKES WEST #4	SMALL	44.63115	-88.96785	Private	TRIBUTARY TO S BRANCH PIGEON RIVER
SPLITT SW	SMALL	44.561310	-88.810800	Private	UNNAMED
SPLITT SE	SMALL	44.562210	-88.808800	Private	UNNAMED
SPLITT E	SMALL	44.564790	-88.802320	Private	UNNAMED
SPLITT NW	SMALL	44.563230	-88.810410	Private	UNNAMED
CLINTON	SMALL	44.524120	-88.810760	Private	UNNAMED
WICHMAN	SMALL	44.634400	-88.947960	Private	UNNAMED
WICHMAN	SMALL	44.635610	-88.938460	Private	UN TRIBUTARY TO S BRANCH PIGEON RIVER
SMITH	SMALL	44.396282	-88.880675	Private	LITTLE WOLF TRIB
GLOCKE	SMALL	44.461152	-88.959461	Private	UNNAMED
MAZEMKE	SMALL	44.468050	-88.958289	Private	UNNAMED
SCHNEIDER	SMALL	44.276442	-88.756356	Private	NATHAN'S CREEK
RAE	SMALL	44.492775	-88.941502	Private	UNNAMED
RISKE	SMALL	44.558503	-88.883556	Private	
LAUTENSCHLAGER	SMALL	44.537021	-88.847163	Private	UNNAMED
OESTERREICH	SMALL	44.660462	-88.692110	Private	UNNAMED
DUNLAVY	SMALL	44.542864	-88.827077	Private	BEAR CREEK TRIB
GASMAN	SMALL	44.2689421	-89.0260267	Private	UNNAMED

Most of these dams are small, mill-type dams under the jurisdiction of the DNR and are also privately owned. 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 Waupaca County.

The Wisconsin Department of Natural Resources assigns hazard ratings to large dams within the state. When assigning hazard

ratings, two factors are considered: existing land use and land use controls (zoning) downstream of the dam. Dams are classified into three categories that identify potential hazards to life and property downstream should the dam fail. A high hazard indicates that a failure would most probably result in the loss of life. A significant hazard indicates a failure could result in appreciate property damage. A low hazard exists where failure would result in only minimal property damage and loss of life is unlikely. For Waupaca County, there are three dams that have a high hazard rating –Marion, Ogdensburg and Felt Mill. One has a significant rating, while the rest are low.

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 Waupaca County, there is concern about ensuring the stabilization of the shorelines.

Watersheds

There are 12 watersheds in one basin covering Waupaca County. For water resource planning purposes, each river basin is further divided into watersheds. Following is a brief description of each watershed:

Lake Michigan Basin

Arrowhead River and Daggets Creek Watershed (WR01) [105]

The Arrowhead River and Daggets Creek Watershed covers approximately 135 square miles in Winnebago, Waupaca and Outagamie counties. A small part of the watershed, about one percent, is located in Waupaca County.

The Winnebago Comprehensive Management Plan (WCMP) rated an 8.2 mile priority strip along the Arrowhead River as high priority for NPS pollution abatement activities. Major problems in this watershed include excessive vegetation, dissolved oxygen standard

[105] https://dnr.wi.gov/water/watershedDetail.aspx?key=924876

violations, and critical levels of soil loss. The watershed contributes an estimated 0.5 pounds of phosphorus per acre per year to the Lake Winnebago pool lakes.

The east half of the village of Winneconne is the only incorporated Waupaca County community located within this watershed. Unincorporated Winnebago County communities in the watershed include Allenville, Butte des Morts, Larsen, Medina, and Winchester. Approximately 10,200 people live in the watershed.

The entire watershed is within the Lower Fox River Designated Planning Area. Only seven percent of the watershed is developed land. Fifty-one percent of the watershed is in agricultural use and 21 percent is wetlands. Undeveloped grasslands and woodlands comprise the remaining 21 percent.

Lower Little Wolf River Watershed (WR06) [106]

The Lower Little Wolf River watershed is 152 square miles and lies in central Waupaca County. Approximately 27 miles of the Little Wolf River are in this watershed, from the confluence of the South Branch Little Wolf River (WR08) to the dam at Big Falls.

The Winnebago Comprehensive Management Plan ranked this watershed as a medium priority for watershed selection due to local soil erosion and animal waste problems. The data search for the Wolf River Basin Plan indicated that problems related to polluted runoff exist in this watershed.

The Lower Little Wolf River Watershed was selected as a priority watershed in 1995 and expired at the end of year 2008. The priority watershed plan was be prepared cooperatively by the WDNR, the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP), and the Waupaca Land and Water Conservation Department, with assistance from the University of Wisconsin-Extension and the USDA Natural Resources Conservation Service (NRCS). The approved watershed plan is considered an amendment to this plan.

The soils, geology and other physical resources of the western and central 20 percent of this watershed indicate the area is highly susceptible to groundwater contamination by poor land use practices. The remaining 80 percent of the watershed lies in an area

[106] https://dnr.wi.gov/water/watershedDetail.aspx?key=924773

of medium susceptibility. A data search revealed groundwater samples contaminated mainly from pesticides.

Lower Wolf River Watershed (WR04) [107]

The Lower Wolf River watershed is 120 square miles and covers parts of Outagamie, Waupaca and Winnebago Counties. This includes a portion of the main stem Wolf River from the junction with the Embarrass River to the mouth of the Waupaca River, including the lower portion to the Weyauwega millpond. The main stem Wolf River flows within the watershed for about 19 miles and contains a diverse warm water sport fishery. Wetlands adjacent to the river provide excellent spawning grounds for these fish.

Those portions of the watershed within Winnebago and Outagamie counties are in the Lower Fox River Designated Planning Area.

There is one industrial point source discharger and one municipal point source discharger in the Lower Wolf River Watershed: Hillshire Brands Company Sara Lee Foodservice and the City of New London.

Middle Wolf River Watershed (WR14) [108]

The 128-square-mile Middle Wolf River Watershed is in Shawano, Waupaca and Outagamie Counties. The watershed extends from the Shawano Dam to where the Shioc River meets the Wolf River north of Shiocton and holds 47 miles of the Wolf River.

The Winnebago Comprehensive Management Plan ranked the Middle Wolf River watershed a high priority due to animal waste problems and soil erosion rates of 3.1 tons/acre/year. The data search for the Wolf River Basin Plan found that streams of this watershed, including the main stem Wolf River, are suffering from streambank erosion and animal waste problems.

Groundwater concerns were ranked as medium under the priority watershed selection process. The northern 20 percent of the watershed are of highest concern for groundwater contamination due to poor land use practices. The remaining 80 percent of the land is of medium susceptibility.

North Branch and Mainstem Embarrass River Watershed (WR09) [109]

[107] https://dnr.wi.gov/water/watershedDetail.aspx?key=924877
[108] https://dnr.wi.gov/water/watershedDetail.aspx?key=924777
[109] https://dnr.wi.gov/water/watershedDetail.aspx?key=924774

The North Branch and Mainstem Embarrass River Watershed lies in Outagamie, Waupaca, and Shawano Counties and covers 292 square miles. This watershed includes 99 miles of the North Branch and Mainstem of the Embarrass River. Those portions in Outagamie County are in the Lower Fox River Designated Planning Area. See the Fox Valley Water Quality Planning Agency (FVWQPA) planning documents for additional information.

The Winnebago Comprehensive Management Plan ranked this watershed a high priority because of critical animal waste and soil erosion problems. Data for the Wolf River Basin plan indicates severe polluted runoff problems exist, with heavy soil losses, impaired fisheries, excess vegetation, and dissolved oxygen violations.

There are two industrial point source dischargers and three municipal point source dischargers in the North Branch and Mainstem Embarrass River Watershed: Village of Bear Creek, Village of Bowler, Embarrass/Cloverleaf Lakes Sanitary District No. 1, Flanagan Brothers, Inc., and the Oak Grove Cheese Factory.

Pigeon River Watershed (WR10) [110]

The Pigeon River Watershed lies in south central Shawano and north central Waupaca Counties and covers 115 square miles. This also includes 25 miles of the South Branch of the Pigeon River.

The Winnebago Comprehensive Management Plan ranked the Pigeon River a high priority due to animal waste and soil erosion problems with a critical average soil loss rate of 3.7 tons per acre per year.

The data search for the Wolf River Basin Plan indicated problems with excess vegetation, turbidity, and habitat degradation.

The soils, geology, and other physical resources in the watershed's northwest portion indicate it is highly susceptible to groundwater contamination by poor land use practices. Approximately 70 percent of the remaining land area is of medium susceptibility. A data search revealed no runoff-related groundwater contamination problems in this area.

Three industrial point source dischargers and two municipal point source dischargers are in this watershed: City of Clintonville, City of

[110] https://dnr.wi.gov/water/watershedDetail.aspx?key=924879

Marion, DuPont Cheese Factory, FWD Corporation, and Marion Plywood.

Pine and Willow Rivers Watershed (WR02) [111]

The Pine River and Willow Creek watershed is the southernmost watershed of the Wolf River Basin and is located in Waupaca, Waushara, and Winnebago counties. This watershed covers 286 square miles. This watershed drains directly to Lake Poygan and the surface water drainage from the majority of this watershed is filtered by the Poygan Marsh Wildlife Area.

The soils, geology, and other physical resources of this watershed's western half indicate the area is highly susceptible to groundwater contamination from poor land use practices.

The Pine River Willow Creek Watershed was selected as a priority watershed in 1995, a status which expired at the end of 2009. The priority watershed plan was prepared cooperatively by the WDNR, the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP), the Waushara County Land Conservation Department, and the Winnebago Land and Water Conservation Department, with assistance from the University of Wisconsin-Extension and the USDA Natural Resources Conservation Service (NRCS).

The City of Wautoma and the Towns of Dakota, Marion, and Wautoma recently contracted with East Central Wisconsin Regional Planning Commission to develop a cooperative land use/development plan. The map based plan will inventory resources, identify patterns, trends, and needs, and offer recommendations for areas for growth. The four communities recognize the benefits of joint planning as they deal with increasing concerns about municipal services (including sewer service) and future growth. This planning initiative provides the communities with an opportunity to take steps to protect the water resources in their area.

Those portions of the watershed within Winnebago County are located in the Lower Fox River Designated Planning Area.

Pine River and Willow Creek are clear, hard-water streams that drain the center two-thirds of Waushara County. Substantial critical animal waste problems affect the eastern half of this watershed, though detailed inventories are needed. Soil erosion, at rates above 2 tons per acre per year, combined with local animal waste delivery and in-

[111] https://dnr.wi.gov/water/watershedDetail.aspx?key=924915

stream erosion have accelerated the deterioration of trophic status of millponds on the Pine River and Willow Creek. WDNR Water Resources Management staff should conduct basin assessment trend stream monitoring on Willow Creek and Pine River to assess long term water quality trends in the Wolf River Basin, and to provide data for determining effluent limitations for the wastewater treatment plant and the fish hatchery.

This watershed ranked "high" as a priority for streams and "medium" as a priority for groundwater under the Nonpoint Source Priority Watershed selection process. Insufficient data on lakes in this watershed prevented their inclusion in this round of priority watershed rankings.

The Winnebago Comprehensive Management Plan rated this watershed a high priority for corrective measures due to critical animal waste problems and in-stream erosion. The data search for the Wolf River Basin Plan indicates polluted runoff-related problems, with excess vegetation and habitat deterioration.

There are five municipal point source dischargers and four industrial point source dischargers in the Pine River and Willow Creek Watershed. They are: Lauritzen Inc., Leach Farms, North Lake Poygan Sanitary District, Poygan Sanitary District No. 1, Poysippi Sanitary District, Redgranite Village, Ripon Pickle Company, Wild Rose Village, and the WDNR Wild Rose Fish Hatchery.

South Branch Little Wolf River Watershed (WR08) [112]

The South Branch Little Wolf River Watershed is approximately 165 square miles and is in Waupaca and Portage Counties. It also contains 64 miles of the South Branch of the Little Wolf River.

The South Branch Little Wolf River watershed drains portions of the planning area generally to the north and east of the city of Waupaca and contains the South Branch Little Wolf River as the major water feature. Drainage generally flows northeastward through small tributaries to the Little Wolf River and eventually drains into the Wolf River and the Lake Winnebago/Fox River/Green Bay system.

This watershed ranks high for lakes and groundwater and low for streams according to the WDNR's draft Upper Fox River Basin Plan (1997). No point-source dischargers are contained within the Planning Area for this watershed.

[112] https://dnr.wi.gov/water/watershedDetail.aspx?key=924897

Upper Little Wolf River Watershed (WR07) [113]

The Upper Little Wolf River watershed is in Marathon, Portage, Shawano, and Waupaca Counties and covers 171 square miles. This watershed includes 61 miles of the Little Wolf River and its tributaries above the Big Falls Dam.

The Winnebago Comprehensive Management Plan lists the Upper Little Wolf River watershed as a "medium" priority for watershed selection due to local significant animal waste problems and a soil erosion rate of 2.2 tons per acre per year. Data for the Wolf River Basin indicates that habitat deterioration occurs from streambank pasturing and cropland runoff.

The soils, geology, and other physical resources of the entire watershed indicate it is highly susceptible to groundwater contamination by poor land use practices.

Prime Veal is the only industrial point source discharger and Rosholt Sewer Commission is the only municipal point source discharger in the Upper Little Wolf River Watershed.

Walla Walla and Alder Creeks Watershed (WR03) [114]

The Walla Walla and Alder Creek Watershed (locally known as Walla Walla Creek Watershed) lies in portions of Waupaca, Waushara, and Winnebago Counties on the northwest shore of Lake Poygan.

Those portions of the watershed within Winnebago County are in the Lower Fox River Designated Planning Area.

The Winnebago Comprehensive Management Plan rated this watershed a high priority due to critical animal waste problems and soil loss. The Wolf River Basin Plan data indicates polluted runoff problems with excess vegetation and habitat deterioration. Approximately 20 percent of the watershed (in the western part) is highly susceptible to groundwater contamination.

The Village of Fremont is the only point source discharger in the Walla Walla and Alder Creek Watershed.

The 97 square-mile watershed is ranked number one in the Waupaca County Animal Waste Management Plan for concerns over both surface and groundwater. A substantial number of medium to high

[113] https://dnr.wi.gov/water/watershedDetail.aspx?key=924878
[114] https://dnr.wi.gov/water/watershedDetail.aspx?key=924926

priority barnyard/feedlot operations exist in the Waushara County portion, with many of these draining directly into Lake Poygan via man-made ditches.

In the Winnebago County portion, three barnyard/feedlot operations were ranked as critical polluted runoff pollution hazards, one was ranked as high priority, and three as medium priority. Average soil erosion rates are 3.1 tons per acre per year in Waupaca County, 3.5 tons per acre per year in Waushara County, and 2.0-3.0 tons per acre per year in Winnebago County. This watershed drains directly to Lake Poygan and is likely to affect lake water quality during storms.

Waupaca River Watershed (WR05) [115]

The Waupaca River watershed is 292 square miles and lies almost entirely in Portage and Waupaca counties. A small part of its southwestern portion is in Waushara County. The river's name changes as it flows from Portage County to Waupaca County. In Portage County it is called the Tomorrow River. In Waupaca County, it is the Waupaca River, which in its entirety runs approximately 63 miles.

The Waupaca River's major tributary, the Crystal River, ties into the system from the south and is included within the planning area and is classified as Class II trout waters. The Crystal River is the outlet to the Chain O' Lakes (Long Lake) which is a very prominent recreational and residential area consisting of 22 interconnected lakes.

These lakes comprise approximately 725 acres and is considered as part of the Tomorrow/Waupaca River Priority Watershed Project. Recent changes to the Waupaca County Shoreland Ordinance should improve this resource from a development standpoint in the future.

The Waupaca River Watershed was selected as a priority watershed project in 1993, a status which expired at the end of the year 2007. A priority watershed plan was prepared cooperatively by WDNR, DATCP, NRCS, University of Wisconsin Extension, Portage County Land Conservation Department, Waupaca County Land and Water Conservation Department, and Waushara County Land Conservation Department.

[115] https://dnr.wi.gov/water/watershedDetail.aspx?key=924772

The soils, geology and other physical resources of the western 95 percent of this watershed indicate that this area is highly susceptible to groundwater contamination due to poor land use practices. A data search revealed groundwater samples with contamination, mainly pesticides, in this area.

Almost half (48%) of the total area of the Waupaca River Watershed is reserved for agricultural use. Forest cover accounts for over a third (35%) of the area. Open water and open space and wetlands each amount to six percent of the watershed's area, and grassland covers almost three percent. Suburban and urban landscapes are the least common type of land use in the watershed with only two percent and one-half of one percent of the area, respectively.

Point Sources: There are three industrial point source dischargers and four municipal point source dischargers in the Waupaca River Watershed: Village of Amherst, City of Waupaca, Wisconsin DVA Veterans Home, Waupaca Foundry Inc. (plants 1, 2, and 3), City of Weyauwega, Weyauwega Milk Products, and the Weyauwega Star Dairy.

CAFOs: Gordondale Farms runs a concentrated animal feeding operation (CAFO) at 9845 Highway 161 in Nelsonville. This dairy farm has a permit to discharge animal waste water to groundwater.

Nonpoint Sources: The Waupaca River watershed is ranked as a high priority overall for nonpoint source (NPS) pollution and is similarly ranked for groundwater NPS pollution. Streams within the watershed are listed as a medium priority for NPS pollution and lakes have yet to be ranked. One stormwater management plan was developed for the Village of Amherst.

The Tomorrow/Waupaca River Priority Watershed Project plan assesses the nonpoint sources of pollution in the Tomorrow/Waupaca River Watershed and guides the implementation of nonpoint source control measures. These control measures are needed to meet specific water resource objectives for Tomorrow/Waupaca River and its tributaries. The primary objective of the project is to reduce nonpoint source pollution to the Tomorrow/Waupaca River, and to enhance and protect the water quality of streams in the Tomorrow/Waupaca River Watershed.

The Tomorrow/Waupaca River Priority Watershed Project has met its goals relative to sediment and phosphorus loading into surface water. However, it continues to struggle with its groundwater goals on the loamy sands and sandy loams within the watershed. It is

impossible to determine in the short term if Best Management Practices (BMP) are reducing nitrogen and soluble phosphorus in groundwater because of the inherent variability of groundwater flow. The project continues to work with UWSP to gather water quality data to try and determine BMP effectiveness.[116]

Wolf River – New London and Bear Creek Watershed (WR12) [117]

The Wolf River - New London and Bear Creek Watershed is in west central Outagamie County and covers 145 square miles. This watershed includes 25 miles of the Mainstem Wolf River from the confluence with the Shioc River to the City of New London.

The watershed ranked medium for streams and lakes and low for groundwater under the Nonpoint Source Priority Watershed selection process. The Bear Creek sub watershed would be a good candidate for a small-scale priority watershed project.

There are four industrial point source dischargers and three municipal point source dischargers in this watershed: Village of Hortonville, Village of Shiocton, Stephensville Sanitary District No. 1, Galloway West Co. Inc., Karl H. Peters Poultry Dressing, Larsen Company (Dean Foods), and Bush Brothers Company Inc.

Floodplain Regulations

Floodplain regulations have been in place in the cities, towns and villages of Waupaca County for many years. The Wisconsin Department of Natural Resources (DNR) 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, Waupaca 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:

[116] Bradley, Steve. Priority Watershed and Priority Lake Program Final Report, 12/30/08

[117] https://dnr.wi.gov/water/watershedDetail.aspx?key=924776

- Reduce the hazards to life and property from flooding.
- Protect flood plain occupants from a flood which is or may be caused by their own land use and 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.

Encroachment on flood plains, including structures or fill, reduces the flood-carrying capacity.

Frequency of 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.

Waupaca County does have a history of flooding problems. Waupaca County has been included in five Presidential Disaster Declarations requests for flooding, the most recent of which are detailed below:[118]

- FEMA-DR-376-WI: On April 27, 1973, the President declared a major disaster as a result of severe storms and flooding that occurred on April 27, 1973. The declaration was granted for Individual and Public Assistance
- FEMA-DR-994-WI: On July 2, 1993, the President declared a major disaster as a result of flooding, severe storms and tornadoes that occurred June 7, 1993 to August 25, 1993. The declaration was granted for Individual and Public Assistance.
- FEMA-DR-1369-WI: On May 11, 2001, the President declared a Major Disaster as a result of flooding that occurred April 10, 2001 to July 6, 2001. The declaration was granted for Public Assistance.
- FEMA-DR-1432-WI: On September 10, 2001, the President declared a Major Disaster as a result of severe storms, tornadoes and flooding that occurred September 2, 2002 to

[118] http://www.fema.gov/disasters

September 6, 2002. The declaration was granted for Individual Assistance.

- FEMA-DR-1526-WI: On June 18, 2004, the President declared a major disaster as a result of severe storms and flooding that occurred May 7, 2004 to July 3, 2004. The declaration was granted for Individual Assistance.
- FEMA 4459-DR: On August 27, 2019, the President declared a major disaster as a result of severe storms, tornadoes, straight-line winds and flooding that began on July 18. Waupaca County was eligible for Public Assistance.

The following list summarizes damages attributed to flooding in Waupaca County by the National Flood Insurance Program through 7 July 2020:

Waupaca County NFIP Loss Claims				
Jurisdiction	**Total Loss**	**Closed Loss**	**Closed Without Payment**	**Total Payments**
City of Clintonville	6	4	2	$ 18,351.90
Village of Fremont	10	4	6	$ 9,136.94
Village of Iola	1	1	0	$ 3,115.92
Waupaca County	23	19	4	$ 60,167.68

There is one repetitive loss property in Clintonville, Waupaca County. It is classified as “Other Residential,” which means a residential building that contains more than four units. It could be an apartment, condominium, hotel, motel, or other rooming house where the normal occupancy of a guest is six months or more. There have been four claims at this property totaling $93,301.79.

Tables showing the flood and flash flood events recorded by the National Weather Service can be found in Appendix B. A careful review of the geography and history of flooding in Waupaca County leads to the conclusion that there is a high probability of flooding in the future and a 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. It was also determined that there was a low to medium probability of a dam break in the county and a low probability of damage and losses due to a dam break.

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 and 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 used 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.

Appendix A contains maps depicting the floodplain in Waupaca County. Appendix F contains excerpts from the Waupaca County HAZUS report. HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. FEMA HAZUS-MH data were used to estimate the number of structures located within the one-percent chance, or 100-year floodplain, based upon Flood Insurance Rate Maps

(FIRMs) published by the Federal Emergency Management Agency (FEMA), the results of which are outlined in the report.

Hazard Mitigation Strategies

Waupaca County is committed to remaining compliant with the requirements of the National Flood Insurance Program (NFIP) and all other state and federal laws. According to the NFIP, the following communities participate in the program. Notes to the side indicate information from the communities regarding their understanding of their participation.

- Waupaca County
- Cities of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega – have a floodplain ordinance and acknowledges participation in the NFIP
- Villages of Big Falls, Embarrass, Fremont and Iola – have a floodplain ordinance and acknowledges participation in the NFIP
- The Villages of Ogdensburg and Scandinavia have been mapped but are not participating because the community does not perceive flooding as a significant risk and therefore does not choose to participate in the NFIP.

Additional proposed mitigation strategies within Waupaca County include:

- Examining the feasibility of installing a river gauge in the Village of Fremont.
- City of Clintonville would like to address flooding concerns on Spring Street, possibly enlarging and/or relocating sewers.
- Town of Bear Creek will continue working with the county Highway Department to ensure roads and ditches are properly maintained to minimize impassable roads following severe storms.
- Town of Dayton will address roadway flooding on Akron Road off of Highway K.
- Comet Road in the Town of Harrison has been washing out and the town may possibly add a culvert and bridge to correct these issues.

- The Town of Lind has had flooding of several roads and will continue to monitor this. They may seek to raise road surfaces and install culverts.
- Erosion of the riverbank in the Village of Embarrass has caused exposure of sewer pipes and is investigating how to address the issue. Leaks to the sewer pipes also need to be repaired.

In addition, the City of Marion would like to conduct flood-proofing measures (acquisition, demolition, elevation, etc.) within the city. Possible projects include:

- School bus garage area – There are three houses within 200 yards below a high-hazard dam.
- Senior Center and Garfield Avenue – There are two storm sewers under low income housing which need to be moved. The senior center floods routinely, usually from ground water coming up through the floor. It sits low and near the mill pond. Flooding has created ongoing costs for damage clean-up and repair (e.g., stained carpet, damaged tile).

In addition to the strategies listed above, Waupaca County can make current and future buildings and infrastructure more disaster-resistant by:

- Using its maps and hydrology studies to ensure that properties at risk are identified and, as available, appropriate grants are sought and secured to mitigate losses. Good data also ensures that decision-makers can create and enforce appropriate zoning and/or building regulations to make any new structures disaster-resistant.
- Targeting old structures for buy-out and converting the land to open, public lands. This also eliminates future damages by preventing building on this land.
- Pre-identifying infrastructure (roads, bridges, culverts, shoulders) prone to flooding and directing current and future budgetary dollars towards making the infrastructure disaster-resistant as it is scheduled for routine maintenance.

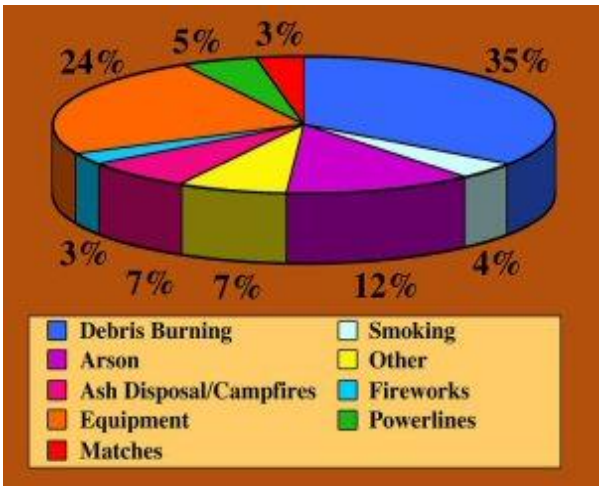
Wildfires

The wildfire season in Waupaca 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 (DNR) 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.

Physical Characteristics

The Wisconsin DNR has previously reported that approximately 1,500 fires annually 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.



Frequency of Occurrence

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 of a wildfire is high, due to the large portion of forested lands in Waupaca County. The probability of damage from wildfires is considered medium.

There has been one statewide wildfire event recorded since 1950 by the National Weather Service. This event occurred on 23 April 1994 and caused no injuries or deaths but did cause $500,000 in crop and property damage (each).

Since the fire in 1994, there have been no large wildfire events recorded in Waupaca County but there have been many smaller, local fires.

Vulnerability

Wildfires can impact the ecology of the open lands. Waupaca County, which has multiple forests, 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.

In 2003, the National Association of State Foresters produced a Field Guidance for Identifying and Prioritizing Communities-at-Risk (CAR). The purpose of the guide was to provide states with a nationally consistent approach for assessing and displaying the risks to communities from wildfire. The DNR, in cooperation with its federal and tribal partners, began working on the statewide assessment of Communities-at-Risk in 2004.

Communities-at-Risk is a model to identify broad areas of the state that are at relatively high exposure to resource damage due to wildfire. Results of the model can then be used by local governments developing Community Wildfire Protection Plans (CWPP) and by the DNR to reduce local risks of wildland fire by prioritizing hazard mitigation and fire protection efforts.

The approach used in this risk assessment model is based on the “Methodology” section of the NASF Field Guidance document which recommends assessing and mapping four factors:

- Historic Fire Occurrence
- Hazard
- Values Protected
- Capabilities

Modifications to this methodology were made to fit the GIS mapping data layers available for Wisconsin. The Wisconsin DNR uses three factors to assess Communities-at-Risk to wildfire damage:

- Hazard – the relative likelihood that an ignited wildfire will achieve sufficient intensity to threaten life or property based on land cover type and historic fire regime.
- WUI (Values at Risk) – the relative vulnerability of each 2000 census block to wildfire damage based on housing density and spatial relationship with undeveloped vegetation based on housing density and proximity to vegetation (Wisconsin's Wildland-Urban Interface). Wisconsin's WUI was layered with a weighted vegetation layer to accentuate proximity to flammable vegetation.
- Ignition Risk – the relative likelihood of a wildfire ignition within a given 30-m pixel based on historic fire occurrence, population density, and proximity to a potential ignition source.

Models were developed in GIS to create statewide grids representing each of the three weighted {Hazard (40%), WUI (30%), and Risk (30%)} inputs. This composite grid represents communities-at-risk (CAR) on a 0-9 scale of threat, with zero representing no threat and nine a very high threat. The data was then represented by municipal civil divisions (MCDs), which are city and village boundaries. Quantitative markers were assigned for five threat levels: very low, low, moderate, high and very high and those MCDs determined to have a high or very high threat of wildfire were considered CARs. In Wisconsin, 337 communities met the requirements for being "at risk."

Communities in Wisconsin vary considerably in size. This is particularly evident in a north-south pattern, with smaller, more rural towns in northern Wisconsin and larger, more urban towns in southern Wisconsin. Because of this variation in size, the potential for missing areas of high risk due to smoothing out by other parts of the town was greater for larger towns. For this reason, WI DNR incorporated a "Community of Concern" category to identify those

towns that have portions of their town in high risk of wildfire but were not otherwise included as a Community-at-Risk. A Community-of-Concern was determined to be an area of at least two contiguous square miles at high or very high risk; 237 Wisconsin communities were named as Communities-of-Concern.[119]

The following Waupaca County municipalities were identified as Communities at Risk or Communities of Concern:

Community at Risk – Very High:

- Village of Ogdensburg
- Town of Dayton
- Town of Farmington

Communities at Risk – High:

- Village of Big Falls
- Village of Scandinavia
- Town of Caledonia
- Town of Helvetia
- Town of Iola
- Town of Lind
- Town of Saint Lawrence
- Town of Scandinavia
- Town of Waupaca

Communities of Concern:

- Town of Fremont
- Town of Harrison
- Town of Mukwa
- Town of Royalton

Hazard Mitigation Strategies

Government at all levels is developing mitigation programs in fire control and firefighting tactics with the goal of protecting lives and property from loss due to wildfire. Local fire departments attend regular trainings on firefighting tactics to keep their skills honed. The County Emergency Management Office assists local departments and their staff with available grant applications for training, exercising, equipment, and planning as able and requested.

[119] Wisconsin State Hazard Mitigation Plan

Fire departments and the DNR will provide ample training for firefighters and fire departments to better prepare them for larger fires. This training currently happens regularly and local fire departments training with the DNR each spring. Additional training opportunities will be explored.

As grant funding is available, the Emergency Management Department, local fire departments, and the DNR will update the DNR zone book. This book was last done in 2009. The City of Waupaca will explore options for self-funding the zone book.

The Planning and Zoning Department, in cooperation with municipalities, will explore improvement of zoning regulations and work with towns on increasing the width of roads, especially in subdivisions where the roads are only one car width. These narrow roads prevent emergency service vehicles from reaching some areas in the county.

The Wisconsin Department of Natural Resources (DNR) does have a small forestry office with limited resources in Waupaca County, at Hartman Creek State Park. If there was a large wildfire for which local firefighters would request state assistance, the DNR may be able to provide limited assistance based upon their deployment level at that time.

Severe Temperatures

Characteristics

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.

Physical Characteristics: Heat

Heat emergencies are a result of the combination of very high temperatures and very humid conditions.

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

The Heat Index estimates the relationship between these two conditions and reports them as a danger category, as can be seen in the following table:[120]

[120] FEMA, 1997; NWS, 1997

Heat Index and Disorders Table			
Danger Category		**Heat Disorders**	**Apparent Temperatures [°F]**
IV	Extreme Danger	Heatstroke or sunstroke imminent.	>130
III	Danger	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	105-130
II	Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90-105
I	Caution	Fatigue possible with prolonged exposure and physical activity.	89-90

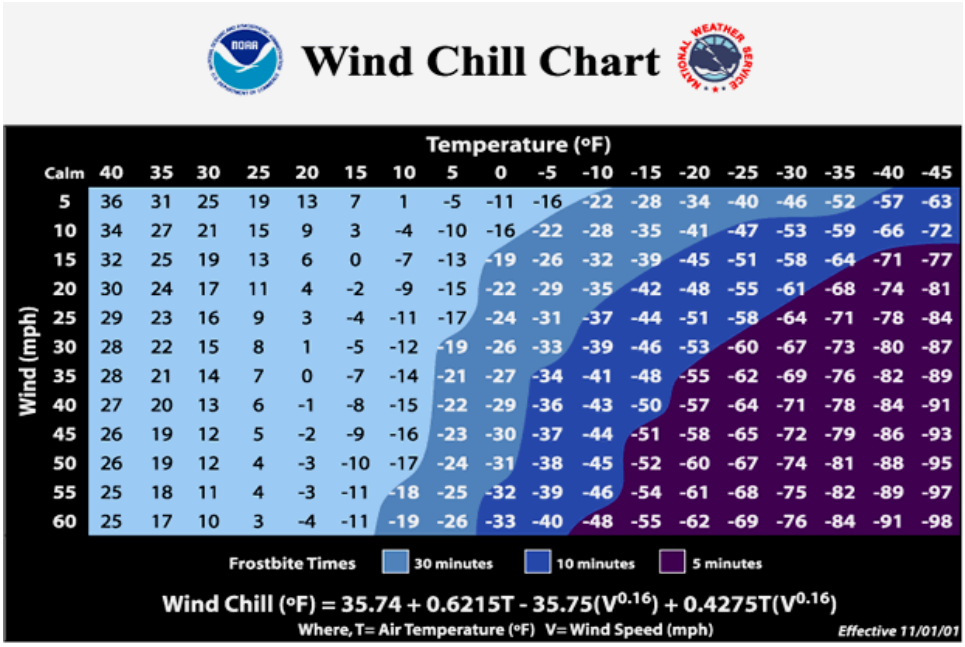
The major risks to people due to extreme heat are:

- Heatstroke – a potentially lethal medical emergency where the ability of a person to thermo-regulate is compromised resulting in the rise of the body's core temperature to above 105°F (Fahrenheit).
- Heat Exhaustion – a less threatening medical condition where the victim complains of dizziness, weakness and/or fatigue. The victim may have a normal or slightly elevated temperature and usually can be successfully treated with fluids.
- Heat Syncope – a sudden "faint" or loss of consciousness usually brought on by exercising in warmer weather than one is accustomed to, usually no lasting effect.
- Heat Cramps – muscular cramping brought on by exercising in warmer weather than one is accustomed to, no lasting effect.

Extreme heat conditions may also affect pets and livestock, decreasing agricultural output by the latter. Crops may suffer reduced yield due to extremely hot conditions.

Physical Characteristics: Cold

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 following table illustrates this relationship.[121]



Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm																		
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

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

[121] http://www.nws.noaa.gov/om/windchill/index.shtml

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.
- Trench foot – a condition that occurs when the lower extremities remain in cool water for a prolonged period of time.

Frequency of Occurrence: Heat

Wisconsin has been affected by a number of bouts of extreme heat including during the Dust Bowl period from 1934-1936. Other heat events occurred in 1979, 1995, 2001, 2011, and 2012.

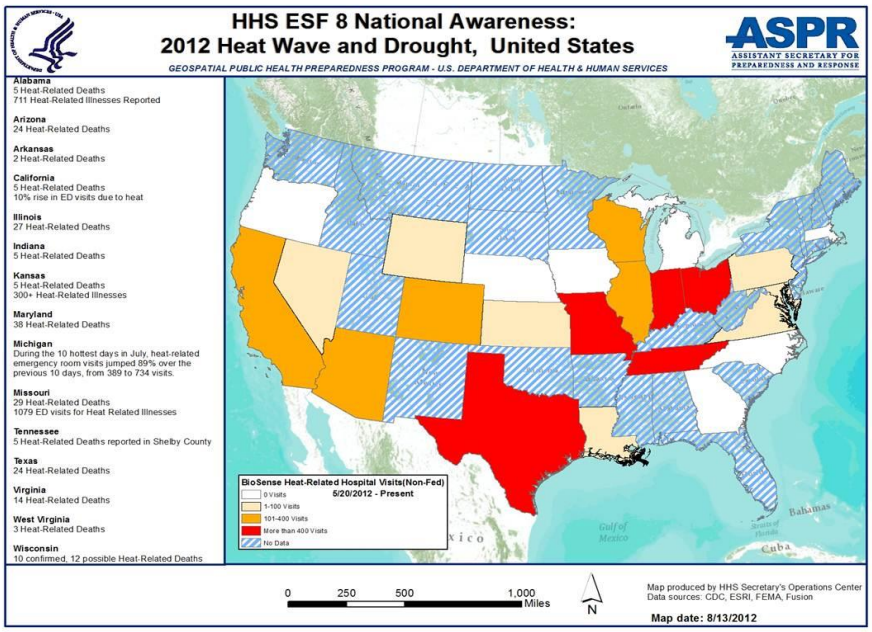
Tables showing the excessive heat and heat events recorded by the National Weather Service in Waupaca County [122] can be found in Appendix B.

It should be noted that during the summer of 2012 much of the country, including Waupaca County, experienced a heat wave, resulting in significant droughts across more the half the country as well as increases in heat related illnesses and deaths. July was the hottest month in US history, eclipsing the record set during the heart of the Dust Bowl in 1936. The worst of the heat was in the Midwest, the Plains and along the Eastern Seaboard. Most of the contiguous US had record and near-record warmth for the seven-month period, except the Pacific Northwest, which was near average.

With the increase in heat-related illnesses comes an increase in emergency department (ED) admission across the country. Dehydration, heat exhaustion and heat stroke were the most common cause for patients' heat-related ED admissions. Most heat-related visits occurred in patients between the ages of 19 and 70. In

[122] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

Wisconsin, there were ten confirmed and possibly 12 heat-related deaths.[123]



According to the State of Wisconsin Hazard Mitigation Plan, extreme heat is the number-one weather killer in Wisconsin with most of the heat deaths attributed to major heat waves. As can be seen by the historical tables, Waupaca County, like the rest of the state, is likely to experience extreme heat events every two to three years with extended, major heat waves occurring about every two decades.

The workgroup therefore felt that there was a low likelihood of occurrence in any given year. The committee also felt that the loss of property, primarily crop and livestock output has a low likelihood of occurring in a drought year. The loss of life or injury to people has a low likelihood of occurrence for the general population but the committee recognized that the likelihood increases for certain populations such as the elderly, chronically ill, children, those who work outdoors and those with limited financial resources (i.e., to pay for heating and air conditioning).

[123] 2012 Heat & Drought Federal Report, HHS ESF 8, UPDATE #2, U.S. Department of Health and Human Services, Assistant Secretary for Preparedness and Response

Frequency of Occurrence: Cold

Wisconsin regularly has extreme cold temperatures as part of its winter climate. Tables that outline extreme cold/wind chill and cold/wind chill events which have been recorded by the National Weather Service in Waupaca County[124] can be found in Appendix B.

After examining this data, the workgroup believed that cold and/or extreme cold has a high likelihood of occurrence in any given year. Since there are no crops out during the winter and most properties (homes, businesses, barns) are insulated for this climate, the loss of property due to temperature extremes is high, although individuals may suffer damage due to water pipe breaks and other such secondary problems. They further believed that the loss of life or injury to people has a low likelihood of occurrence among the general population when there are cold/extreme cold weather events. Again, the workgroup recognized that people who work outdoors, who have limited financial resources, the elderly, the young, and the chronically ill have a higher risk profile.

Vulnerability

There has been a trend toward higher temperatures that is expected to continue. As with drought, periods of high temperatures can cause decreased poultry and bovine production rates, which impact the economy of the community's large agricultural base.

More frequent and longer sub-zero stretches have been noted during the winter. These, coupled with concerns about utility failures, can disrupt agriculture, particularly with water supply disruption and with wind chill effects posing a risk to livestock and farmer health. Temperature extremes also pose significant problems for functional needs populations such as the elderly, the young, and the disabled. The primary general effects of extreme cold consist of water lines and mains freezing and breaking, disrupting water supply; shutting down of rural bus lines due to safety risks for children; and school closings, most often due to wind chill concerns.

[49 & 124] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

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 Waupaca 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.

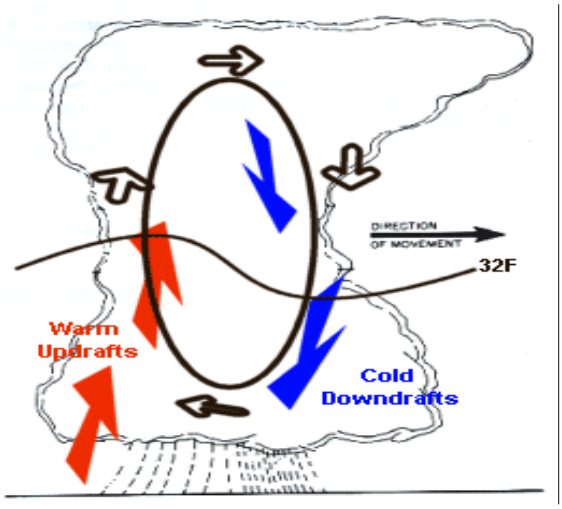
Hazard Mitigation Strategies

The goal of severe temperature mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events. Temperature extremes are difficult for a community to mitigate and the risks are to the health and safety of citizens, animals and crops. There are no strategies that need to be employed to reduce damages to buildings and infrastructure.

Waupaca County Emergency Management participates in the statewide public information campaigns for Winter and Heat Awareness Weeks each year and provides links to personal preparedness information on its website. The Public Health Department will also coordinate cooling and warming shelters during severe weather. The county and its municipal and private sector partners will continue to review, update, and support these projects over time.

Storms: Hail

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:[125]



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

Physical Characteristics

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.

[125] NWS, January 10, 2003

Hail Size Estimates [126]	
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

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.

Frequency of Occurrence

Hailstorms usually occur from May through August and Wisconsin averages two or three hail days per year. Waupaca County has a high probability of hail occurrence in Wisconsin. The likelihood of damage due to hail is considered low. Over the past 25 years hail has occurred 90 times for an average of just under 4 times per year.

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. A table showing the hail events recorded by the National Weather Service in Waupaca County[127] can be found in Appendix B.

[126] NWS, January 10, 2003

[127] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

It should be noted that this table represents only the hail incidents reported to the National Weather Service. One limitation of the source data is that it showed no property or crop loss, death or injury while it is likely that there was some loss incurred. After a careful review of the data by the workgroup, it was believed that there has been more accurate record-keeping and recording since the 1990s but that the table also shows an increasing frequency in the occurrence of hailstorms.

Vulnerability

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. Hail is a localized phenomenon and it would be difficult to estimate losses.

Hazard Mitigation Strategies

The goal of mitigating for hail is to reduce the amount of financial loss due to these incidents. Insurance is the most widely used adjustment

for crop and property damages due to hail. Hail crop insurance is available from two sources: commercial stock and mutual companies and the Federal Crop Insurance Corporation (FCIC). Farmers rarely purchase insurance coverage up to the full value of the losses that would result from a severe hailstorm.

The Waupaca County University of Wisconsin Extension Office distributes information on various hail insurance options. In the event of major damage, a team composed of county and federal agricultural agency representatives and the county emergency management director have primary responsibility for assessing and documenting hail damage.

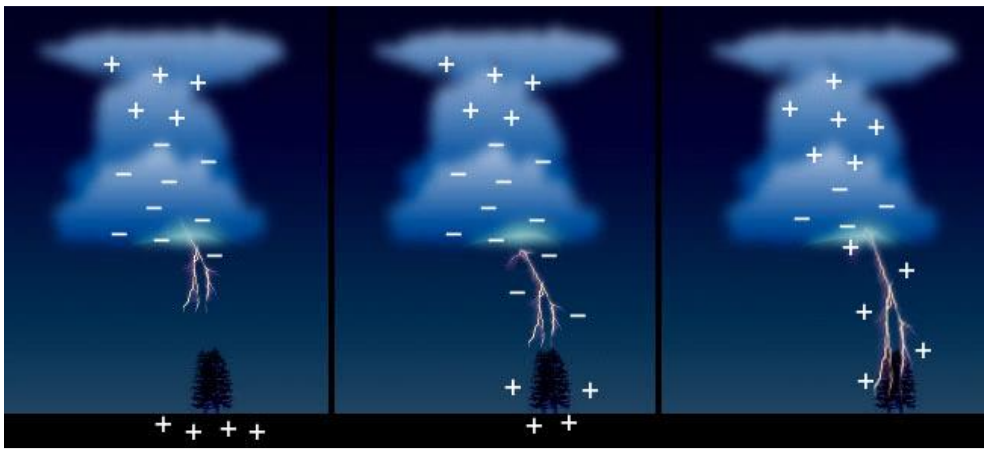
The Waupaca County Emergency Management Office provides hail information to the public as part of the spring severe weather awareness week. The office also provides information about hail on the website and in display racks. Federal emergency assistance is available in the form of low-interest loans when a Presidential Disaster is declared or when the United States Department of Agriculture (USDA) declares that a county is eligible for aid. Damage from hailstorms alone is generally not extensive enough to invoke a disaster declaration.

The hazard mitigation strategies listed above primarily involve providing information on safety measures and insurance to the public for agricultural concerns and residential and commercial structures. These measures provide basic safety information but, since there is little one can do to prevent hail damage, these measures will do little to reduce damages to existing or future buildings and infrastructure but the recommended insurance may make recovery easier.

Storms: Lightning

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.[128]

Formation of Lightning



Lightning may travel from cloud to cloud, cloud to ground, or if there are high structures involved, from ground to cloud.

Physical Characteristics

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.

[128] University Corporation for Atmospheric Research [UCAR]

Frequency of Occurrence

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. Waupaca County has a medium probability of lightning occurrence; the likelihood of damage due to lightning is considered high.

A table showing the lightning events recorded by the National Weather Service (NWS) in Waupaca County[129] can be found in Appendix B. This table from the NWS is obviously not reporting all of the incidents of lightning strikes but those with notable/reportable losses from the past and can reasonably be inferred to show that there is exposure to potential future losses.

Vulnerability

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

[129] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

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 Mitigation Strategies

The goal of lightning mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events. The two primary ways to effectively reduce lightning losses are modifying human behavior and protecting structures (e.g., using fire resistant materials in building construction). The use of fire resistant materials will make existing buildings and future construction less likely to catch fire or will minimize fire damage and spread due to lightning strike. Surge protectors limit data losses.

The Waupaca County Emergency Management Office has awareness and educational materials in a display rack and online that inform the public of safety procedures to follow during a lightning storm. Severe summer weather safety information is also emphasized during severe weather week.

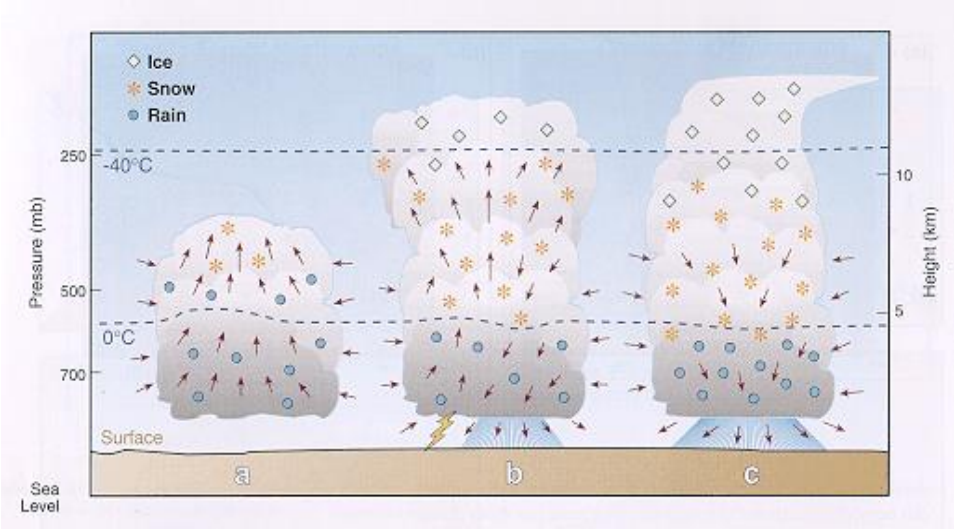
Storms: Thunderstorms

There are three distinct stages of development for thunderstorms (birth, growth, maturity), each of which can be seen in the following schematic. [130]

In the first stage of development, an updraft drives warm air up beyond condensation levels where clouds form.

The second stage of development occurs as levels of water vapor in the expanding cloud rise past saturation and the air cools sufficiently to form solid and liquid particles of water. At this point, rain or snow begins to fall within the cloud.

A thunderstorm's mature stage is marked by a transition of wind direction within the storm cells. The prevailing updraft which initiated the cloud's growth is joined by a downdraft generated by precipitation. Lightning may occur soon after precipitation begins. Hail and tornadoes may also develop during this stage.



[130] National Weather Service - Flagstaff

Physical Characteristics

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.

Frequency of Occurrence

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 ¾" hail, winds of at least 58 mph, or a tornado). Most Wisconsin counties, including Waupaca 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 Waupaca 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.

The probability of thunderstorms occurring in Waupaca County is high as these storms usually occur one or more times each year during the summer in Wisconsin and Waupaca County. The probability of damage is also considered to be 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 in discussed in the appropriate chapters.

Tables showing the thunderstorm events that have been recorded by the National Weather Service in Waupaca County can be found in Appendix B. [131]

Vulnerability

[131] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

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

Hazard Mitigation Strategies

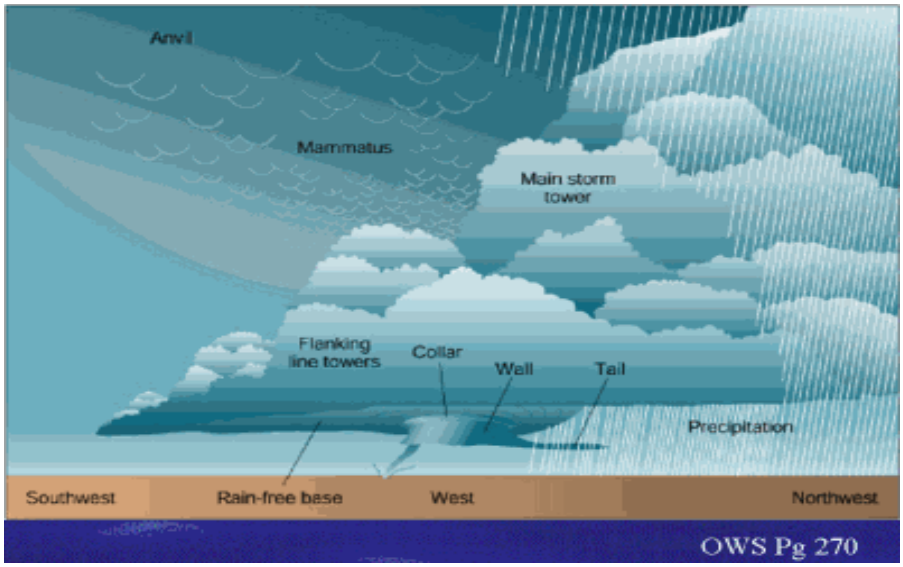
The goal of thunderstorm mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events.

Waupaca County Emergency Management has developed severe weather safety information that it disseminates to the public in a display rack and online with the goal of protecting the lives and property of citizens. During Tornado Awareness Week, there is extensive media coverage of safety tips. Additionally, the department assists the National Weather Service (NWS) in conducting tornado spotter training programs and in organizing local tornado spotter networks.

The damage to buildings and infrastructure in a thunderstorm is generally caused by components of the storm such as hail, flooding, lightning, or wind. A discussion of strategies to reduce effects on existing and future buildings and infrastructure is discussed in the chapters that cover each of these components in detail.

Storms: Tornadoes and High Winds

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.

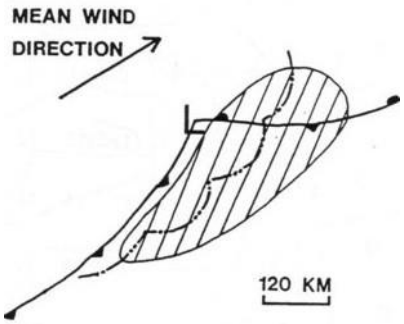


A derecho is a widespread, long-lived, violent, convectively-induced, straight-line windstorm that is associated with a fast-moving band of severe thunderstorms usually taking the form of a bow echo. Derechos blow in the direction of movement of their associated storms; this is similar to a gust front 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 occur as frequently at night as in the daylight hours.

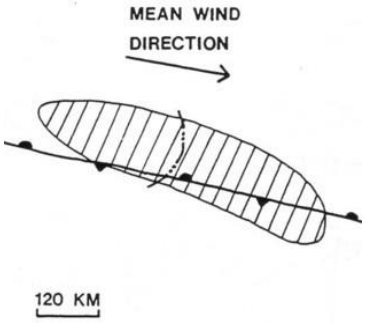
The traditional criteria that distinguish a derecho from a severe thunderstorm are sustained winds of 58 mph during the storm as opposed to gusts, high and/or rapidly increasing forward speed and geographic extent (typically 250 nautical miles in length). In addition, they have a distinctive appearance 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: [132]

- 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 both serial and progressive derechos. Hybrid derechos are associated with a deep low like serial derechos but are relatively small in size like progressive derechos.



Serial Derecho



Progressive Derecho

Physical Characteristics

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

[132] http://en.wikipedia.org/wiki/Derecho

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[133]		
Category	**Wind Speed**	**Description of 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.

On 1 February 2007, the National Weather Service began rating tornadoes using the EF-scale. It is considerably more complicated than the F-scale and it will allow surveyors to create more precise assessments of tornado severity. Below is a comparison between the Fujita Scale and the EF Scale:

Fujita Scale			Derived EF Scale		Operational EF Scale	
F Number	**Fastest ¼ 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

[133] FEMA, 1997

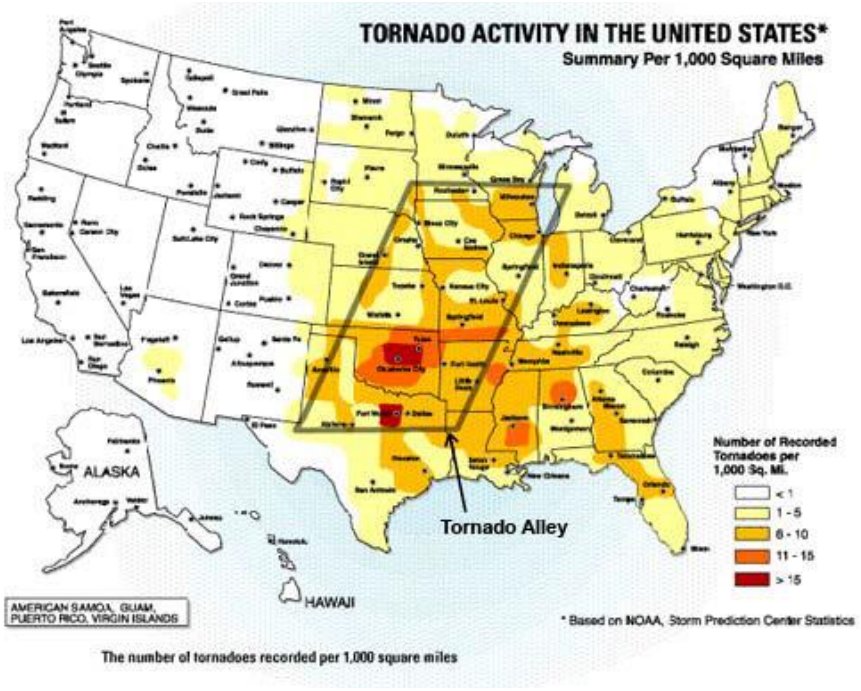
Downburst Characteristics

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.

Frequency of Occurrence

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 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.

According to local historians, an additional tornado system struck Waupaca County on 18 September 1950. A NOAA-recorded tornado almost exactly one year later (26 September 1951) followed a nearly identical path; this tornado resulted in six deaths, including one entire farm family. Because of findings in the after-action review following the 1951 tornado, NOAA enacted nationwide changes in tornado alert/notification protocols.

The 06 August 2013 storm system produced thunderstorms, high winds, and tornadoes in Waupaca County (see also Storms: Thunderstorms) and other east-central Wisconsin counties. According to the National Weather Service Storm Survey[134],

[134] http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=459677

> A line of severe thunderstorms, known as a quasi-linear convective system (QLCS), produced six tornadoes and widespread damaging winds across east-central Wisconsin during the late night hours of August 6-7. The storms formed ahead of a cold front that also produced severe weather in Minnesota and western Wisconsin.
>
> The tornadoes occurred within about 50 minutes--between 12:22 am and 1:10 am CDT. Hundreds of homes, businesses and farm buildings were damaged. Two injuries occurred at a campground in Waupaca County. Thousands of trees and power lines were also downed, leaving tens of thousands of people without power. The strongest tornado of the event reached EF2 intensity (winds estimated at 115 to 120 mph). This tornado caused significant damage to a church in New London.
>
> The six tornadoes that occurred on August 7 were the most nighttime tornadoes in a single event in northeast Wisconsin since accurate tornado records began (1950).
>
> A tornado formed just after 12:20 am CDT and quickly moved east-southeast. The storm hit a campground, blowing several camper trailers over. Two people sustained minor injuries at the campground. Over 100 trees were snapped or uprooted along the path of the tornado (DI 27, DOD 3 and 4; DI 28, DOD 3 and 4). The tornado moved into Outagamie County about 3.1 miles south of New London at 12:26 am CDT. The average path width of the tornado in Waupaca County was 75 yards.

The tornado in New London hit a local church, destroying it[135].

[135] http://interactives.fox11online.com/photomojo/gallery/8541/166856/reportit-severe-weather-august-7-2013/trinity-lutheran-church-in-new-london-hit-by-storm/ (credit, Joel Gregory, Oconomowoc)

Tables showing the frequency of high winds, funnel clouds and tornadoes as reported by the National Weather Service can be found in Appendix B.[136] There have been three funnel clouds reported for the county. The probability of Waupaca County being struck by a tornado in the future is low and the likelihood of damage from future incidents is high. All parts of Waupaca County are equally susceptible to tornadoes and high winds.

Vulnerability

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; Waupaca County has several of each type of property. Both have high concentrations of people in a small area, generally have structures that provide less protection than standard construction homes, and usually do not provide 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.

Mobile Home Parks [137] [138]	
Park Name	**Location**
Parkview Heights Estates	Clintonville
Korth's Mobile Home Park	Clintonville

[136] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN
[137] https://www.mobilehome.net/mobile-home-park-directory/wisconsin/county/waupaca-county
[138] https://www.mhvillage.com/Communities/MobileHomeParks.php?State=WI&County=Waupaca

Cloverleaf Lakes Mobile Home Park	Clintonville
Oakwood Estates Mobile Home Park	New London
Lamplighter Village Mobile Home Park	Weyauwega
Oak Manor Community	Waupaca
Northgate Estates	New London
Mintons Hy-Land Villa	Waupaca
Coenen's Mobile Home Park	New London
Cloverleaf Mobile Home Park	Clintonville
Kriesers Hillside Mobile Home Park	Marion
Rustic Resort Mobile Home Park	Clintonville
Walnut Grove Estates	Manawa
D&B Manufactured Homes, LLC	New London

Campgrounds [139]	
Campground Name	**Location**
Blue Top Resort and Campground	Fremont
Fremont Jellystone Park Campground	Fremont
Red Banks Resort and Campground	Fremont
Triangle Farm Campground	Fremont
Weber's Landing	Fremont
Yogi Bear's Jellystone Camp	Fremont
Iola Pines Campground	Iola
Bear Lake Campground	Manawa

[139] http://www.hikercentral.com/campcounty/Wisconsin_Waupaca.html

Conroy's Bear Lake Campground	Manawa
Huckleberry Acres Campground	New London
Weiland's Landing	New London
Wolf River Trips and Campground	New London
Casey Lake Campground	Ogdensburg
Camp Young Judea	Waupaca
Deerhaven Campground	Waupaca
Hartman Creek State Park	Waupaca
Royal Oaks Golf Resort	Waupaca
Rustic Woods Campgrounds	Waupaca
Waupaca Camping Park	Waupaca

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 Mitigation Strategies

The goal of tornado and high wind mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events. Waupaca County has a history of damage due to tornadoes and high winds. Some strategies below will deal with public information and alert and notification while others will enable the community to make current and future buildings and infrastructure more disaster-resistant by enacting more “bricks and mortar” solutions.

An effective warning system is the single most important resource for alerting the public to a tornado hazard, which is critical to the main goal of saving lives and reducing property losses. Forecasting of tornadoes is difficult, however, because of the suddenness of their onset, their relatively short duration, the extreme variability of a tornado striking area, limited knowledge of tornado dynamics, and the limitations of the weather observation system. Tornado sirens are municipally owned and maintained in the county. The municipalities regularly test warning systems, repairing and upgrading as they deem necessary. The emergency management office promotes the use of NOAA weather radios for public alert and notification. The office also continues to evaluate various technologies to determine if they can be effectively integrated into the county’s alert and notification systems

During the past several years, there has been a statewide Tornado Awareness Week in late March or April. Media information packets are distributed to reemphasize and alert the public to tornado warning procedures. Waupaca County actively promotes tornado safety public information as well as other summer severe weather public awareness and educational efforts, including applicable links on the county website. Waupaca County also assists the National Weather Service with sponsoring tornado spotter training and in organizing local tornado spotter networks.

The Waupaca County Parks and Recreation Department will continue preventative tree removal to reduce the probability of damage during tornadoes or high wind events.

In addition, the county and several municipalities will explore the feasibility of constructing tornado shelters in deficient areas, especially in mobile home parks and campgrounds. Possible projects include:

- Keller Lake
- Vic-To-Rae Park
- Walnut Grove Estates
- Athletic Field – City of Marion
- Bertram Street Trailer Park
- Northgate Estates Trailer Park
- Swan Park
- Oak Street Mobile Home Park
- County Fairgrounds
- Car Show Campground
- Rodeo Grounds
- County Transfer Facility
- Oakwood Trailer Court
- Huckleberry Campground
- Wolf River Campground

The Village and Town of Scandinavia will also upgrade and reinforce the restroom facilities in Ellison Park to make it suitable for use as a storm shelter structure.

Storms: Winter

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

Picture of snow drifts after the “Groundhog Day Blizzard” in 2011.

Physical Characteristics

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°F 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.

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.

Frequency of Occurrence

Annual snowfall in Wisconsin varies between thirty inches in southern counties to one hundred inches in the north. Waupaca County averages approximately 50-60 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. For example, blizzard conditions existed in Wisconsin in February, 2011 when record snowfalls were recorded in many areas and very strong northeast winds were gusting from 45 to 60 mph for an extended period of time. Waupaca County received from 1 up to 8 inches associated over this three-day storm. It should be noted that there were two additional large snow storms that occurred in late February and late March of 2011.

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.

Tables showing winter storm statistics as reported by the National Weather Service can be found in Appendix B.[140] The tables show that there is little property damage but this does not take into account the public costs of managing the snow and ice as well as the costs of managing utility repair to power, telephone and water lines. There is one recorded blizzard event for the county.

The probability that there will be severe winter storms in Waupaca County is high and the likelihood that those storms will cause significant damage is also high.

Vulnerability

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 Mitigation Strategies

The goal of winter storm mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events. Communities prepare for severe winter weather by ensuring that plowing and sanding equipment is operational and available to handle potential emergencies. Funding is budgeted for the overtime hours of extra personnel but in a large emergency this may not be

[140] http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=55%2CWISCONSIN

adequate. Redundant communication modes (e.g., radio, telephone) exist between government, police, fire, EMS, hospitals, and highway departments. The Waupaca County Emergency Operations Plan provides for coordination of public safety support agencies such as the American Red Cross and for resource acquisitions during winter emergencies.

Winter safety information is prepared and distributed to the media and the public by the Waupaca County Emergency Management Office during Winter Awareness Week. Preparedness information is also available from display racks in the courthouse and the website. During a storm, the public is advised to monitor local radio, television, and NOAA weather alert radios for up-to-date forecasts.

Waupaca County has also identified the following strategies that could possibly be implemented depending on funding available:

- Examine options for planting living fences to keep snow from roadway. Unfortunately, few landowners or farmers are interested or willing to do this.
- Explore road sign upgrades for electronic signs that can be turned on and off during hazardous weather.
- Explore installing ramp barricades.
- Explore options for increased salt storage facilities. Four such facilities are needed – one for the county, one for the state, and one each for the Cities of Manawa and Waupaca.

The hazard mitigation strategies listed above primarily involve providing information on general safety measures to the public. These measures provide basic safety information but, since the response to winter storms is primarily a government and/or corporate function comprised of tasks such as clearing roads of snow and ice and repairing downed utility lines, there are few measures that can be employed to reduce damages to existing or future buildings and infrastructure.

Utility Failure

A utility emergency is a disruption to the building services, usually defined as electrical power, water, natural gas, and/or sewage, which restricts the ability of people to safely occupy the facility. Electrical power or natural gas outages are often caused by a fuel shortage caused by an oil embargo, power failure, or natural disaster. Disruptions to the water and sewage systems are often the direct result of a natural disaster (e.g., flooding) or are indirect losses due to another failure (e.g., a power outage disrupts the pumping of water and/or sewage).

Physical Characteristics

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. WE Energies and Alliant Energy provide electrical services to most of Waupaca County. Natural gas pipelines running through the county are owned by ANR, Alliant Energy, and WE Energies.

Electrical substation

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.

Rural residents usually heat their homes with propane. During the winter of 2014 there was a propane shortage due to five factors:

1. An increase in the amount of propane used to dry corn due to a late crop harvest coinciding with heavy rains depleted supplies last fall.
2. From November 28 to December 18 a major pipeline supplying propane to Wisconsin, Minnesota and Iowa was temporarily closed for maintenance.
3. Colder-than-normal winter temperatures.
4. An increase in exports of propane.
5. Constrained rail service.

On January 25, 2014 the Governor declared a state of emergency in response to the shortage and the state provided and estimated $31.2 million in funding to residents of Burnett, Polk and Washburn Counties. During this period, suppliers were rationing propane forcing people to use alternative heat sources, which can cause carbon monoxide poisoning or may lead to fires.

The water and sewage systems are most often a function of a municipal system and are usually found in more urbanized areas. Rural water is often provided by individual wells found on each property and sewage is managed by a septic system, also found on each individual property. Both municipal and individual systems are vulnerable to flooding, which can overwhelm the sewage systems and contaminate both municipal and private wells. Both types of systems are also vulnerable to electrical power loss because the electrical system powers the pumps and lift stations that move and treat the water and sewage.

Frequency of Occurrence

Waupaca 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.

The workgroup agreed that Waupaca County has a high likelihood of electric utility failures; a low likelihood of natural gas and sewer utility failures; and a very low likelihood of water utility failure. However, the likelihood of damage for any type of these utilities is high, especially with natural gas during the winter. 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 functional and access needs (e.g., the elderly, the young, those on special medical equipment) is involved.

Vulnerability

The failure of a utility to function can have wide-ranging impact in Waupaca County. People, especially functional and access 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 on sewage lift stations in Waupaca County, other utilities may also 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 be forced to operate at a reduced capacity due to the loss of utility services. Facilities with hazardous materials that are required to report under the Emergency Planning and Community Right-to-Know Act (EPCRA) 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 animals require fresh water and to some extent, temperature control in shelters/barns. Extreme temperatures reduce the production volume and products such as milk may not be able to be properly stored. Modern farms also require on a large amount of automation for feeding, watering, and managing the wastes of the facility.

Finally, transportation on roadways may become unsafe due to the loss of directional and street lights.

Hazard Mitigation Strategies

The goal of utility failure mitigation activities is to reduce, in a cost effective manner, the loss of lives and property due to these events. Waupaca County has worked directly with the utility companies and emergency responders in formulating emergency management plans. During a fuel or power shortage, residents, schools, industry and businesses will be asked to take measures to conserve fuel. If the fuel shortage reaches a critical stage, all non-essential facilities may be closed and contingency plans activated.

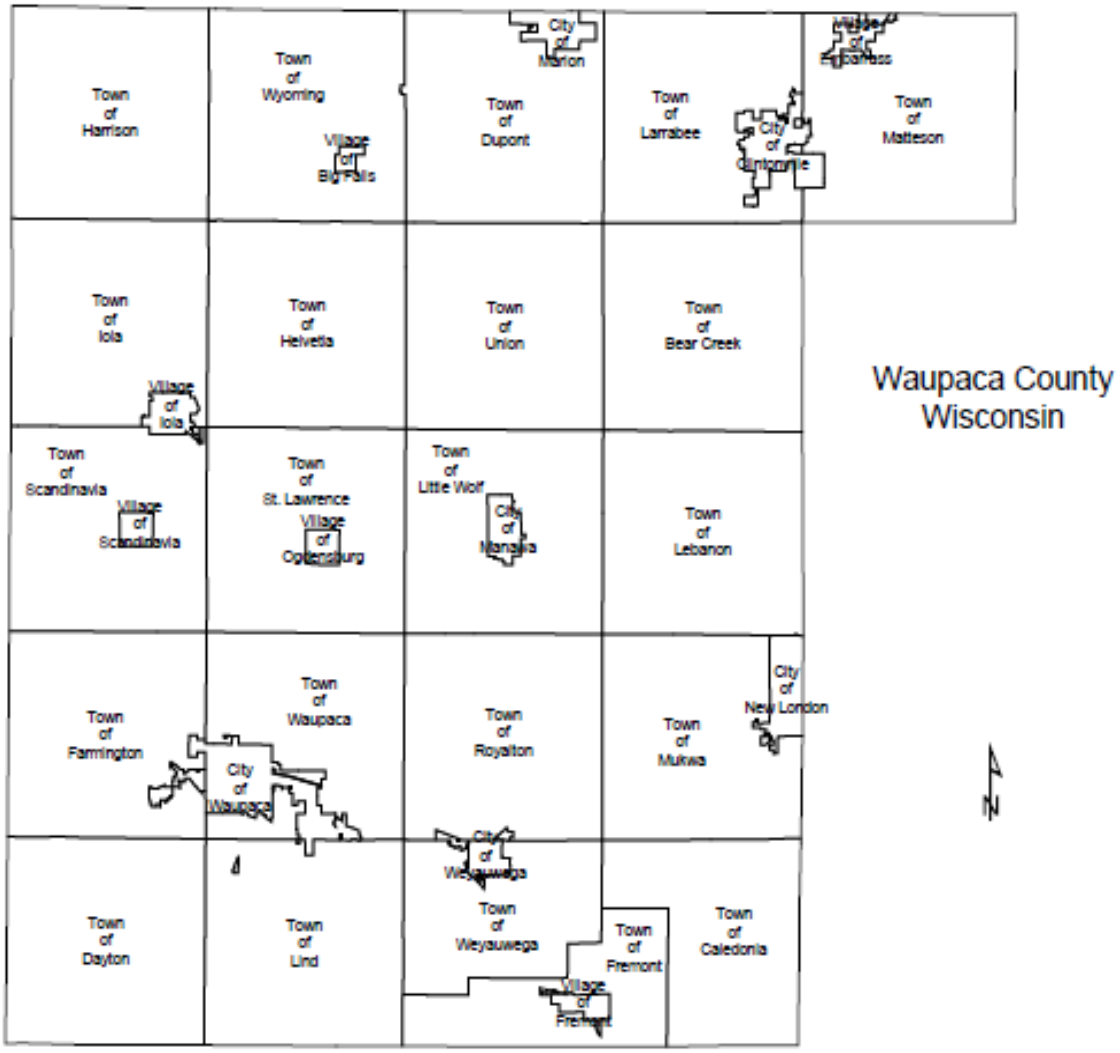
In the event of a prolonged power outage, Waupaca County would need generators to power various operations and facilities. Options and costs of purchasing generators should be explored. Evacuation and shelter arrangements have been prepared in case of a severe power outage.

Discussions should be opened with service providers about burying phone, cable, and power lines, especially in high-risk areas.

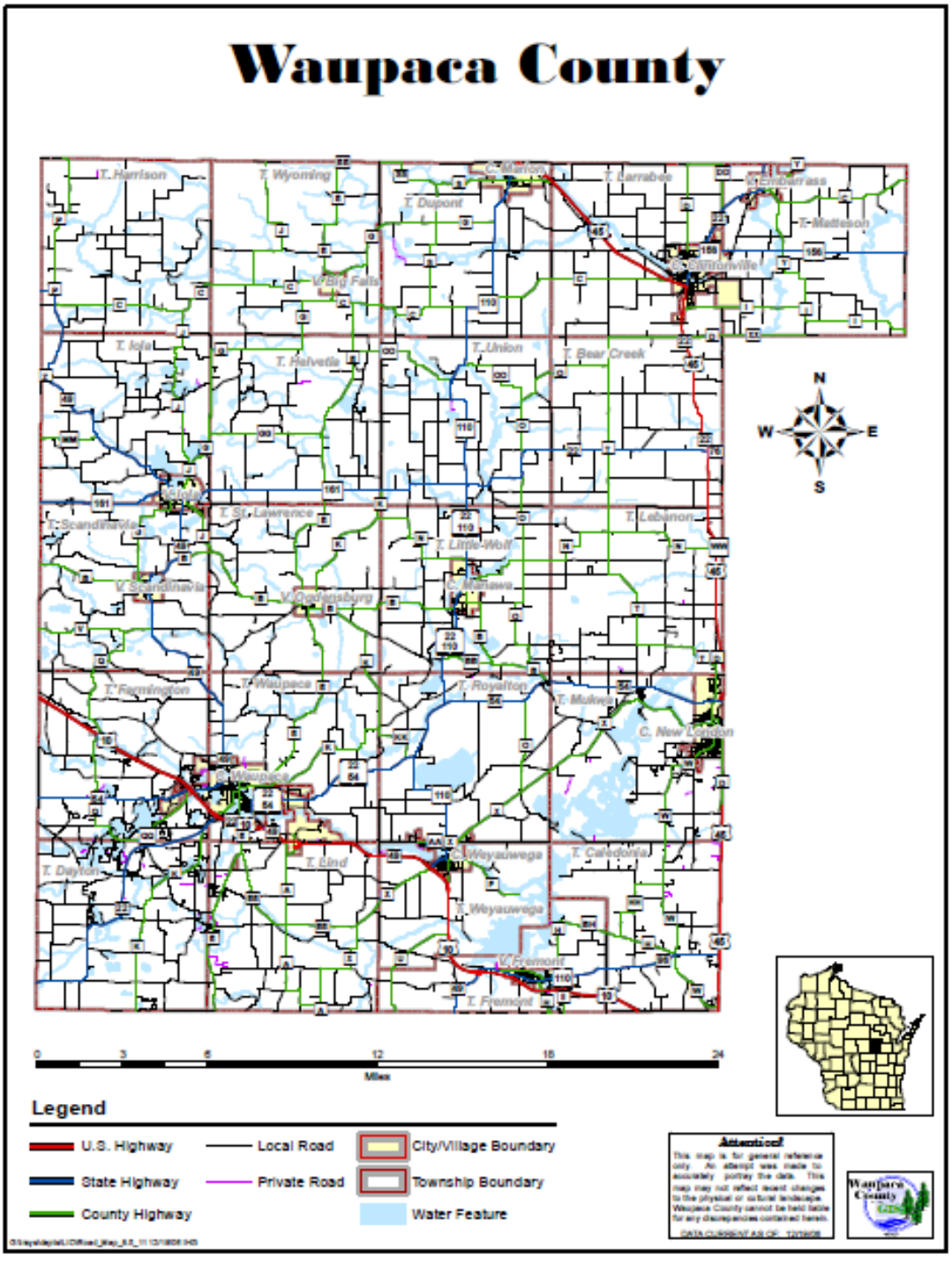
The county will also explore the possibility and options to build a fiber ring around the county and an offsite back-up to improve emergency communications.

Appendix A: Maps

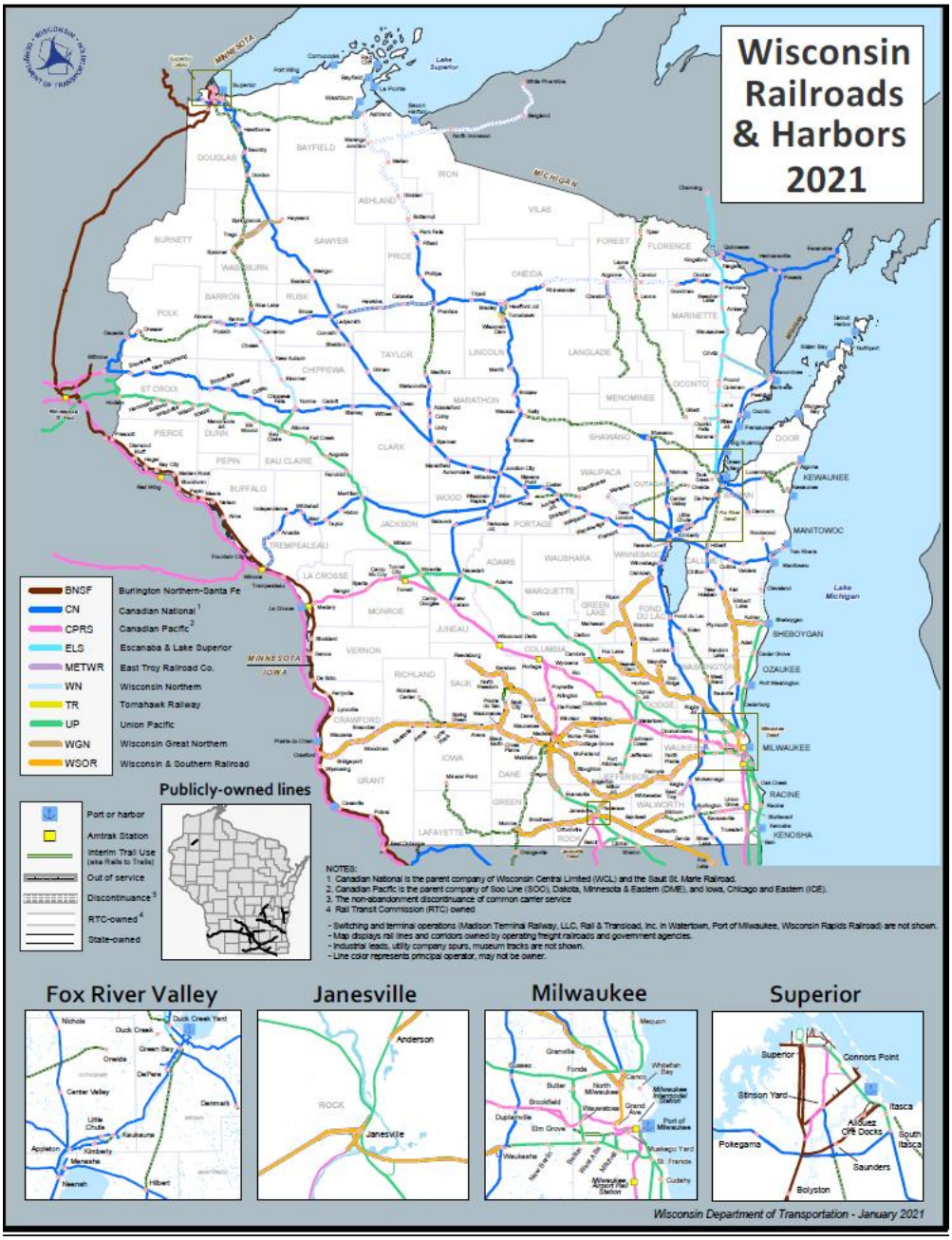
Map of County Municipal Divisions



Map of County Road Network

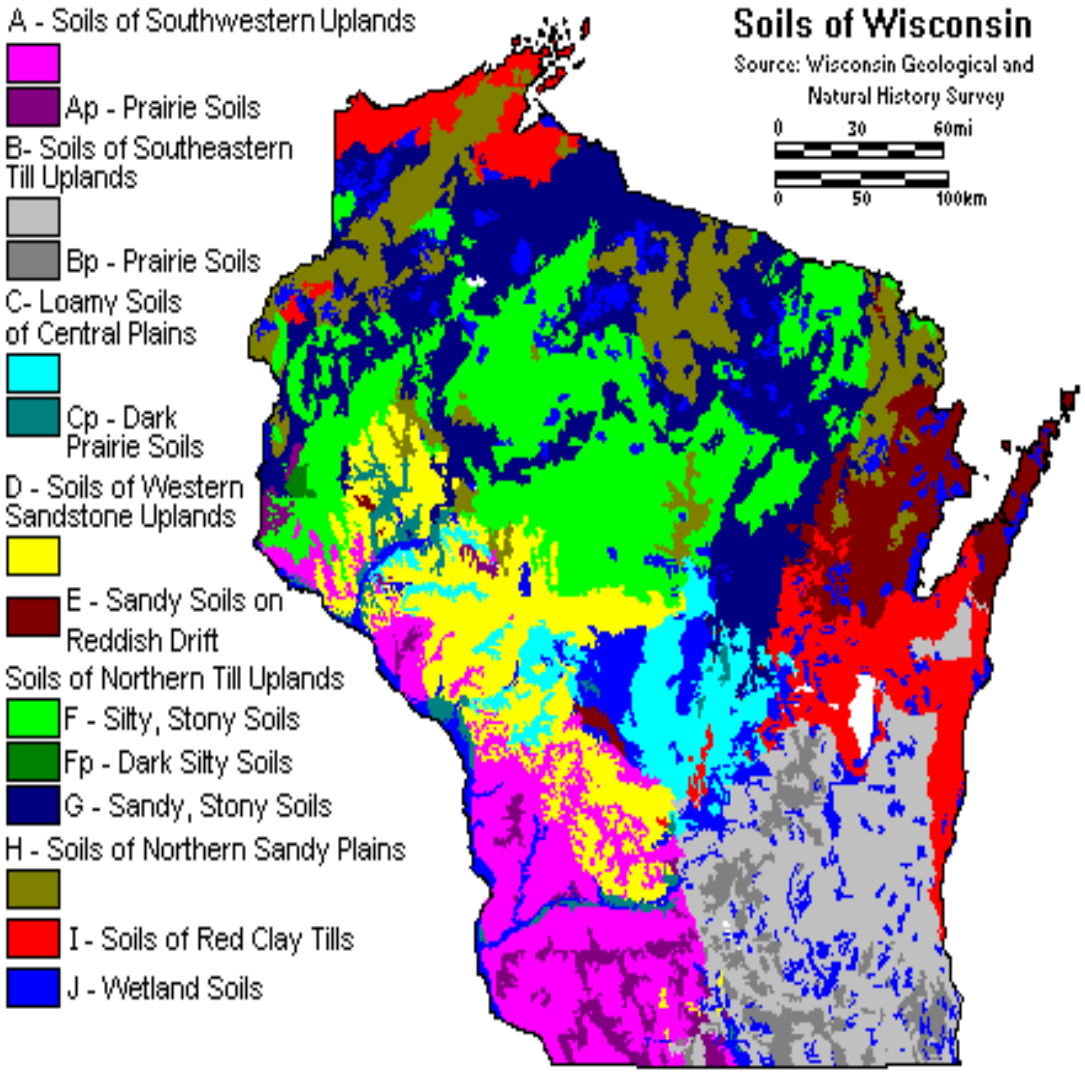


Wisconsin Railroads and Harbors Map [141]



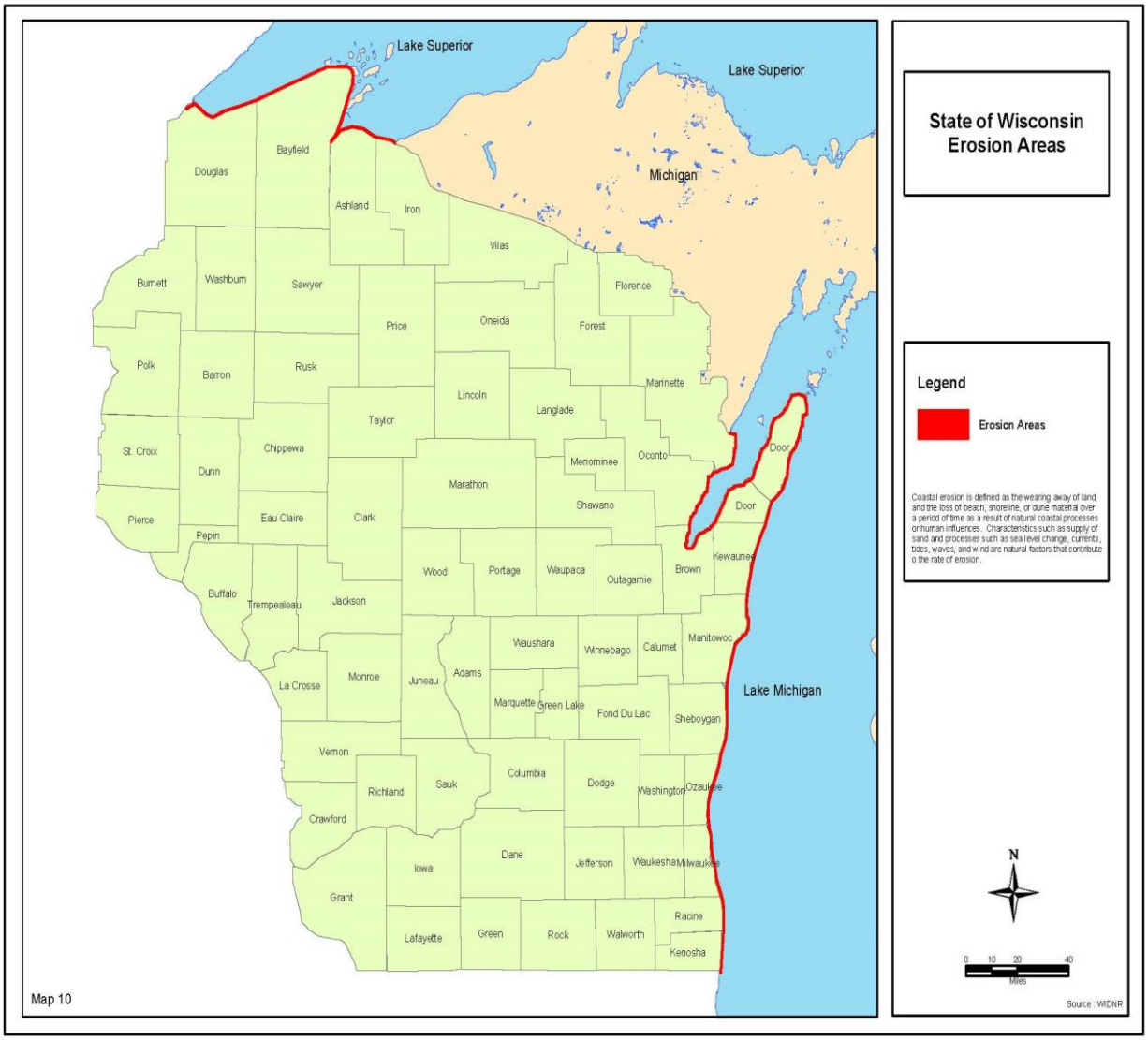
[141] http://wisconsindot.gov/Documents/travel/rail/railmap.pdf

Soils Types[142]



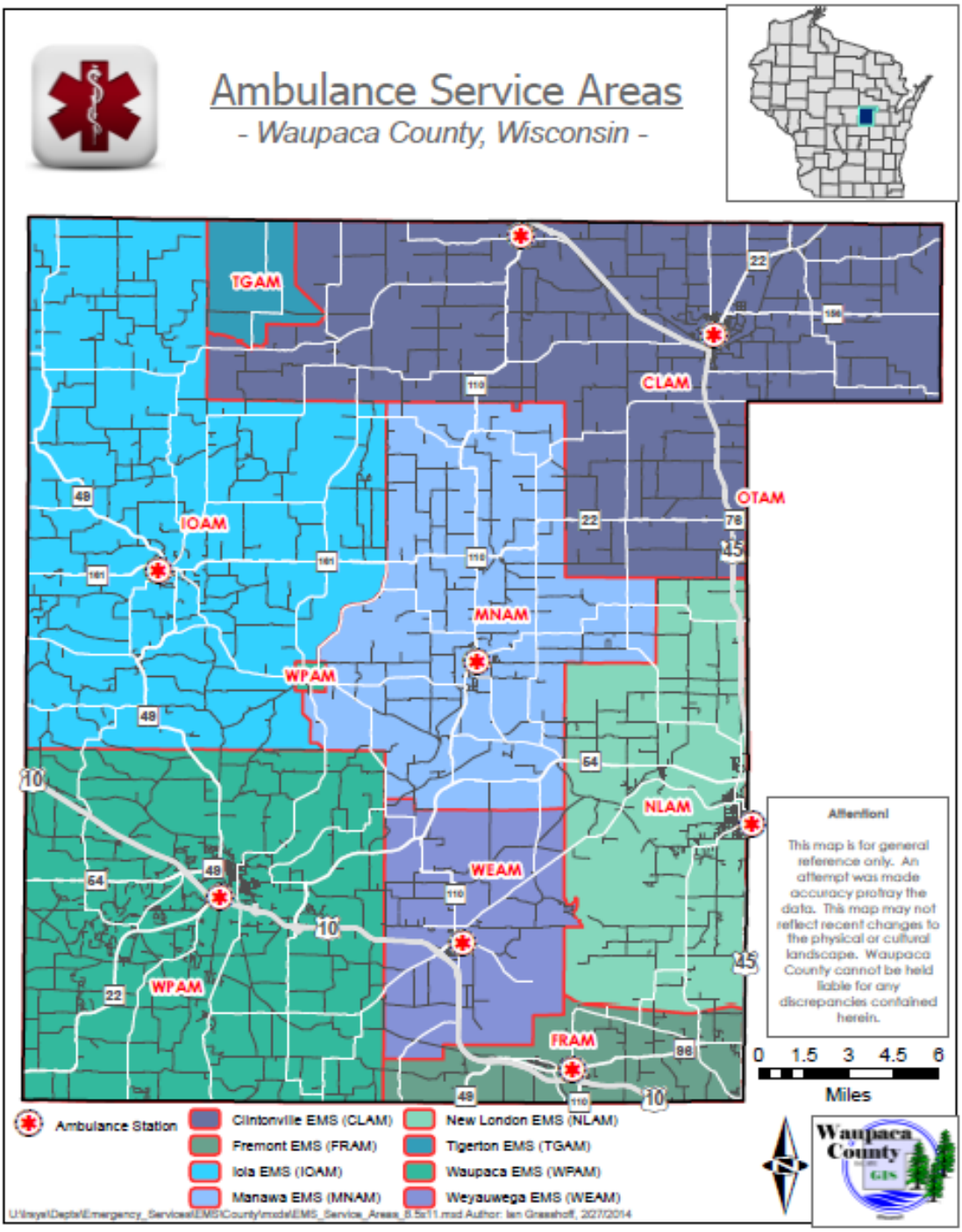
[142] *Soils of Wisconsin* compiled by F. D. Hole, 1973; Wisconsin Geological and Natural History Survey Map, scale (approx.) 1: 3,150,000.

Erosion Areas in Wisconsin[143]

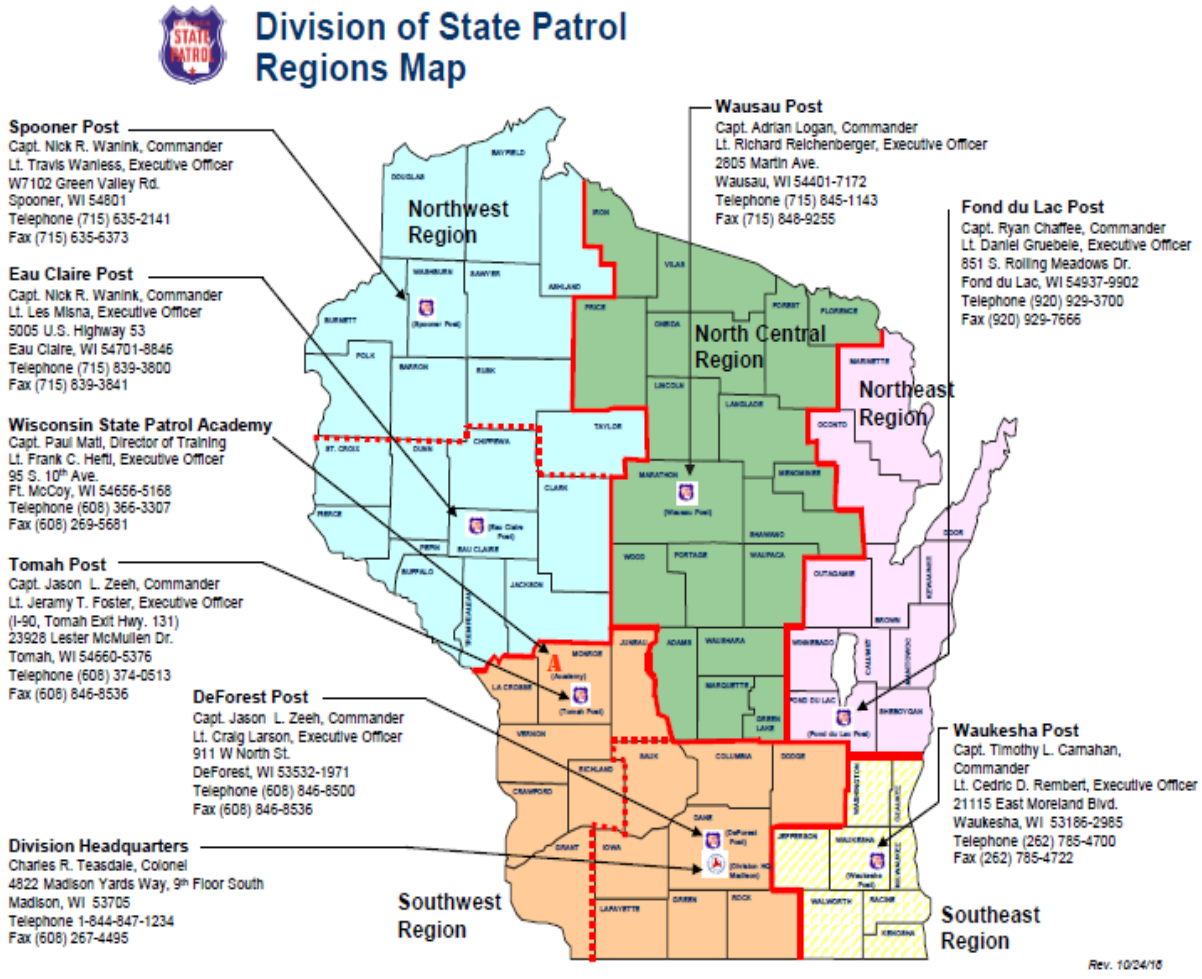


[143] Wisconsin State Hazard Mitigation Plan

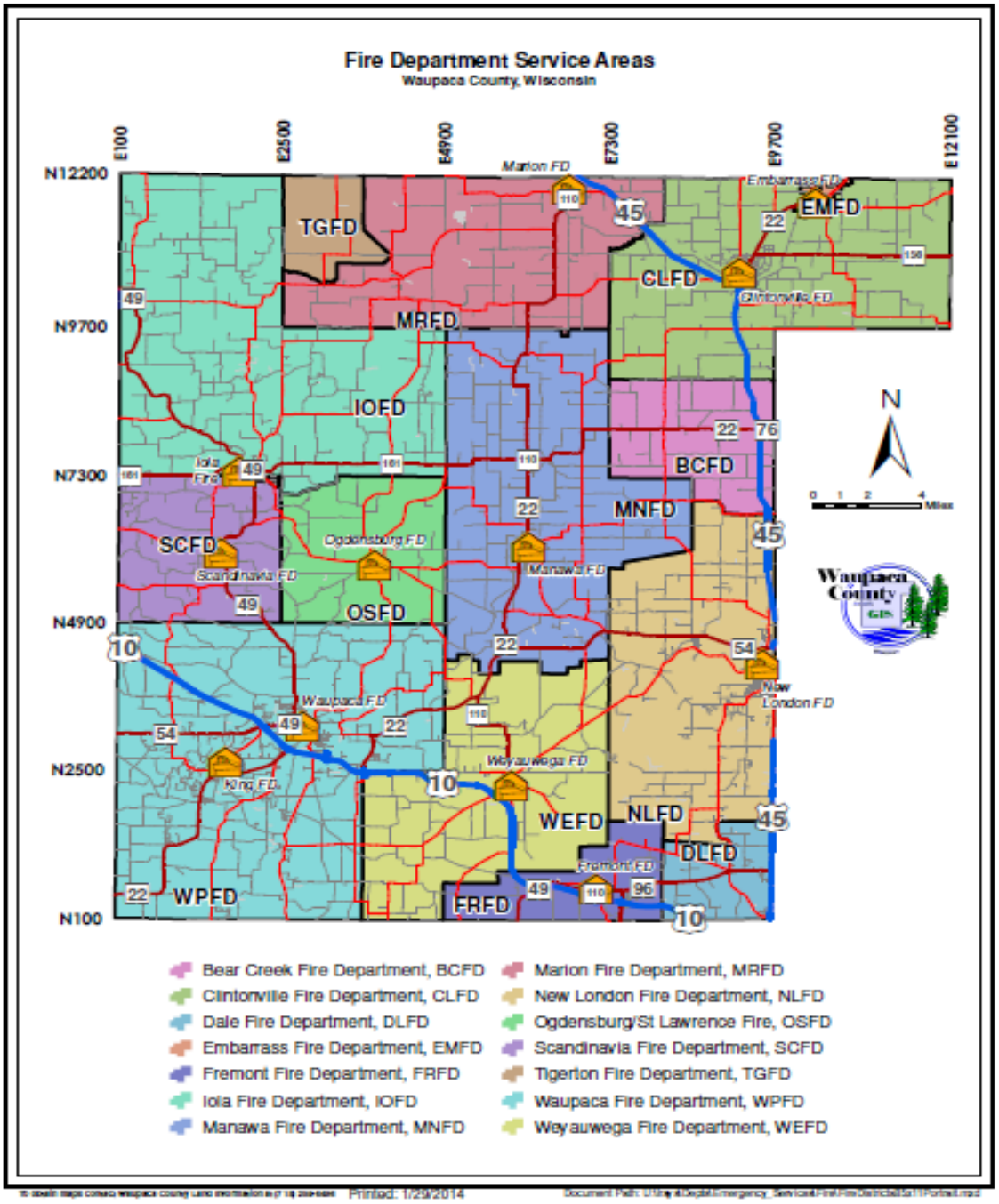
County EMS Districts



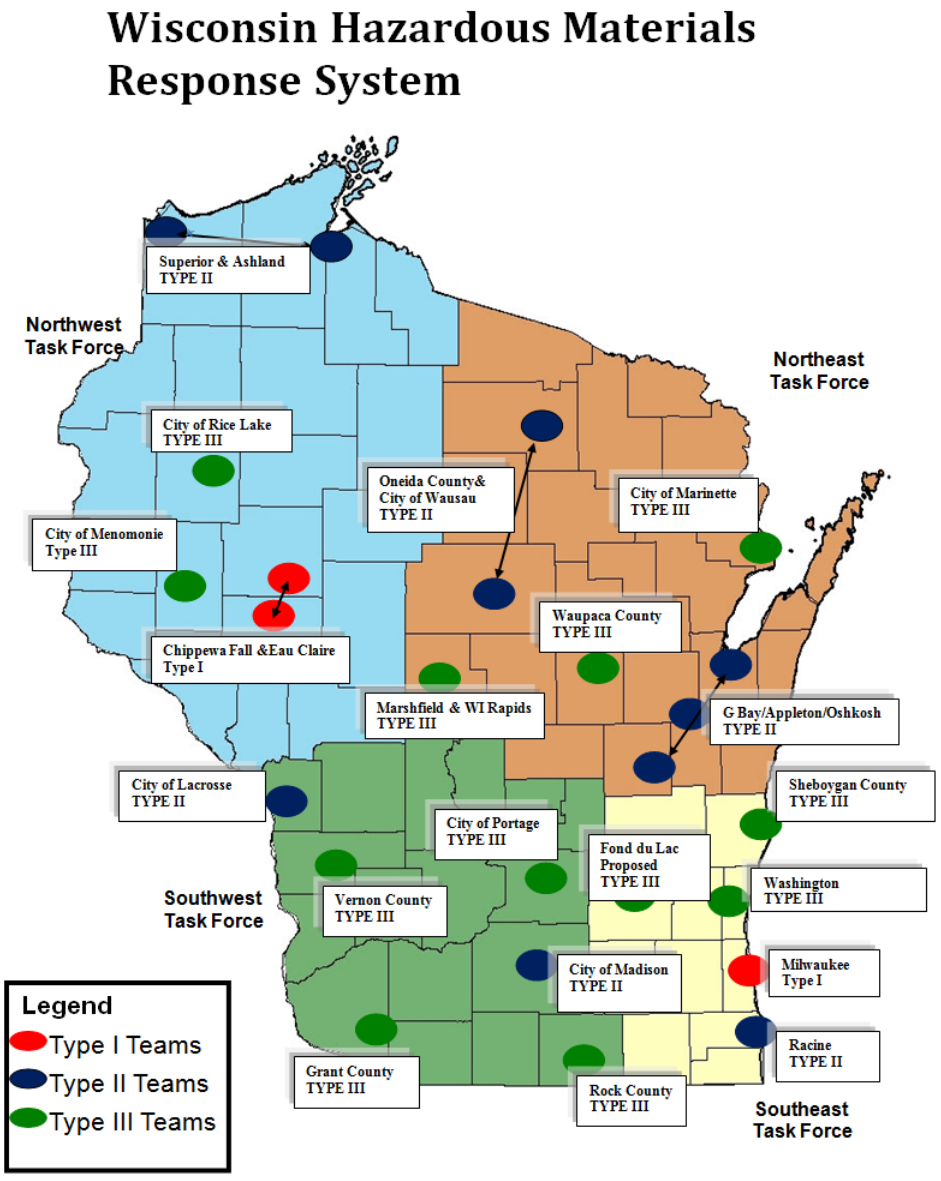
Wisconsin State Patrol Regions



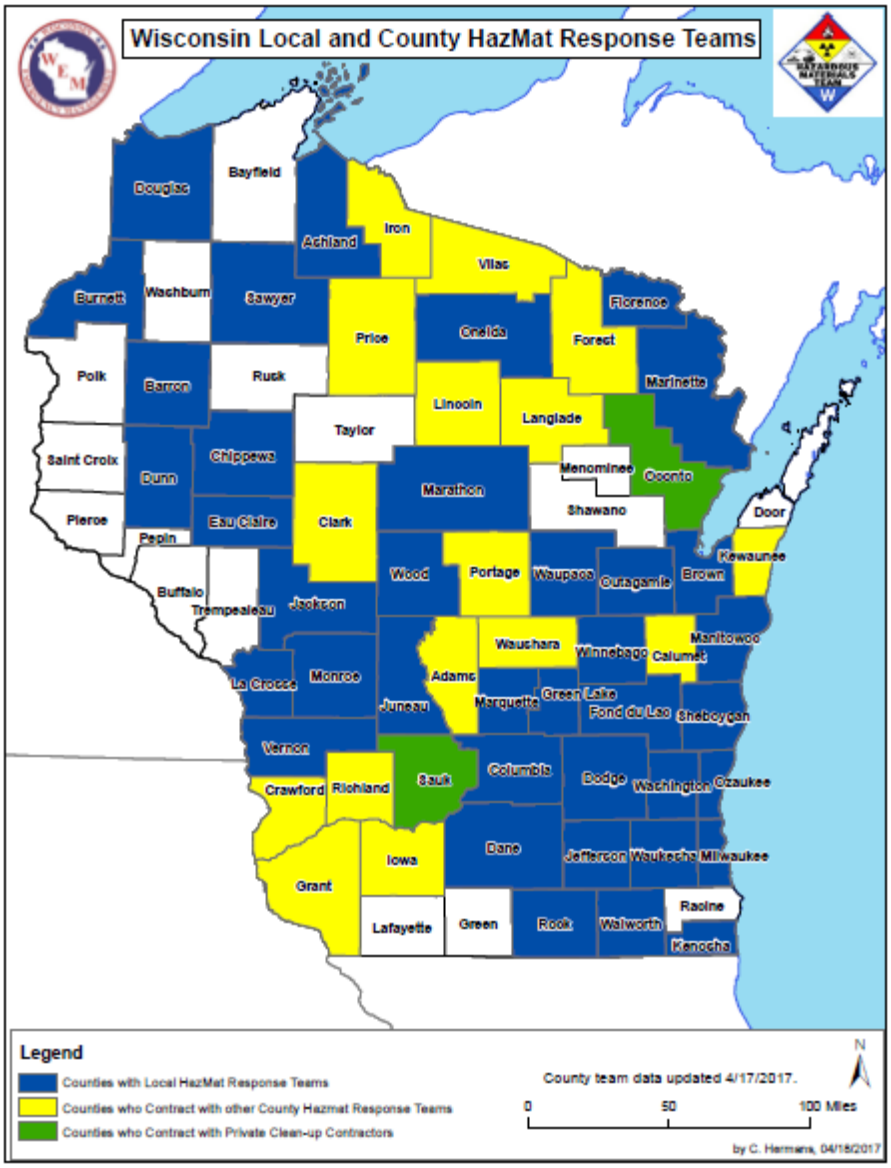
County Fire Districts



Wisconsin's Regional & County/Local HazMat Response Teams

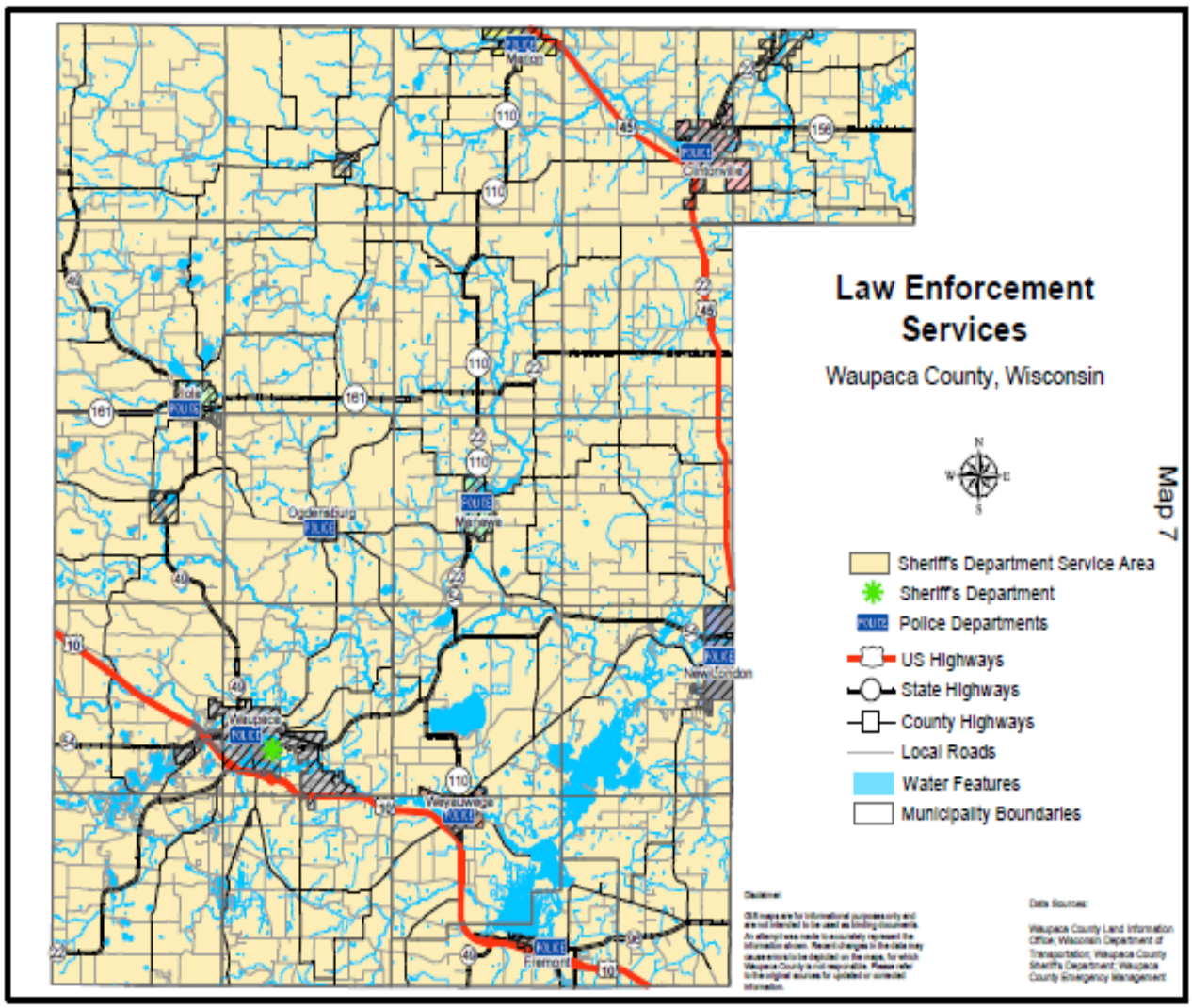


Wisconsin Hazardous Materials Response Teams[144]

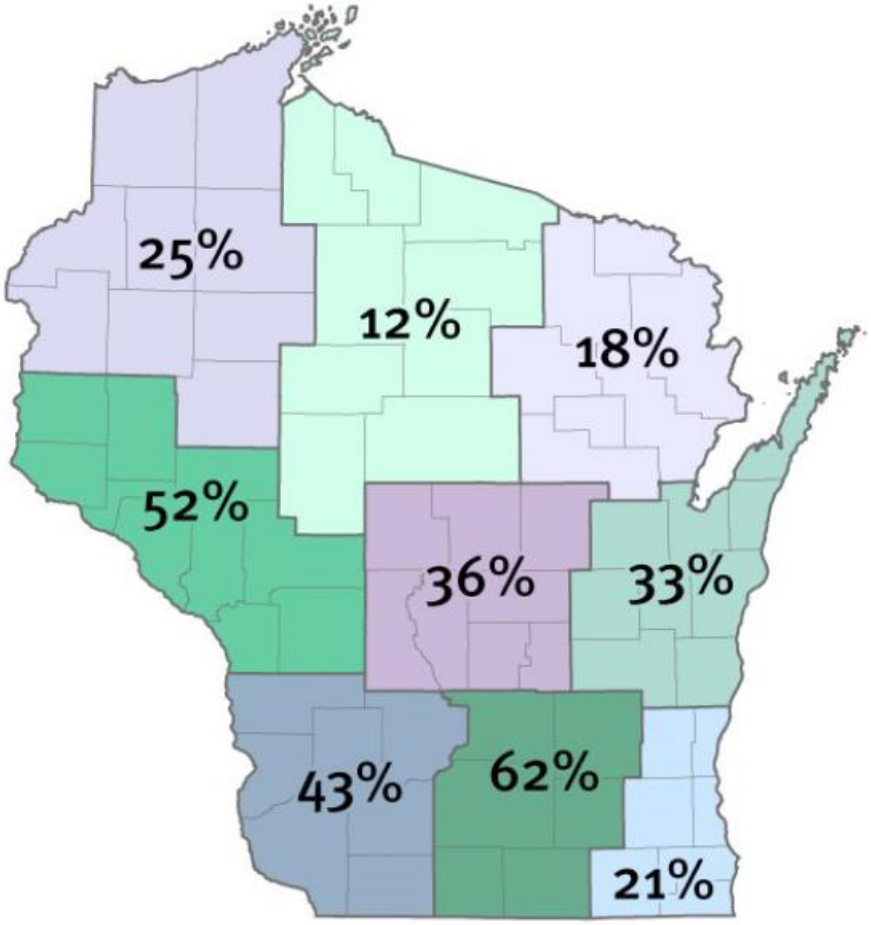


[144] Note that as of the publication date of this plan, Marathon County is in the process of disbanding their hazardous materials team but a final effective date has not been published.

County Law Enforcement Districts



Percentage of Private Wells with Detectable Herbicides or Herbicide Metabolites (2001)[145]



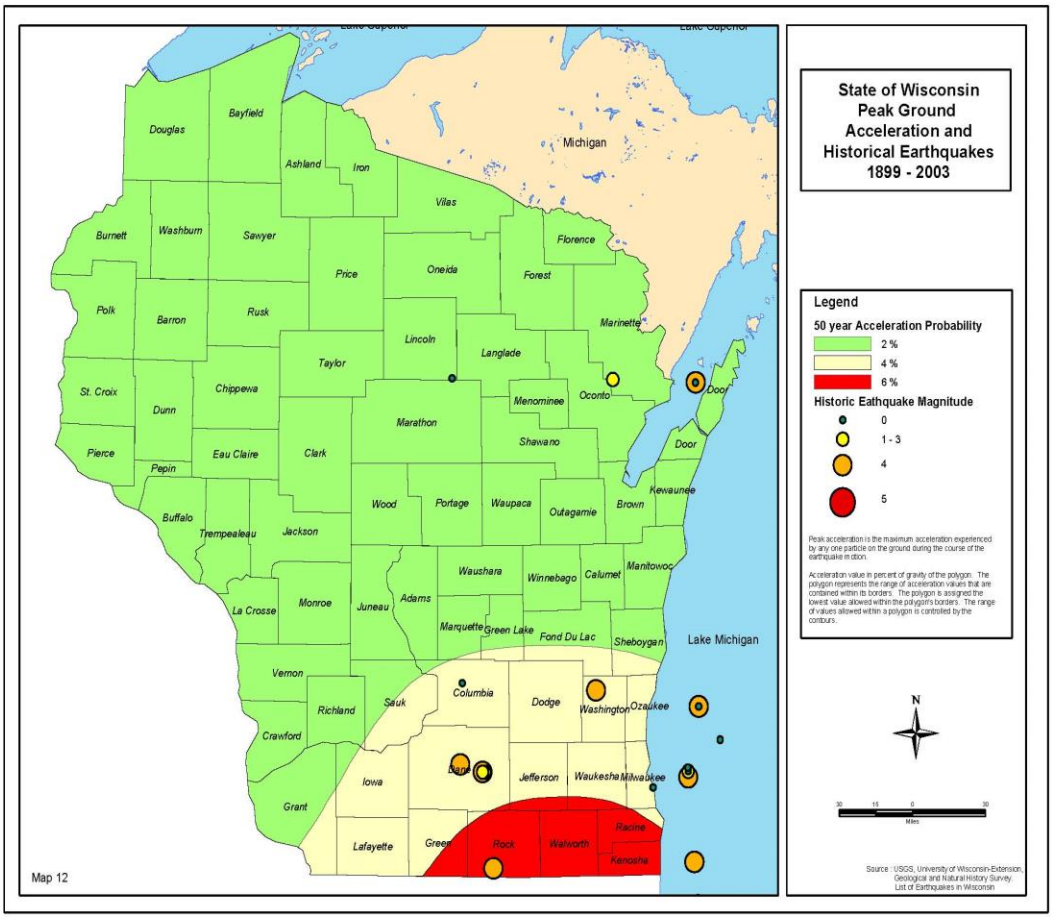
Herbicide data: Wisconsin Department of Agriculture, Trade and Consumer Protection, 2002, Agricultural chemicals in Wisconsin groundwater: final report, *http://www.datcp.state.wi.us/arm/agriculture/land-water/environ_quality/pdf/arm-pub-98.pdf*

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

[145] https://wi.water.usgs.gov/gwcomp/find/waupaca/pesticidestate.html

Earthquakes in Wisconsin[146]

Peak Ground Acceleration Contours and Historical Earthquakes in Wisconsin



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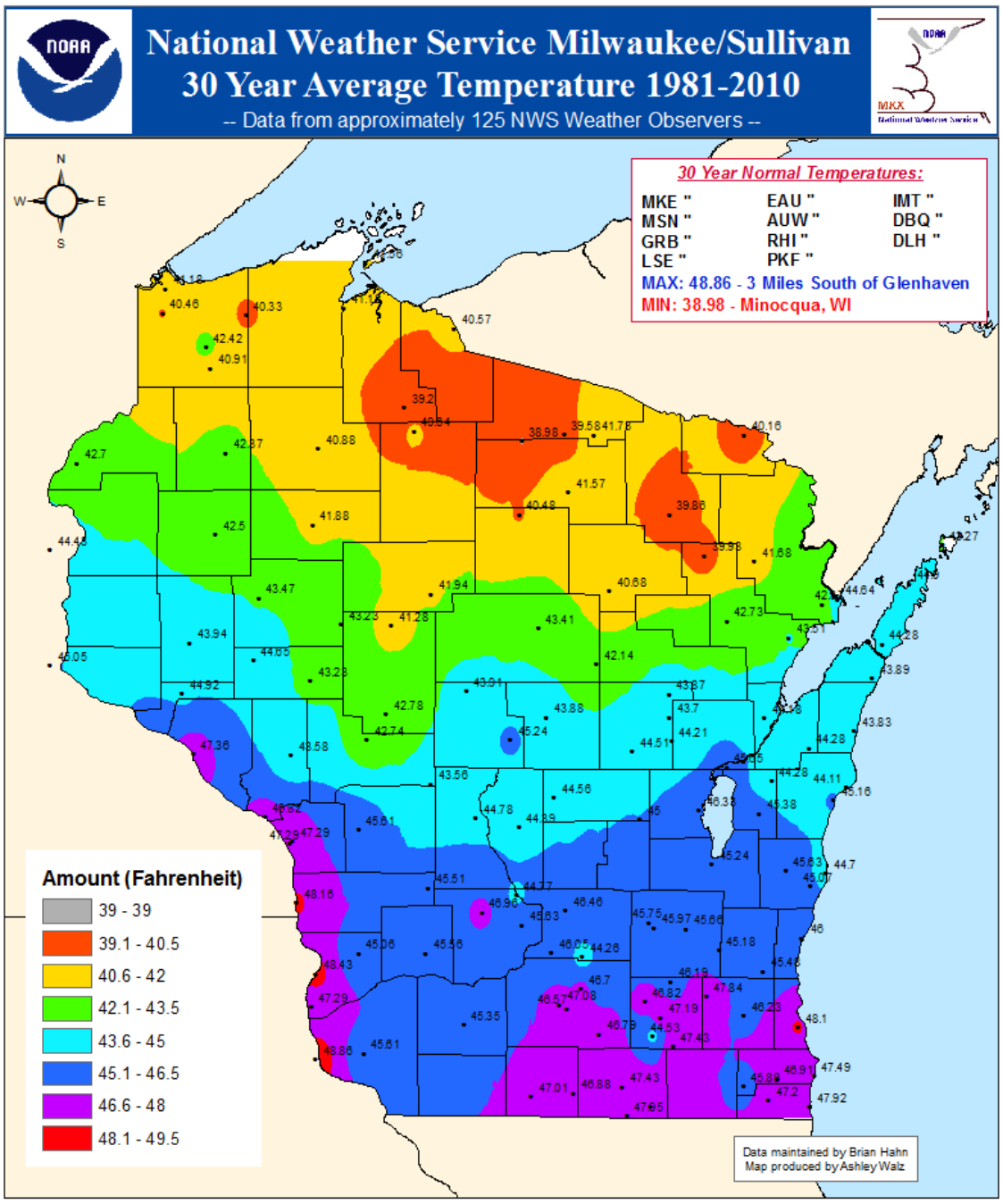
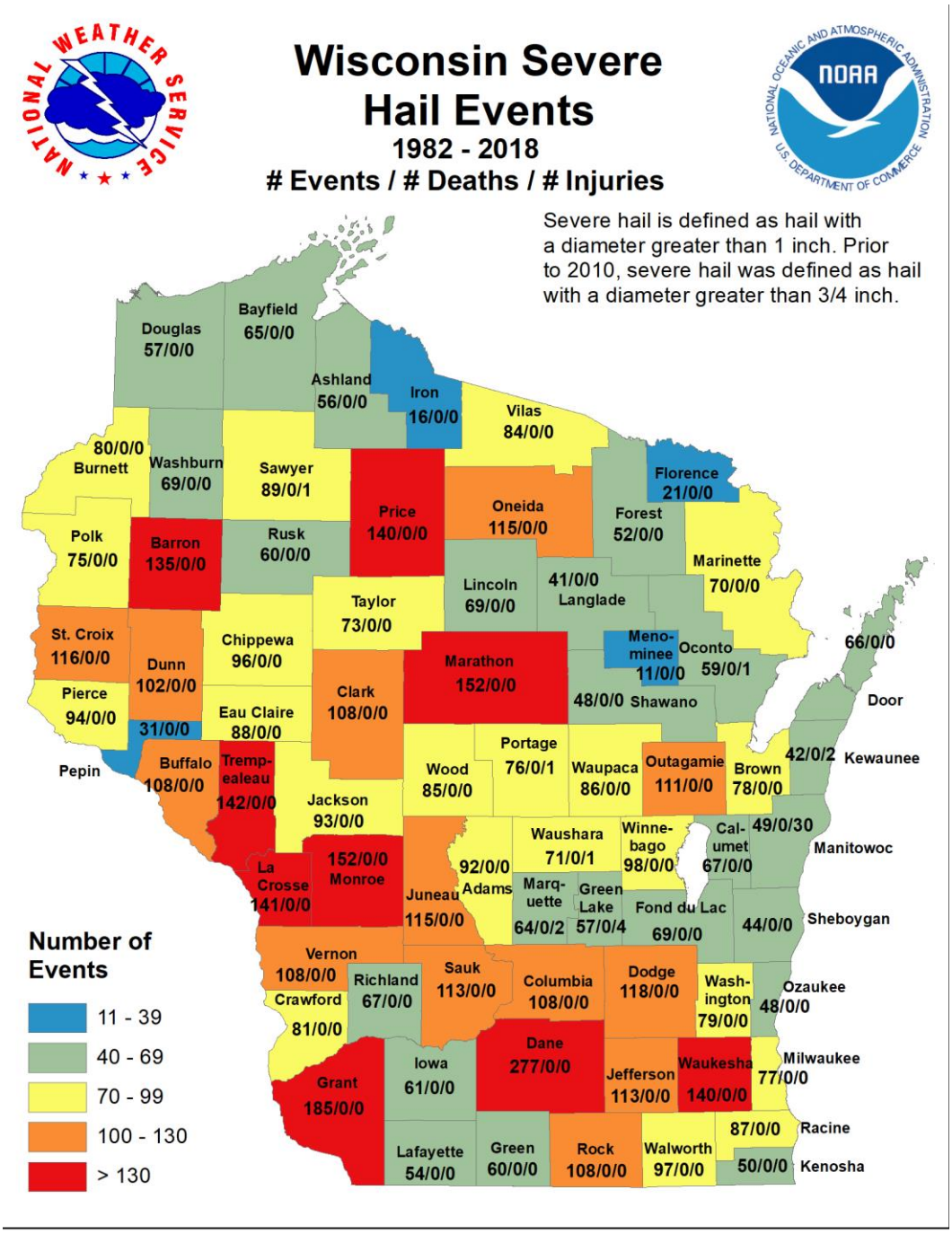
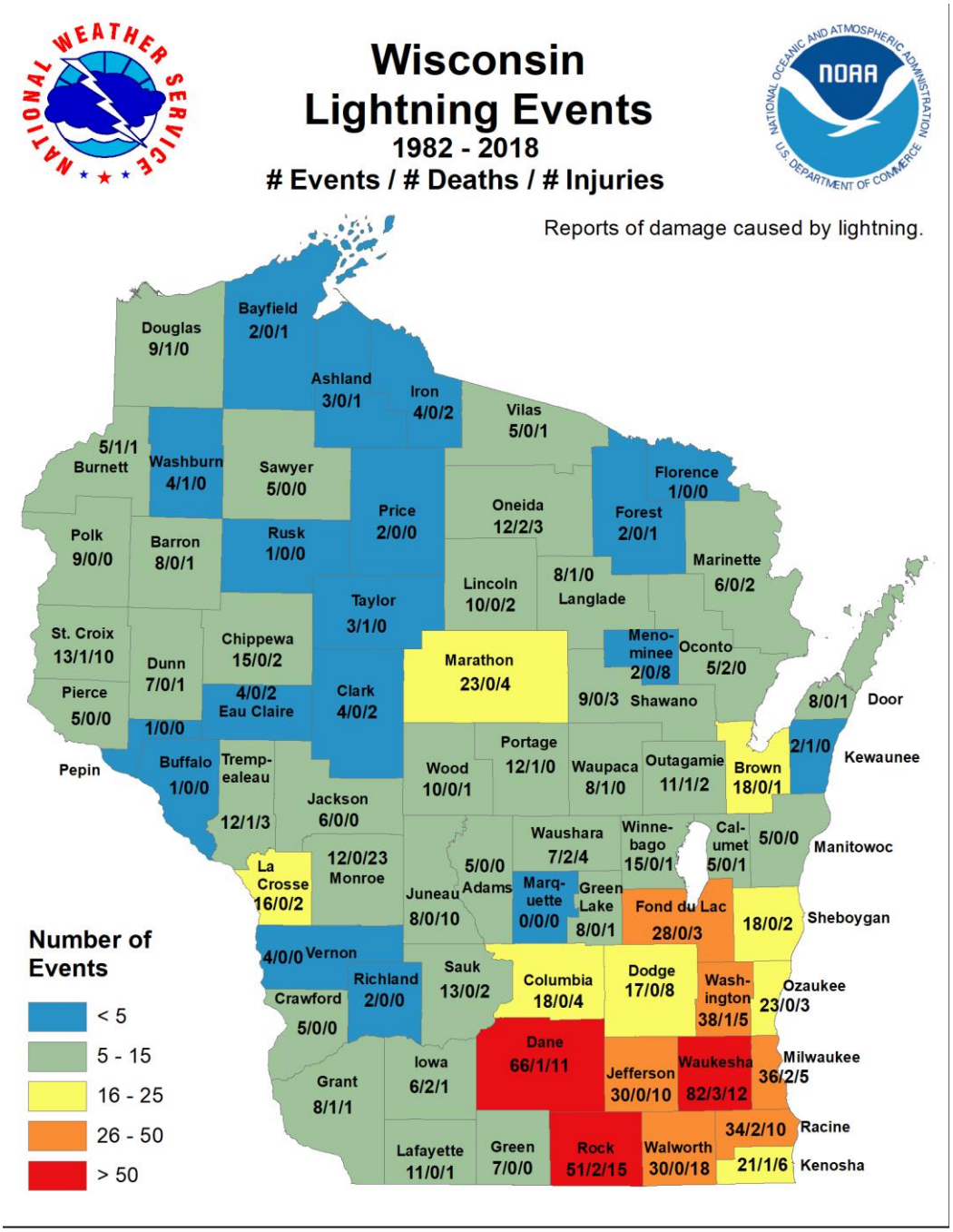
Wisconsin 30 Year Average Temperature



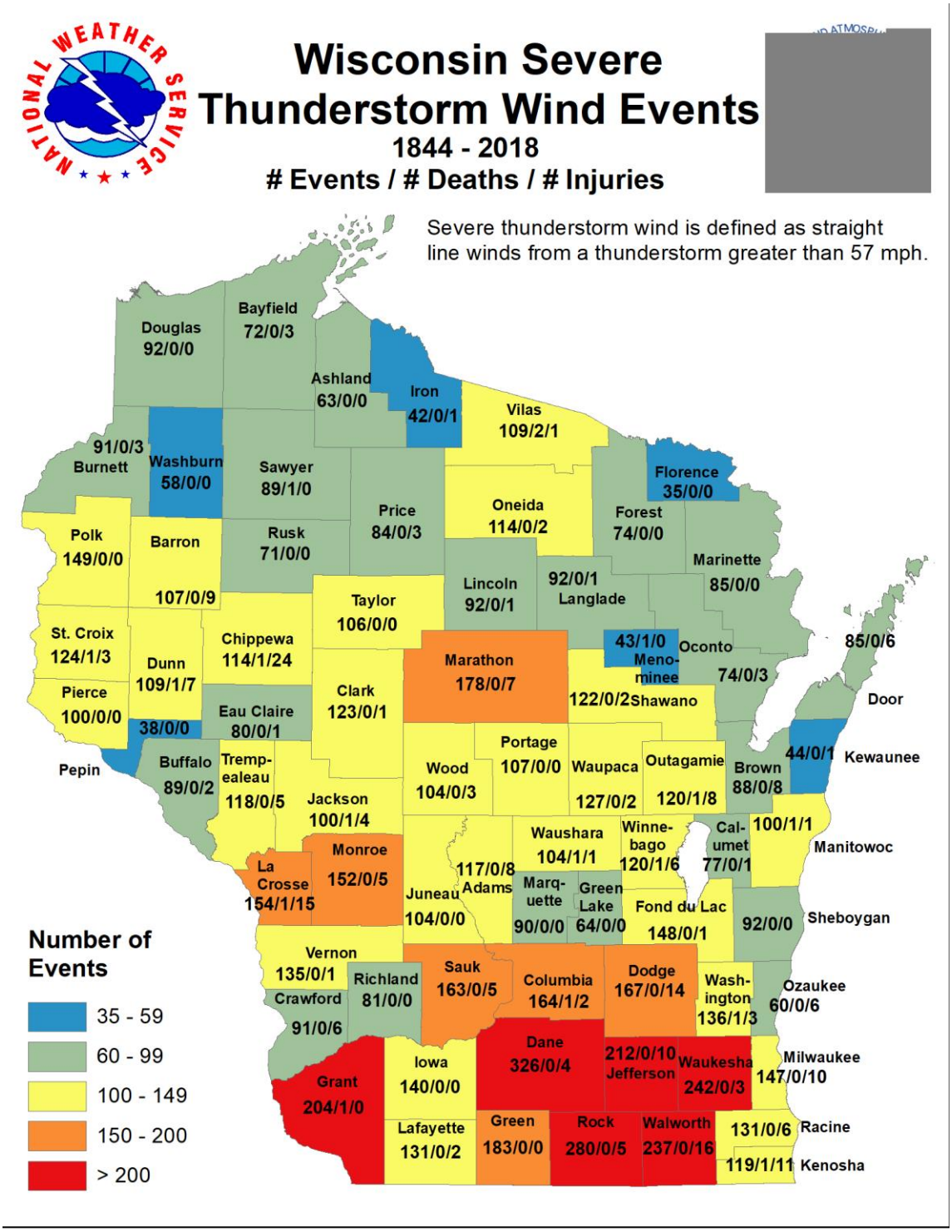
Wisconsin Severe Hail Events



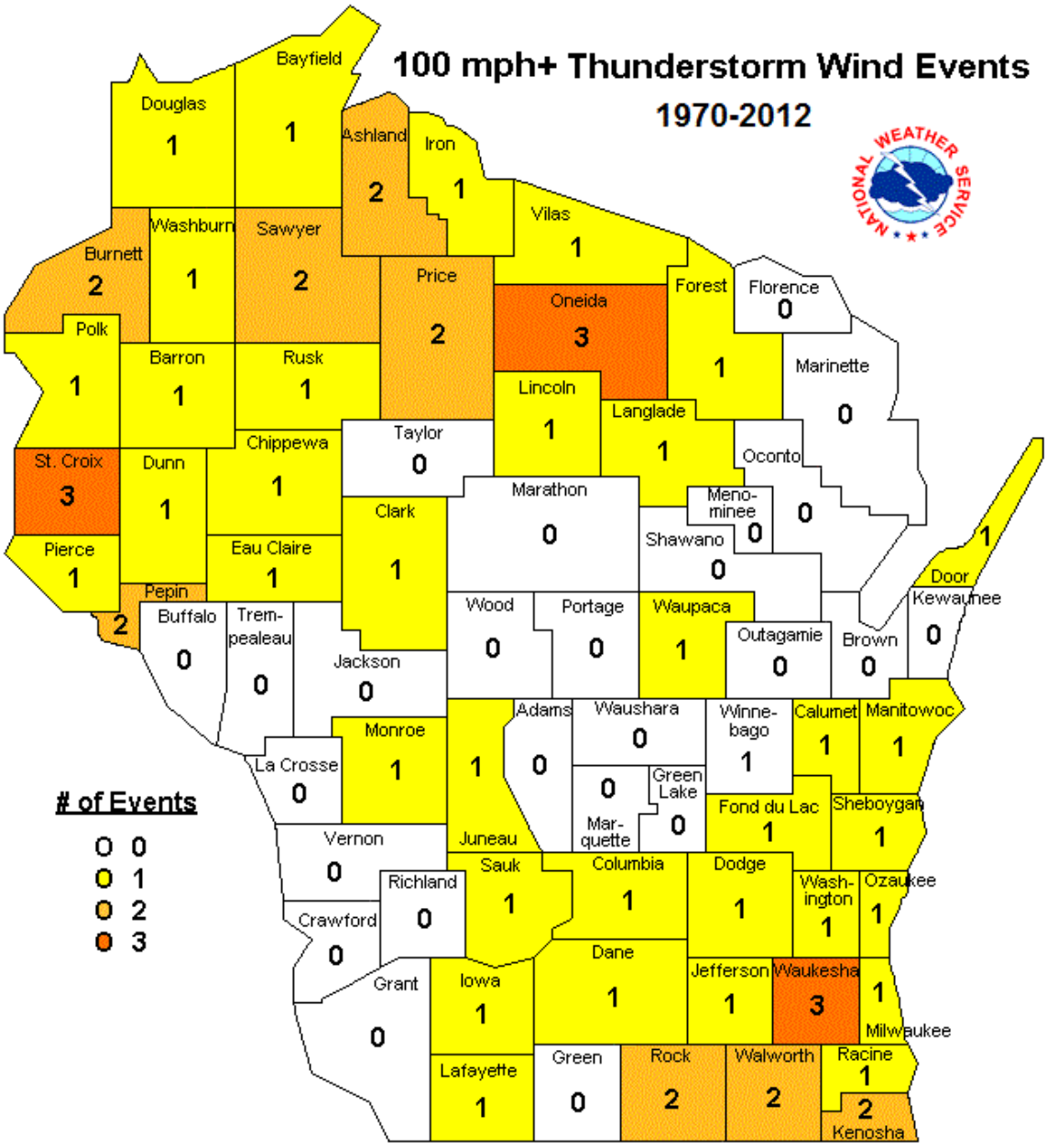
Wisconsin Lightning Events



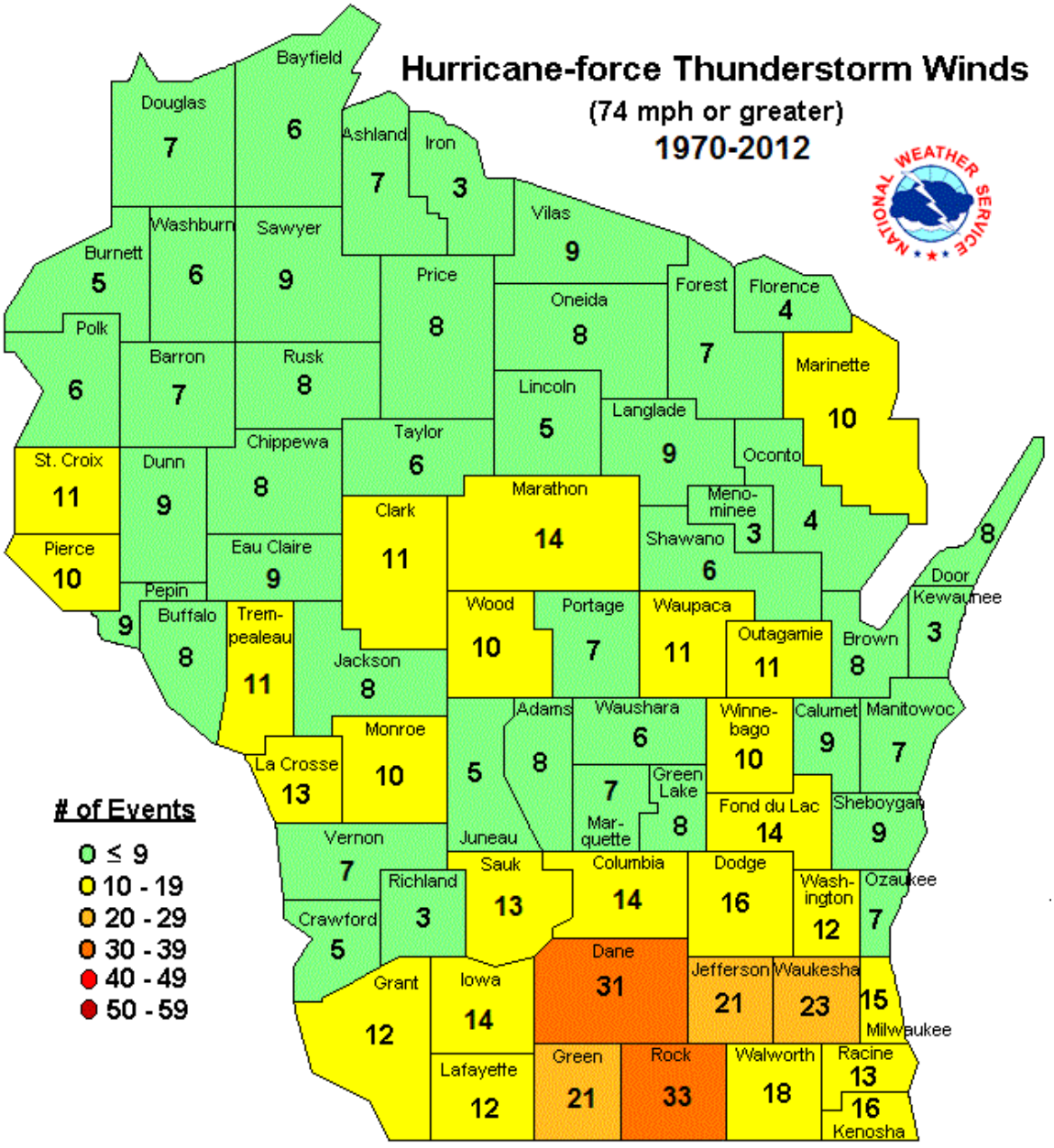
Wisconsin Severe Thunderstorm Wind Events



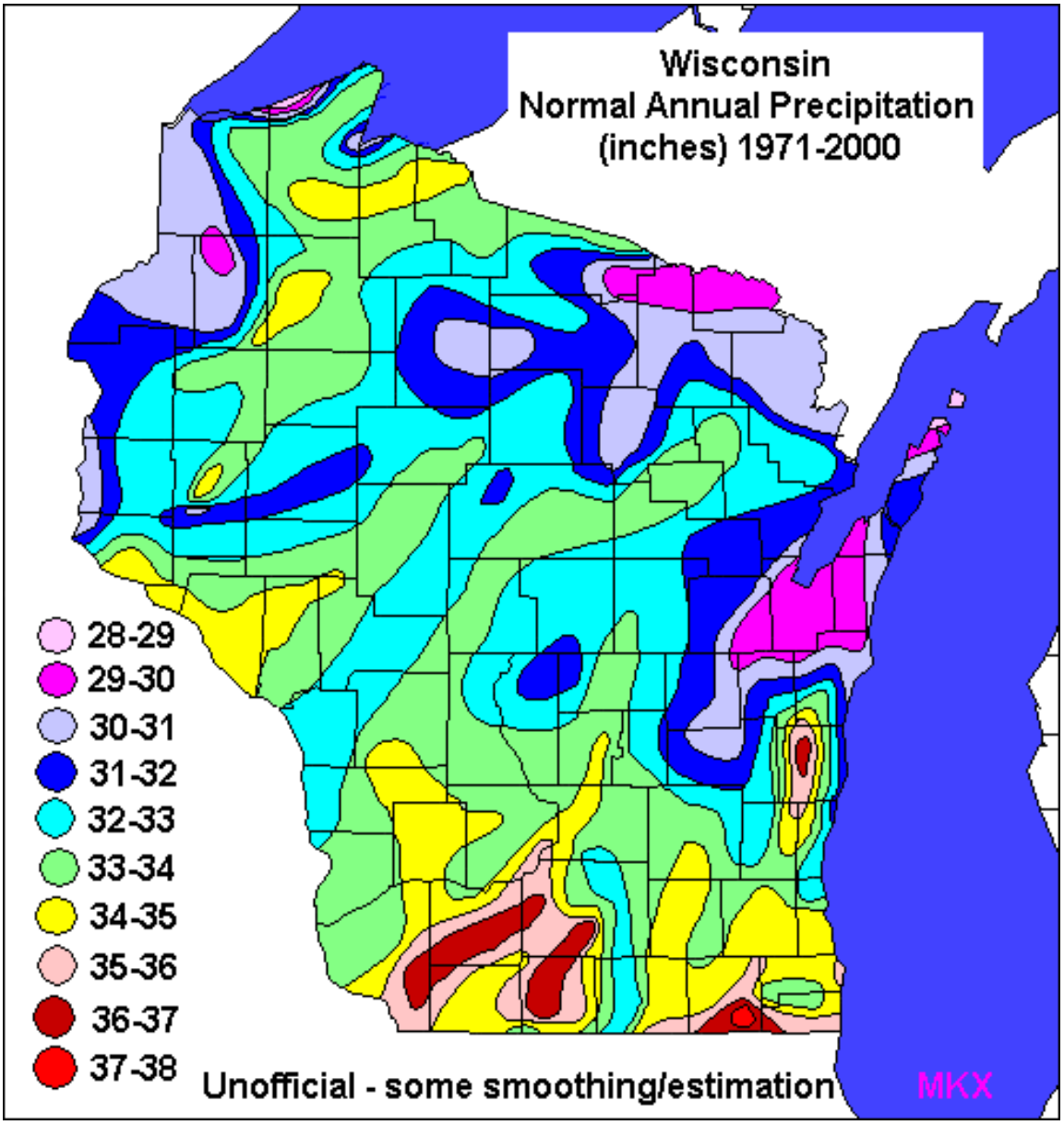
Wisconsin 100+ mph Thunderstorm Wind Events



Wisconsin Hurricane-force (74+ mph) Thunderstorm Winds

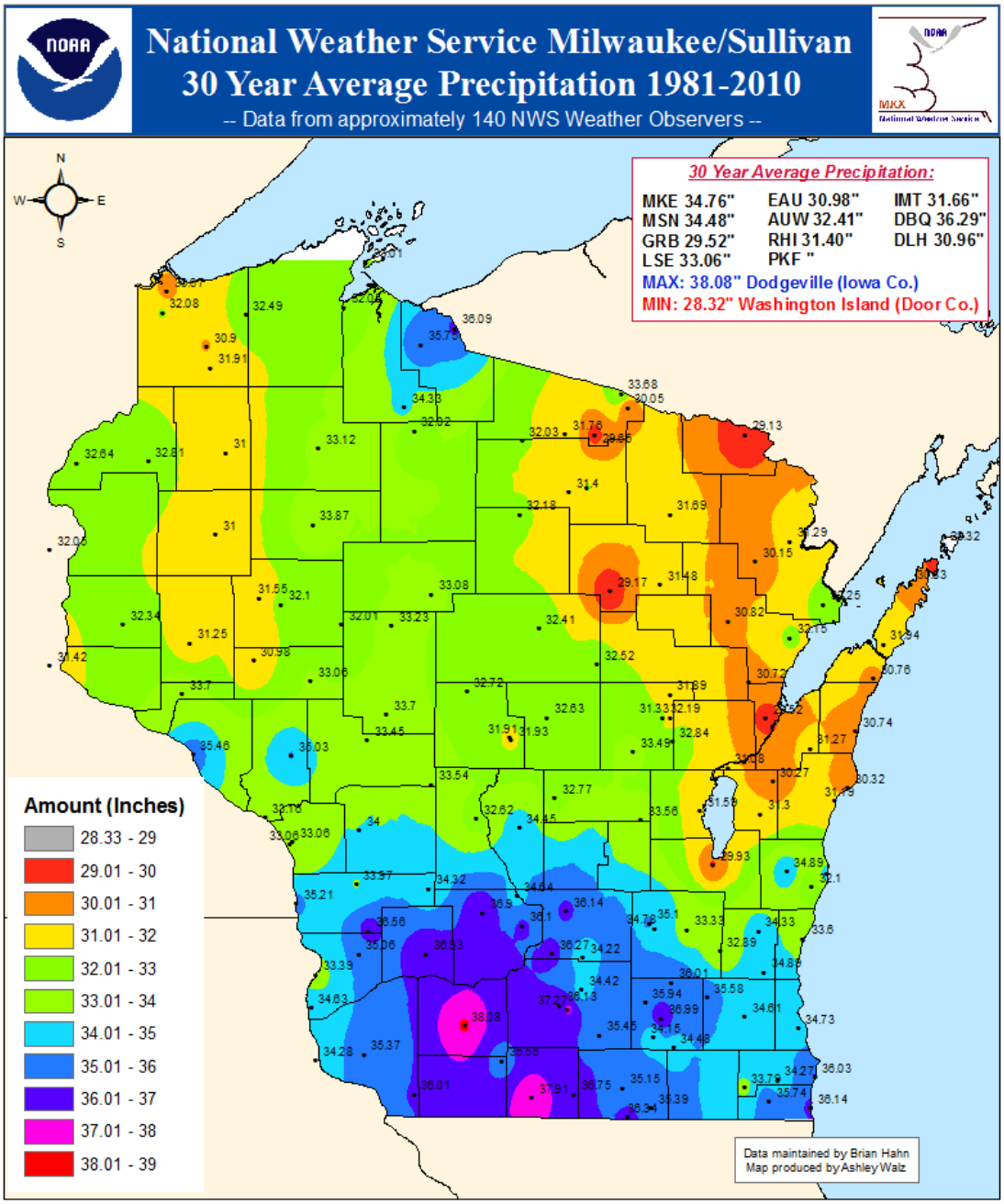


Wisconsin Annual Precipitation[147]



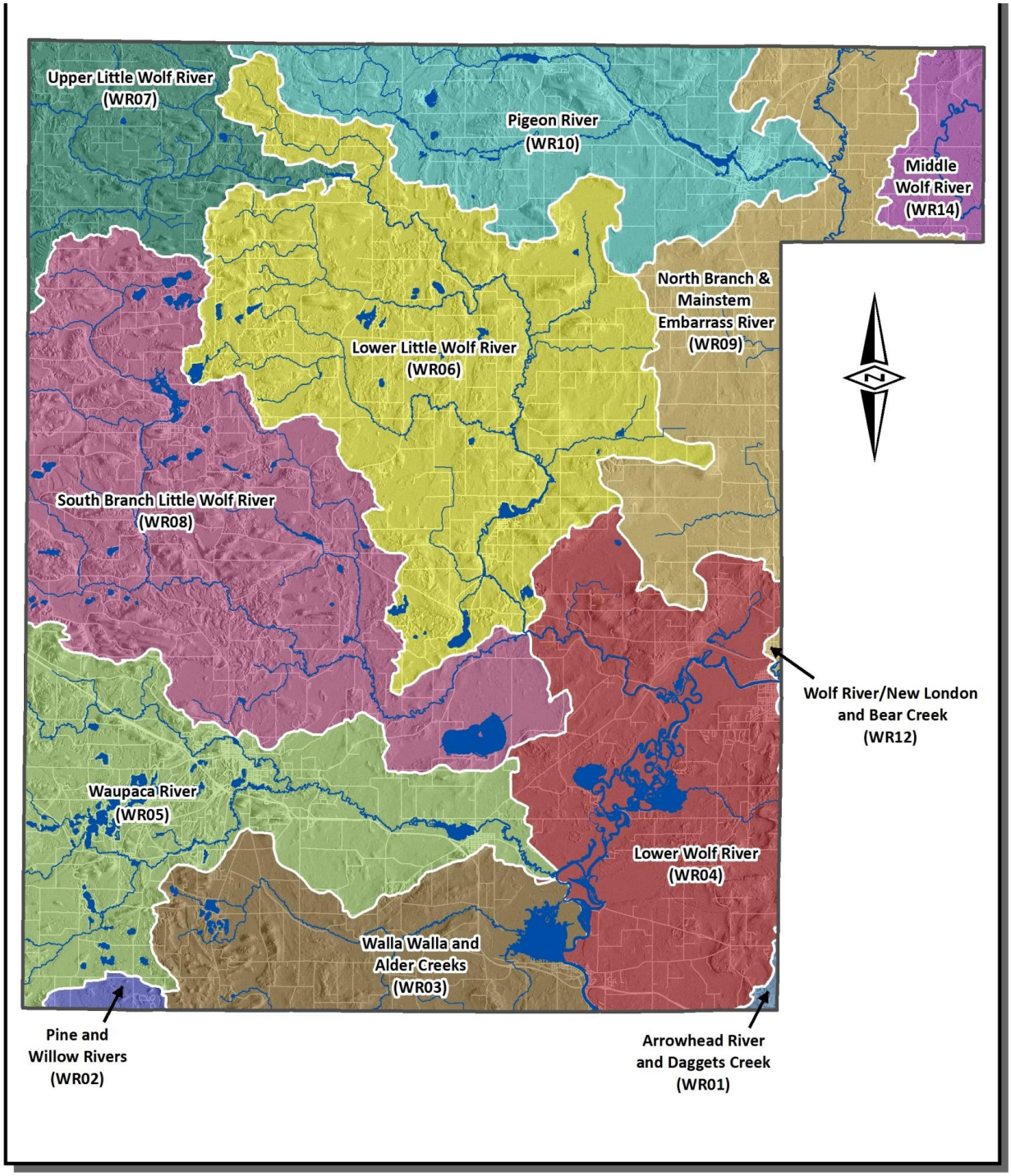
[147] http://www.crh.noaa.gov/mkx/climate/wipcpn.gif

Wisconsin 30-Year Average Precipitation[148]



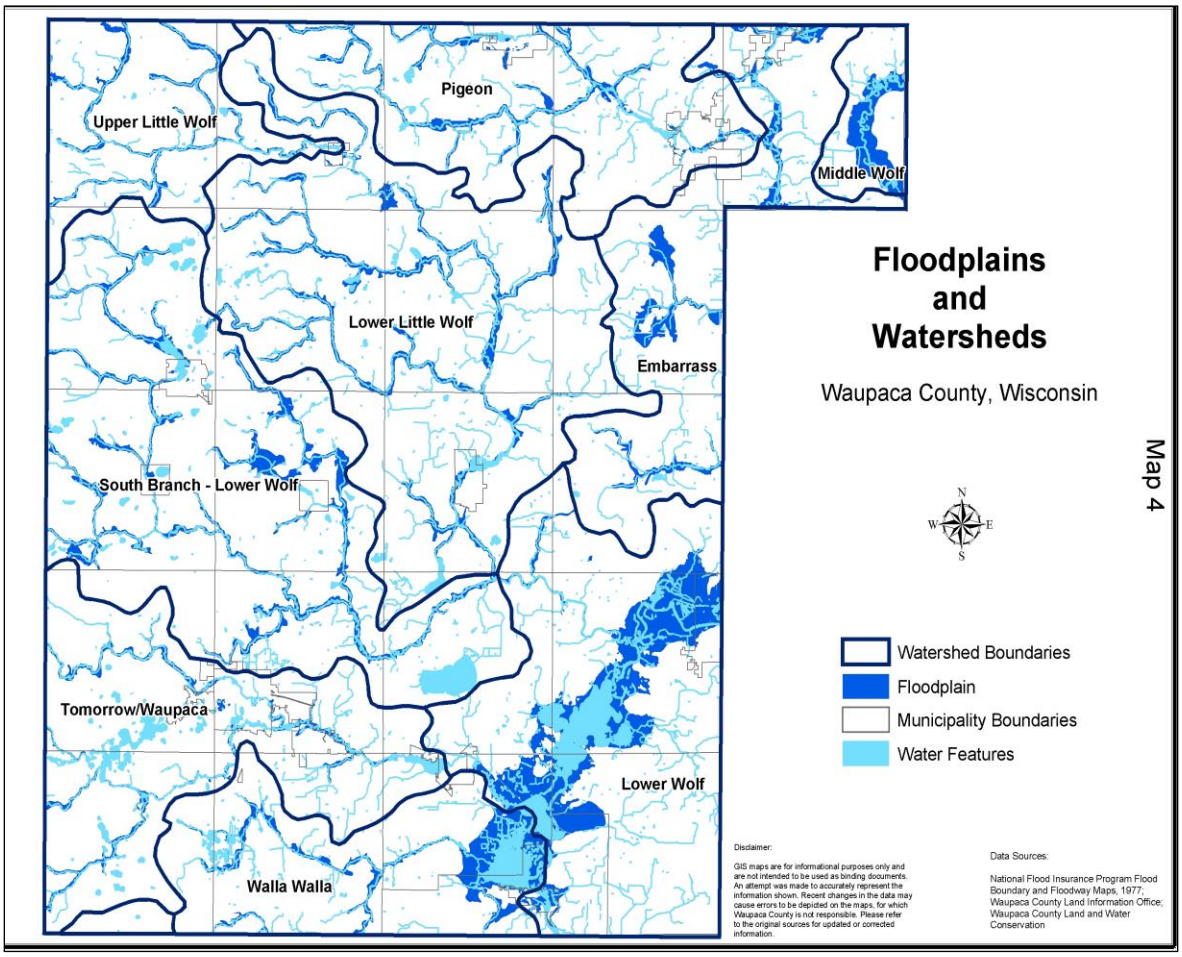
[148] The National Weather Service

County Watersheds [149]

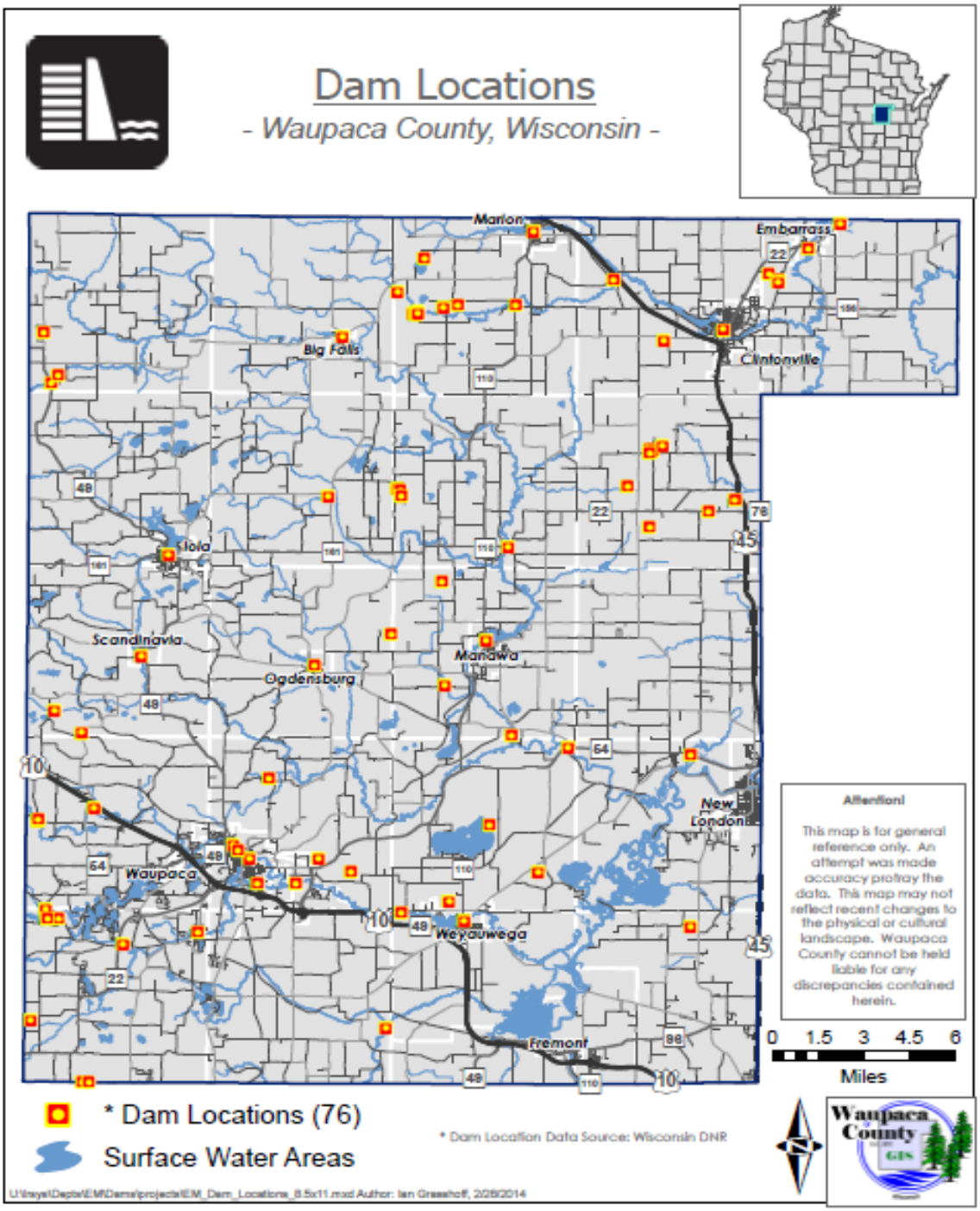


[149] Waupaca County Land and Water Resource Management Plan, 2012

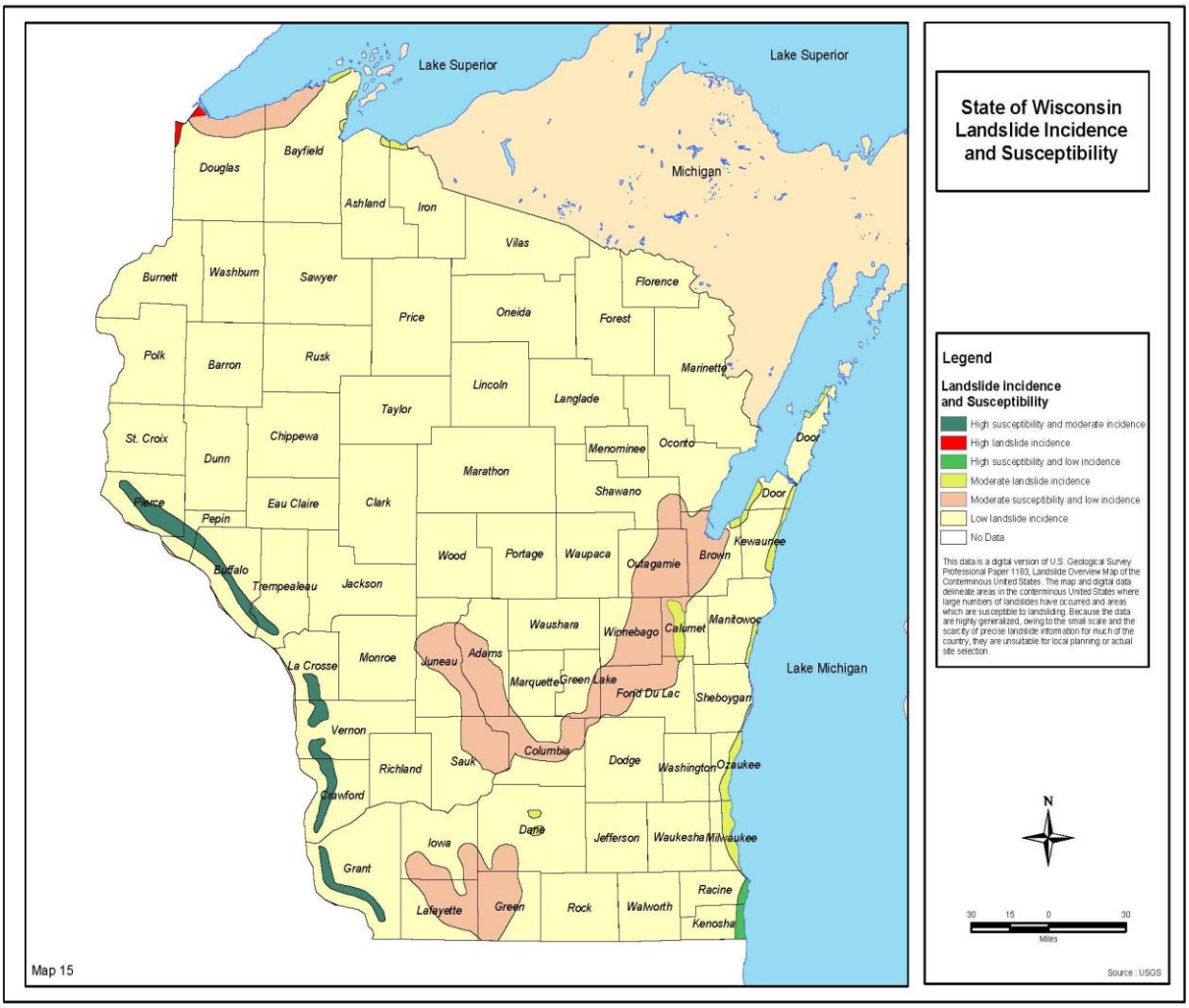
County Floodplain



County Dams

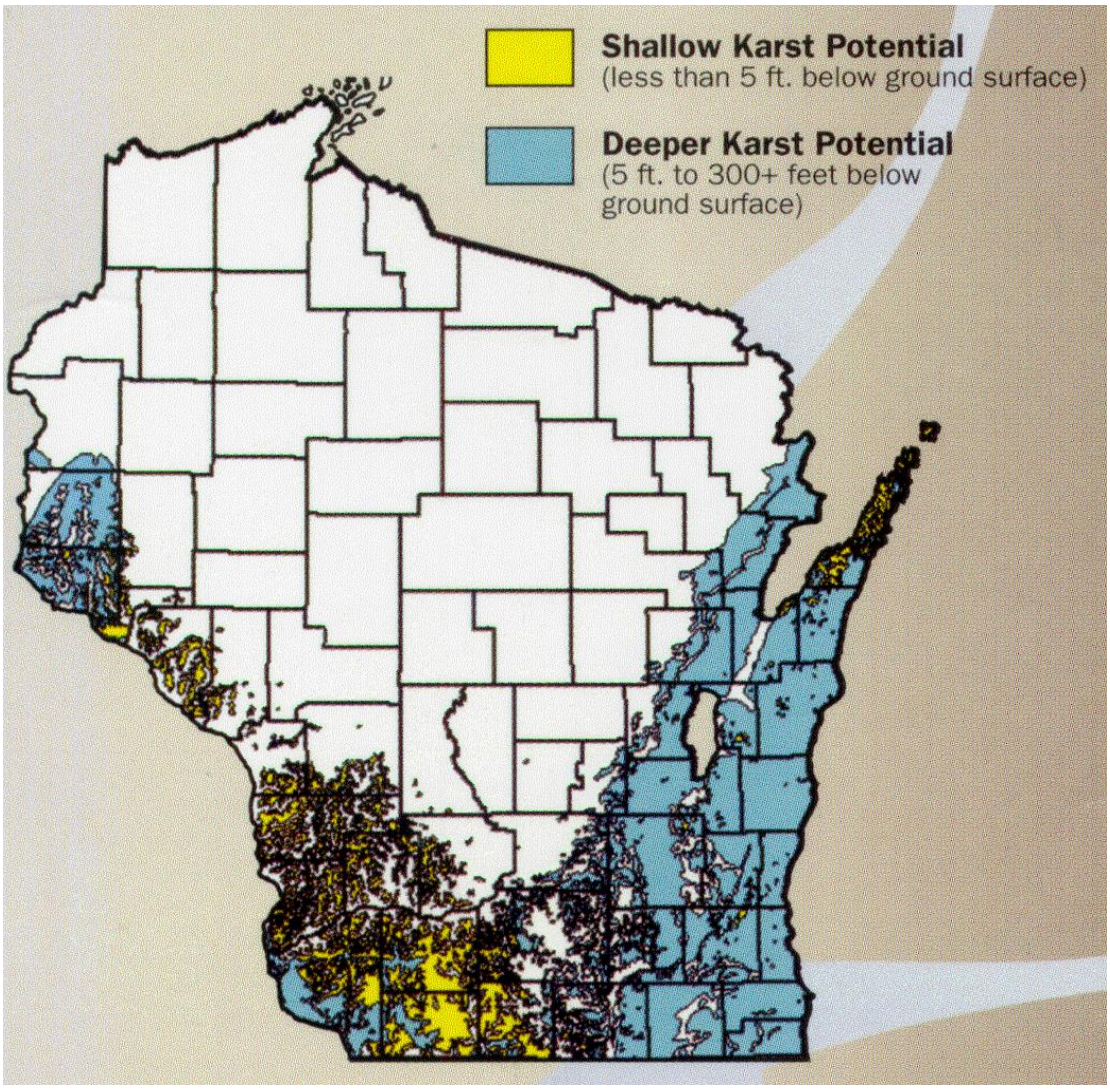

Dam Locations
- Waupaca County, Wisconsin -
Marion
Embarrass
Big Falls
Clintonville
Iola
Scandinavia
Ogdensburg
Manawa
New London
Waupaca
Weyauwega
Fremont
Attention!
This map is for general reference only. An attempt was made accuracy portray the data. This map may not reflect recent changes to the physical or cultural landscape. Waupaca County cannot be held liable for any discrepancies contained herein.
0 1.5 3 4.5 6
Miles
* Dam Locations (76)
Surface Water Areas
* Dam Location Data Source: Wisconsin DNR
Waupaca County GIS

Landslide Incidence and Susceptibility[150]



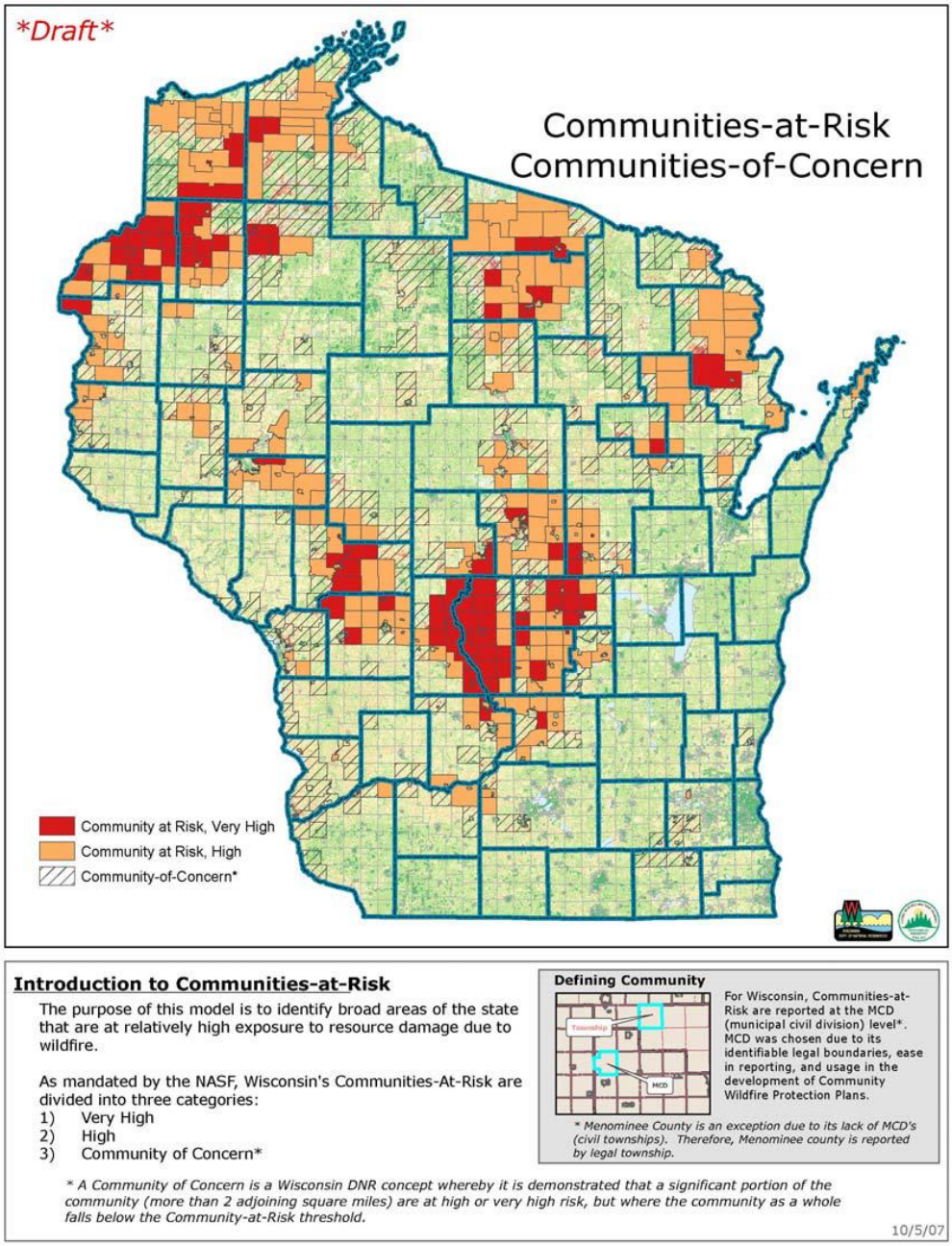
[150] Wisconsin State Hazard Mitigation Plan

Karst Potential[151]



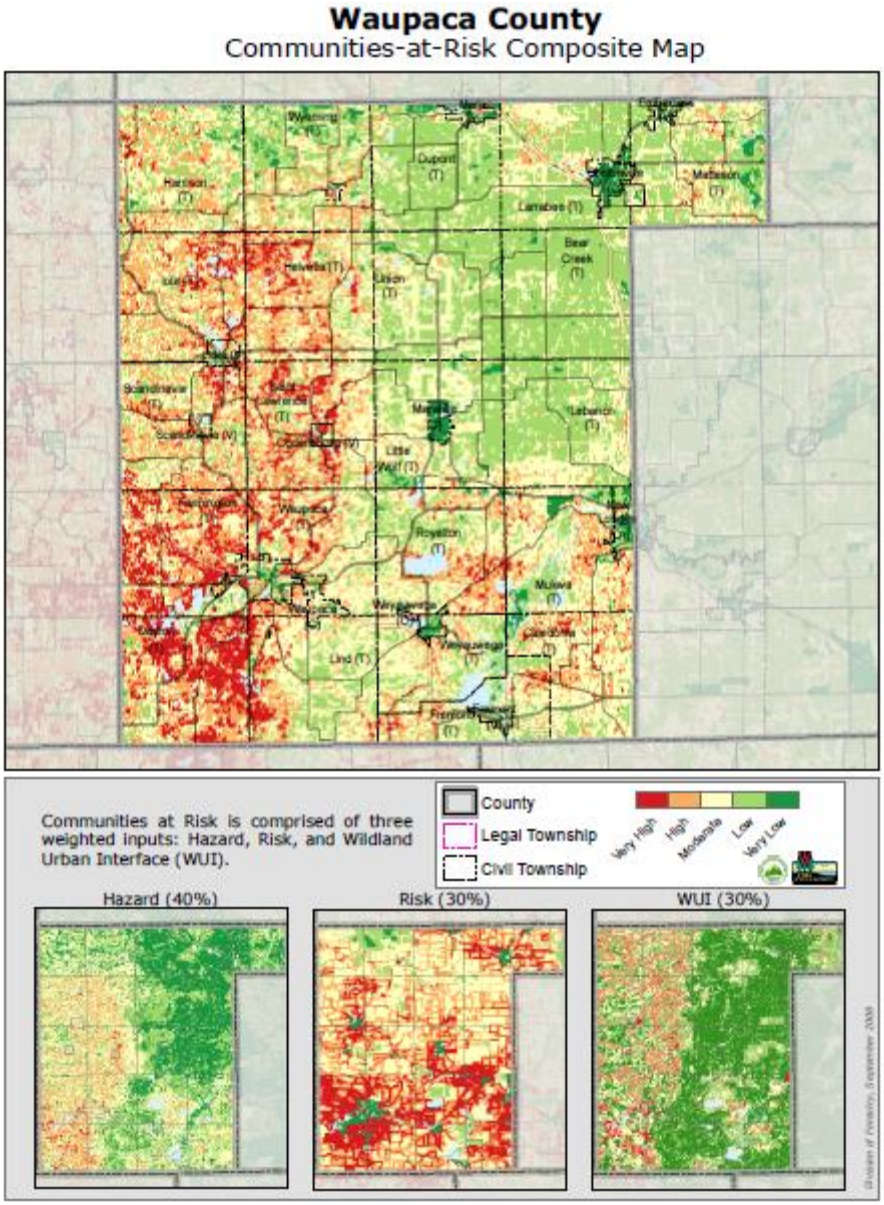
[151] Wisconsin State Hazard Mitigation Plan

Wildfire Communities at Risk[152]



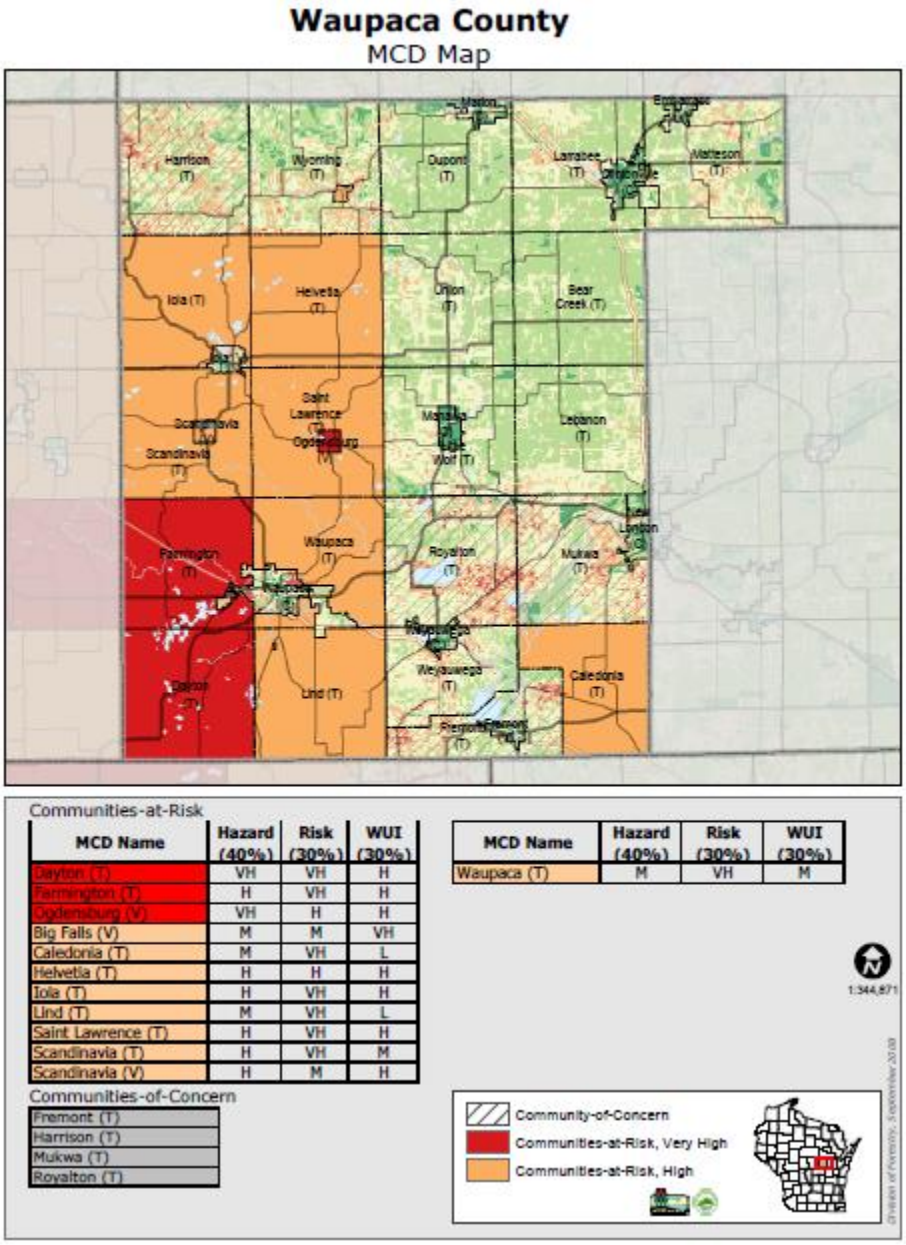
[152] Wisconsin Department of Natural Resources

Waupaca County Communities at Risk Composite[153]



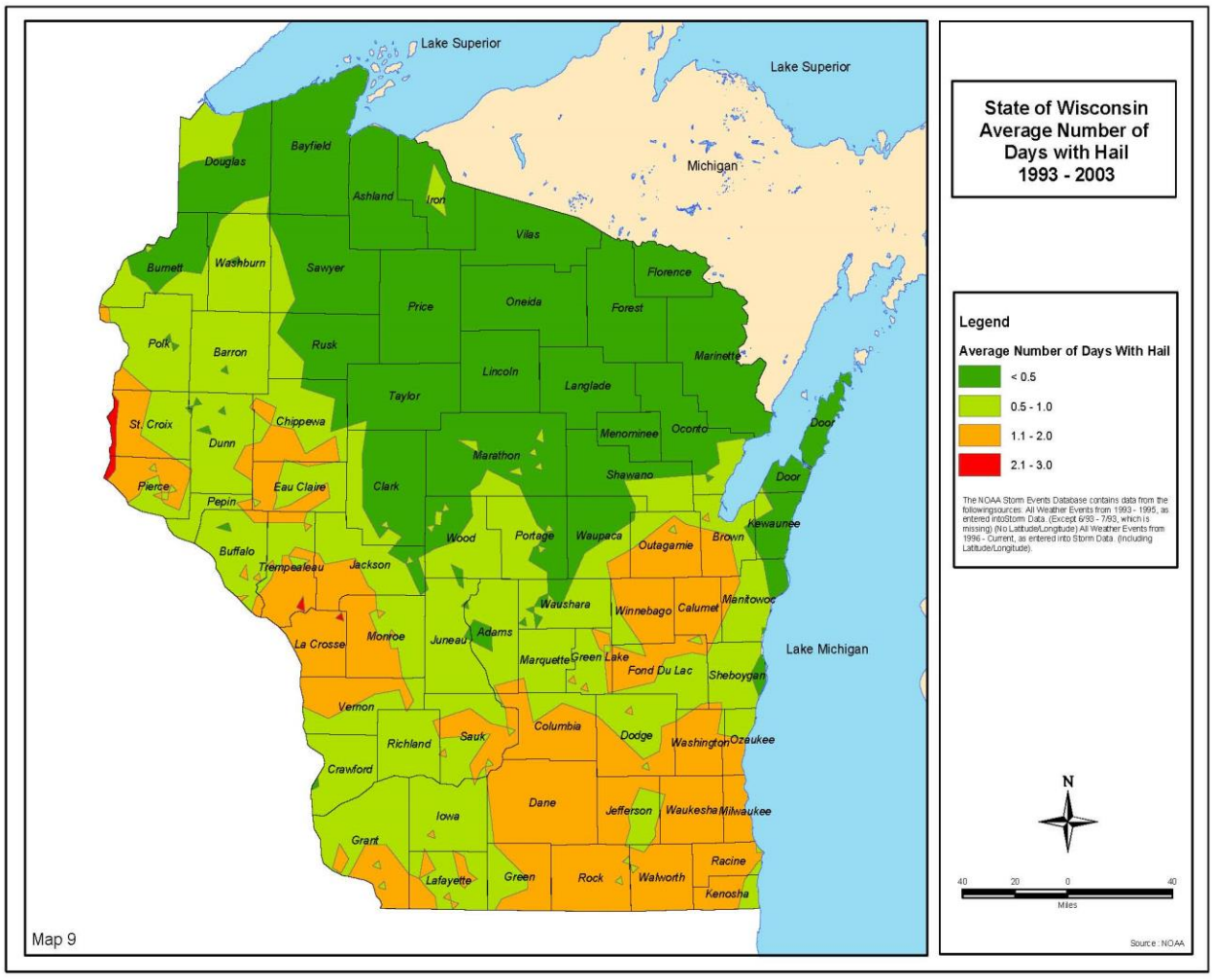
[153] Wisconsin Department of Natural Resources

Waupaca County Communities at Risk Municipal Map[154]



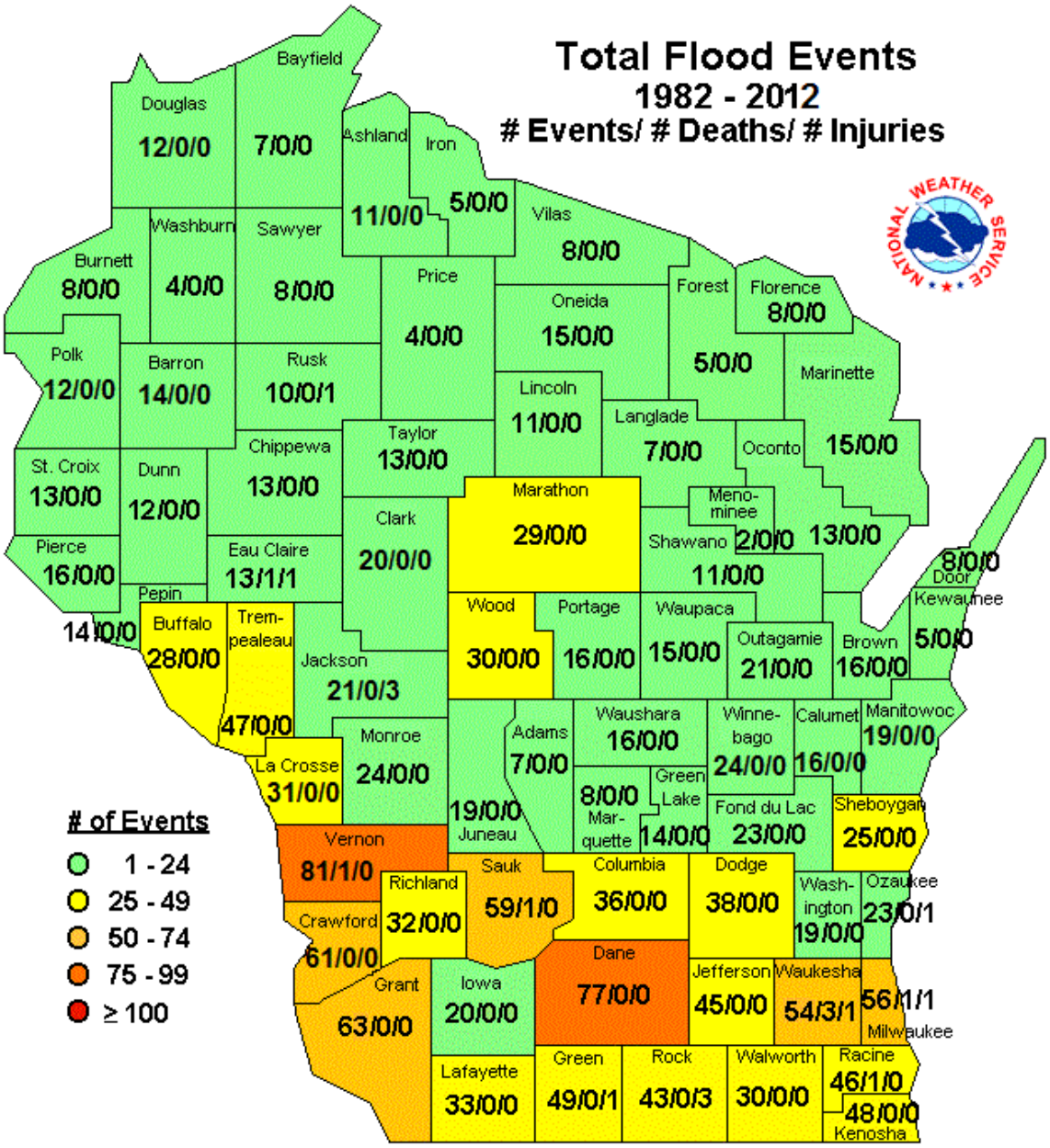
[154] Wisconsin Department of Natural Resources

County Days with Hail[155]



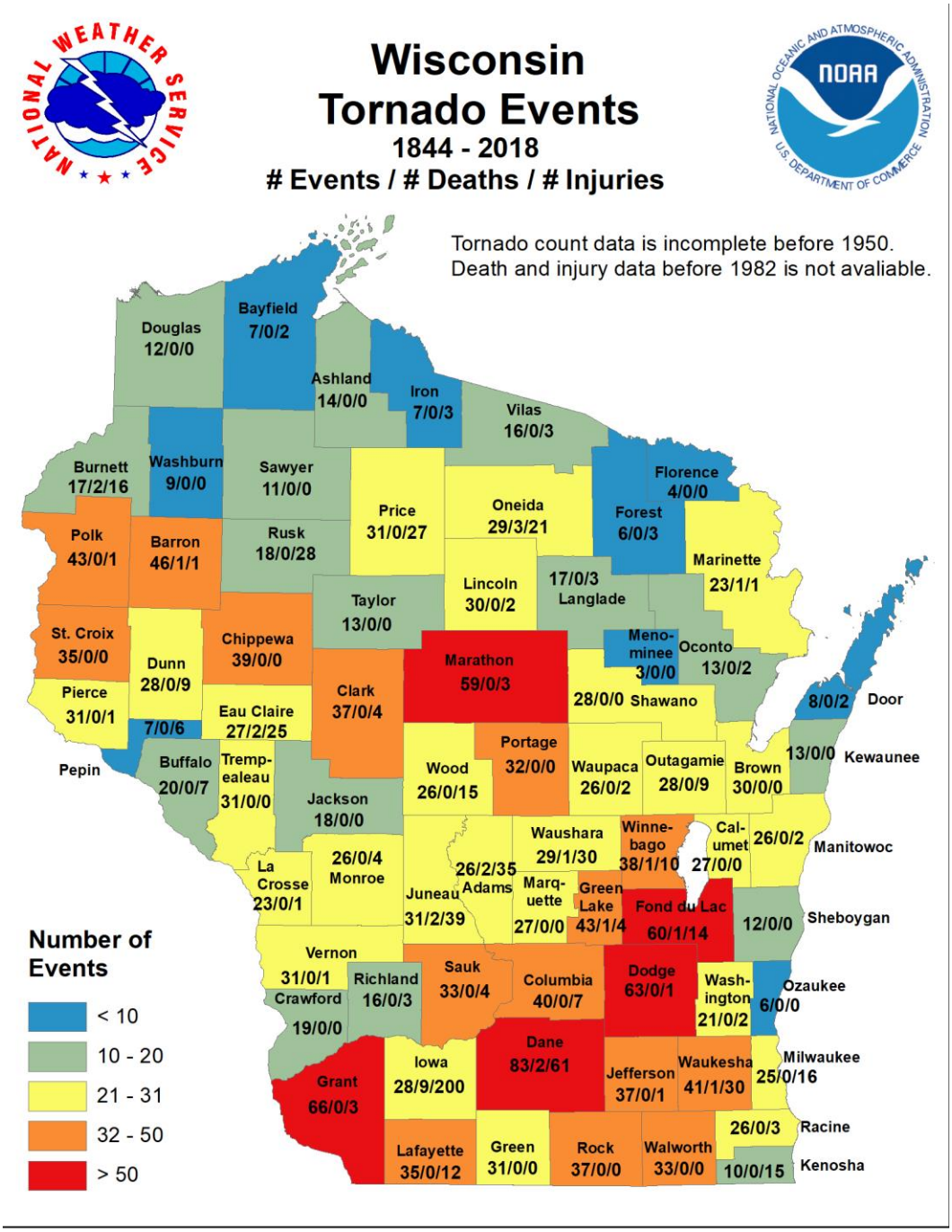
[155] State of Wisconsin Hazard Mitigation Plan

Wisconsin Total Flood Events[156]

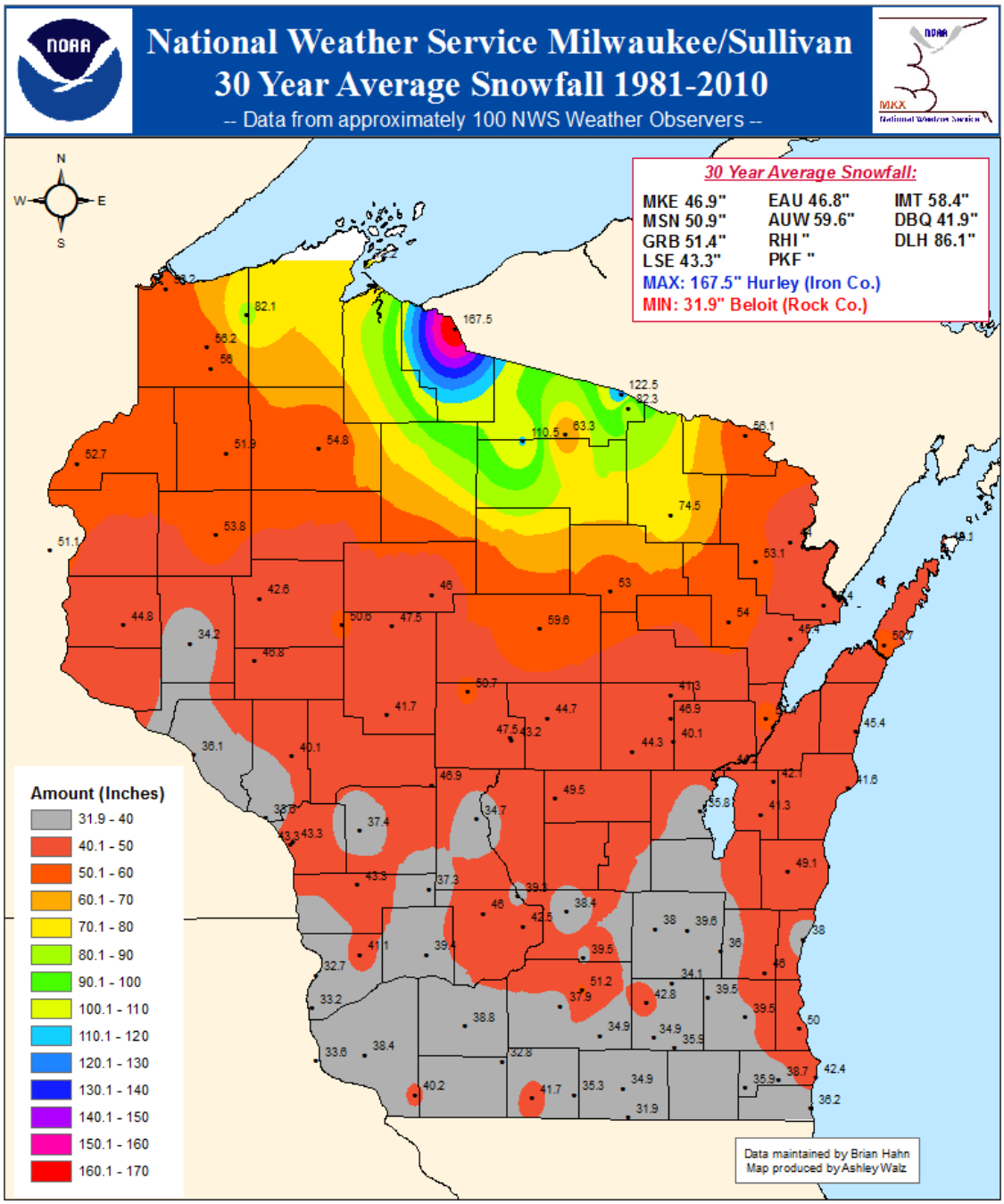


[156] The National Weather Service and Wisconsin Emergency Management

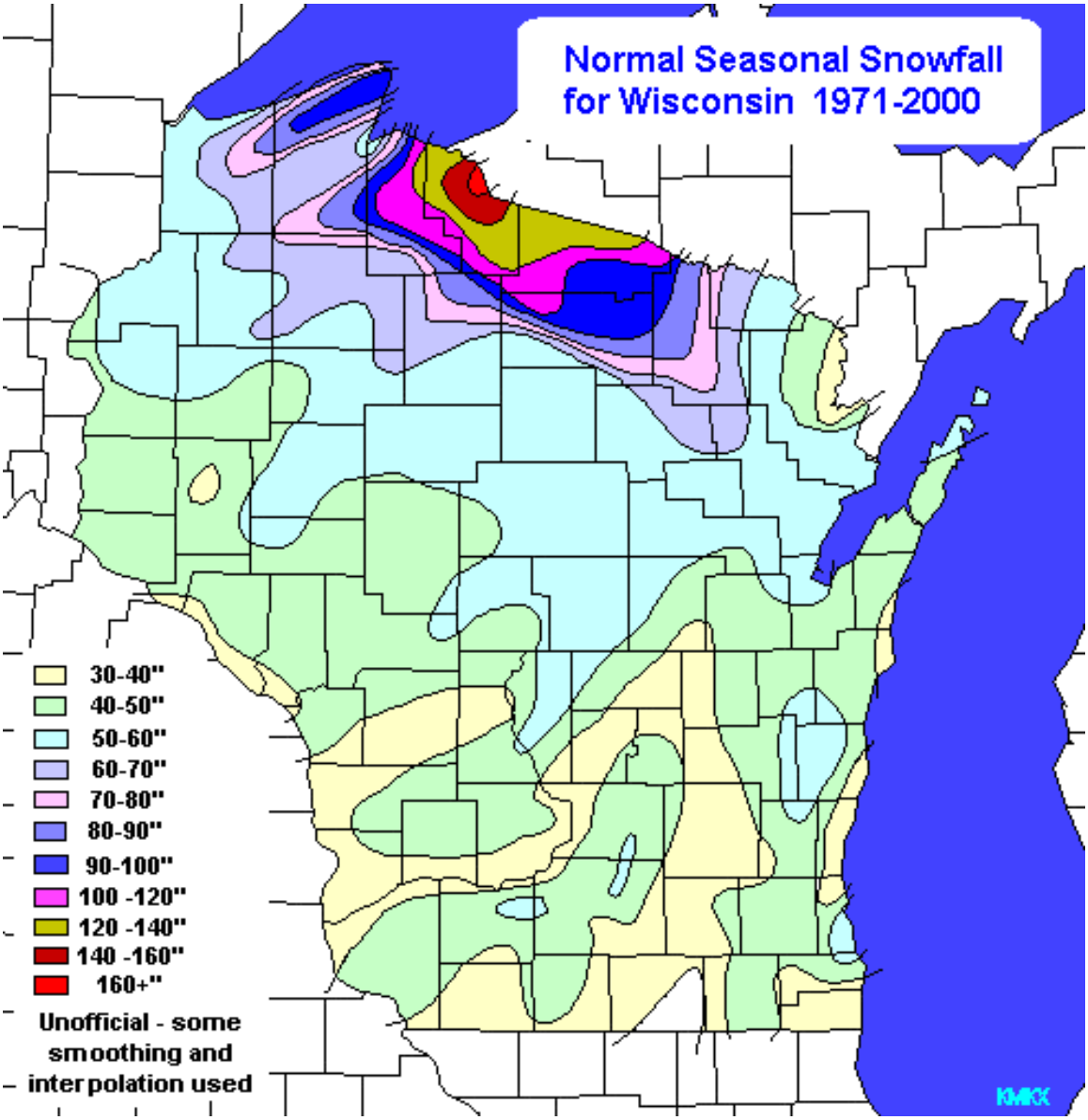
Wisconsin Tornado Events



Wisconsin 30-Year Average Snowfall

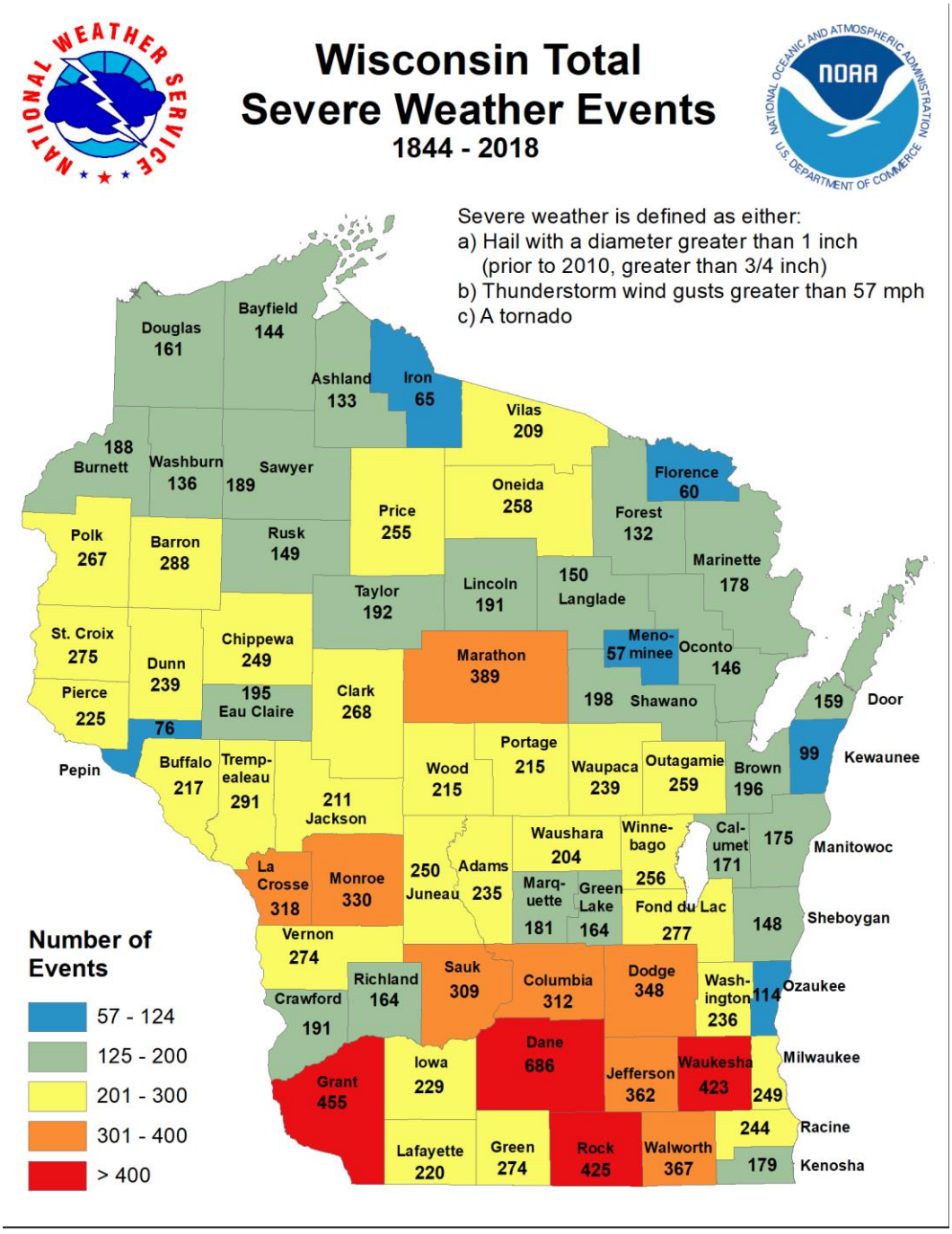


Wisconsin Average Seasonal Snowfall[157]

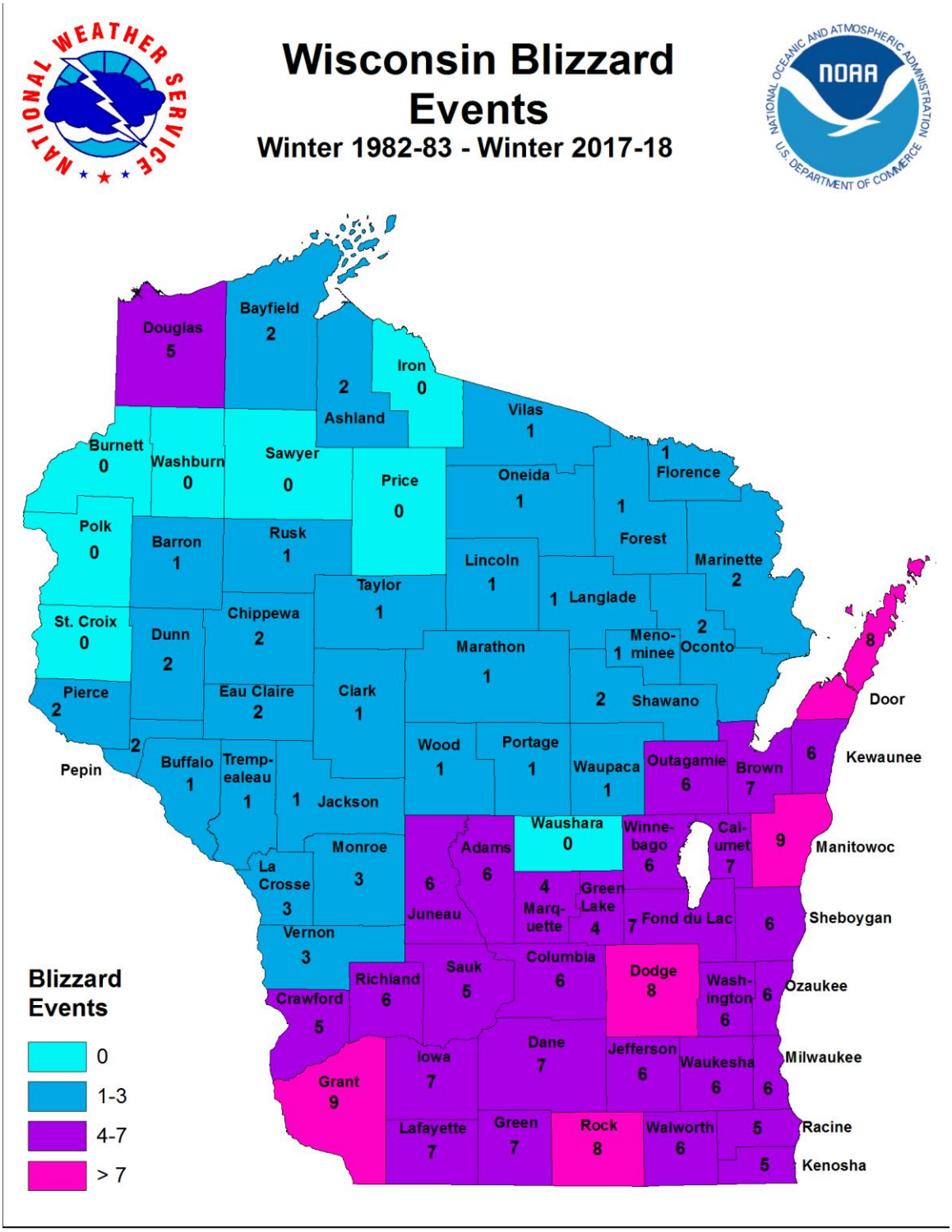


[157] http://www.crh.noaa.gov/mkx/climate/wisnow.gif

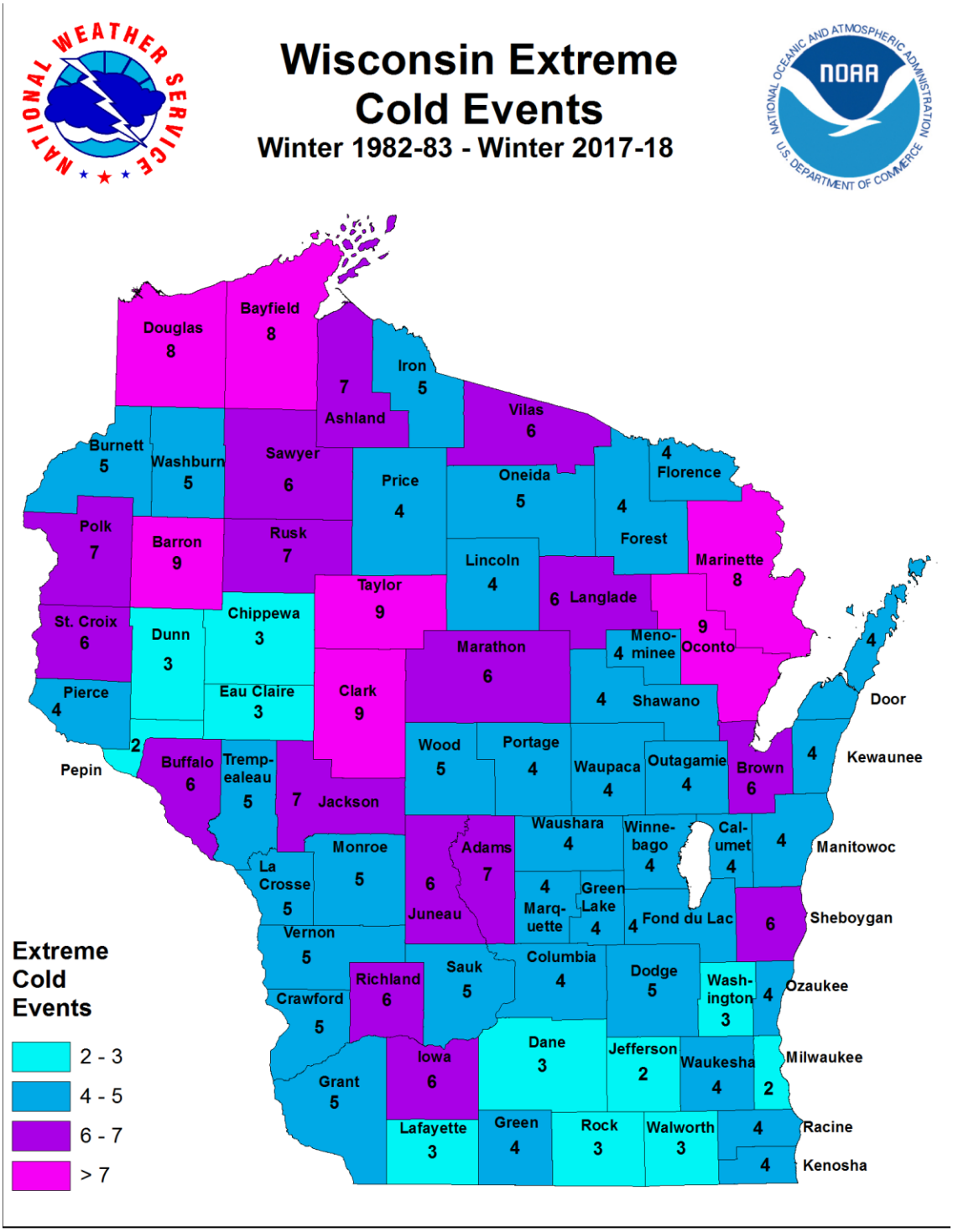
Wisconsin Total Severe Weather Events



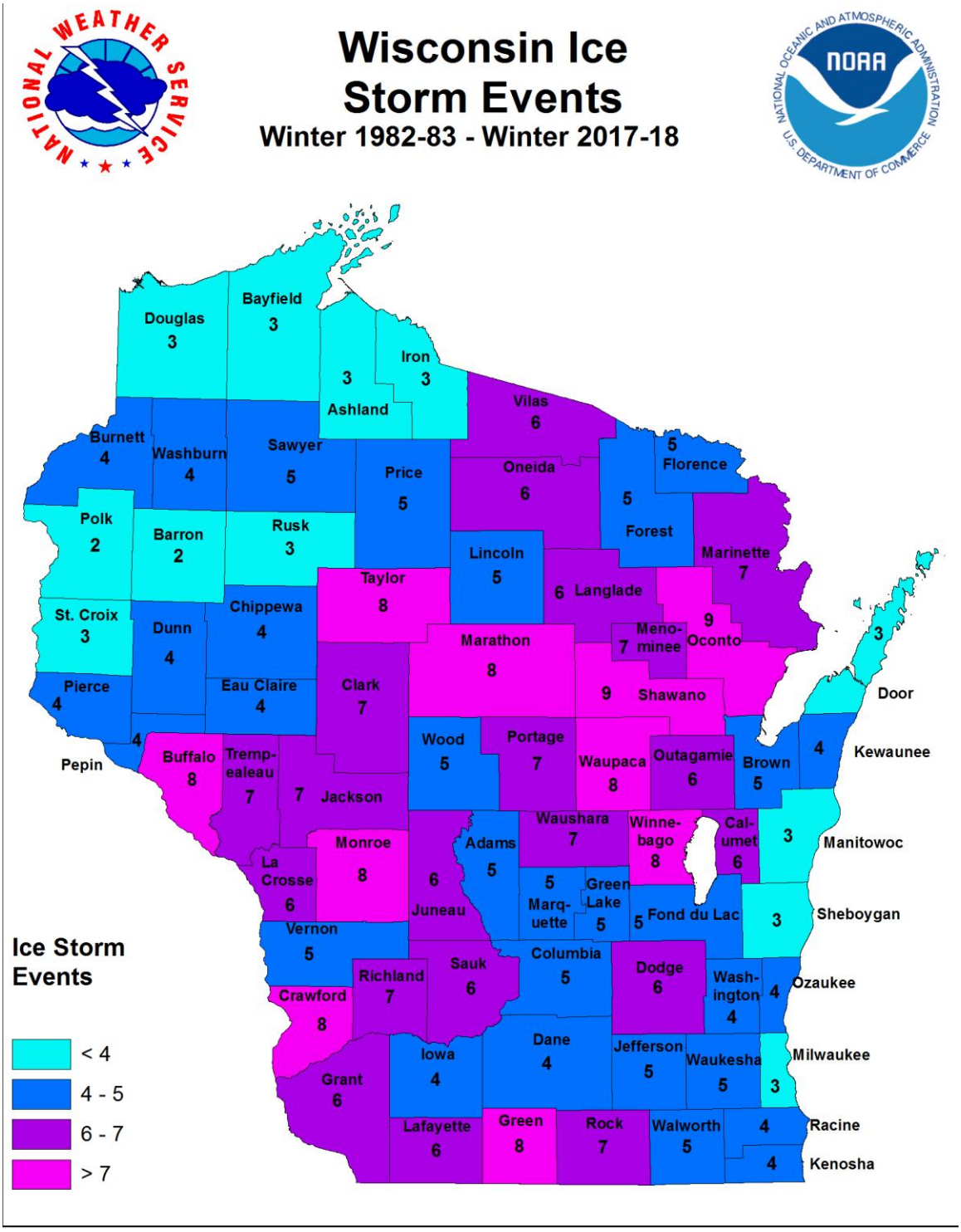
Blizzard Events



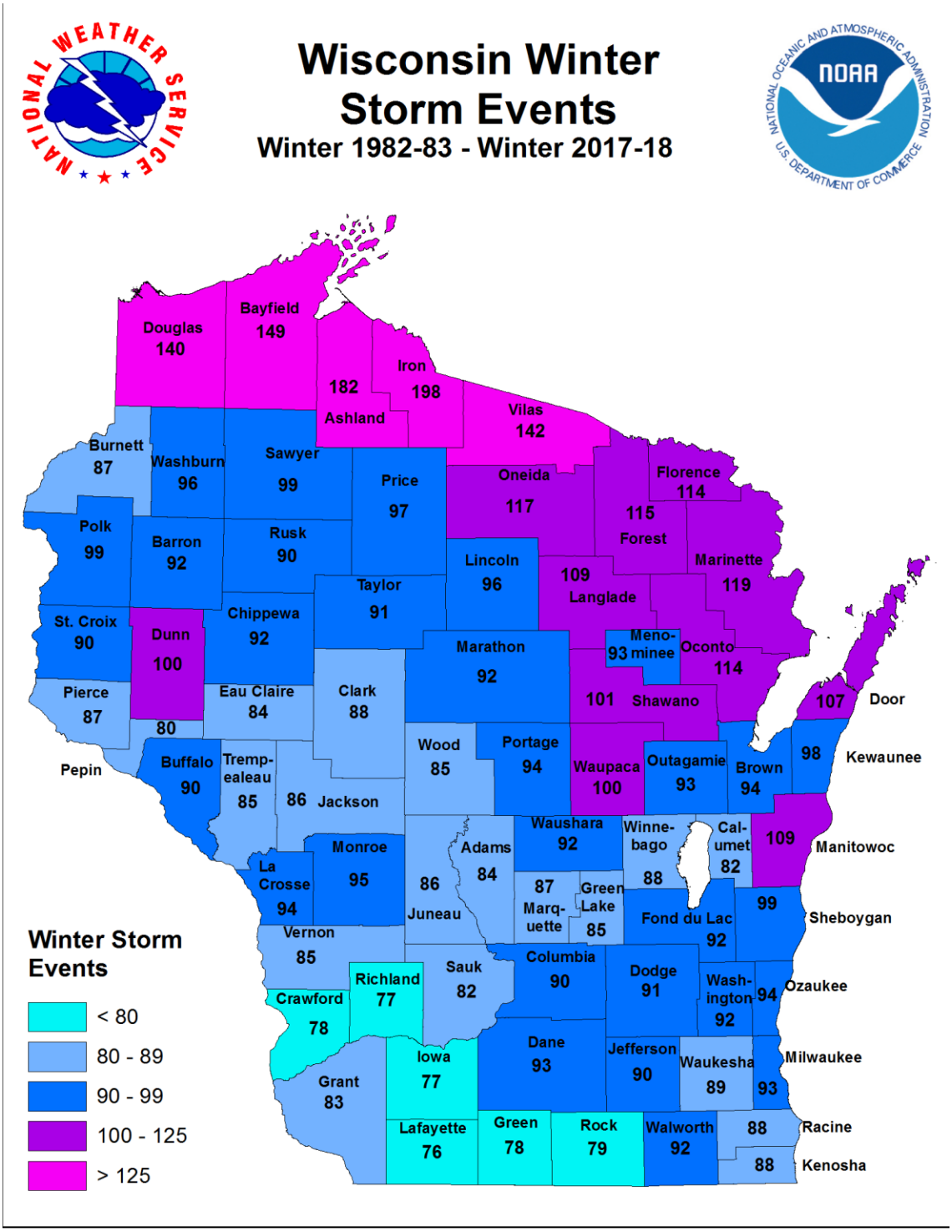
Extreme Cold Events



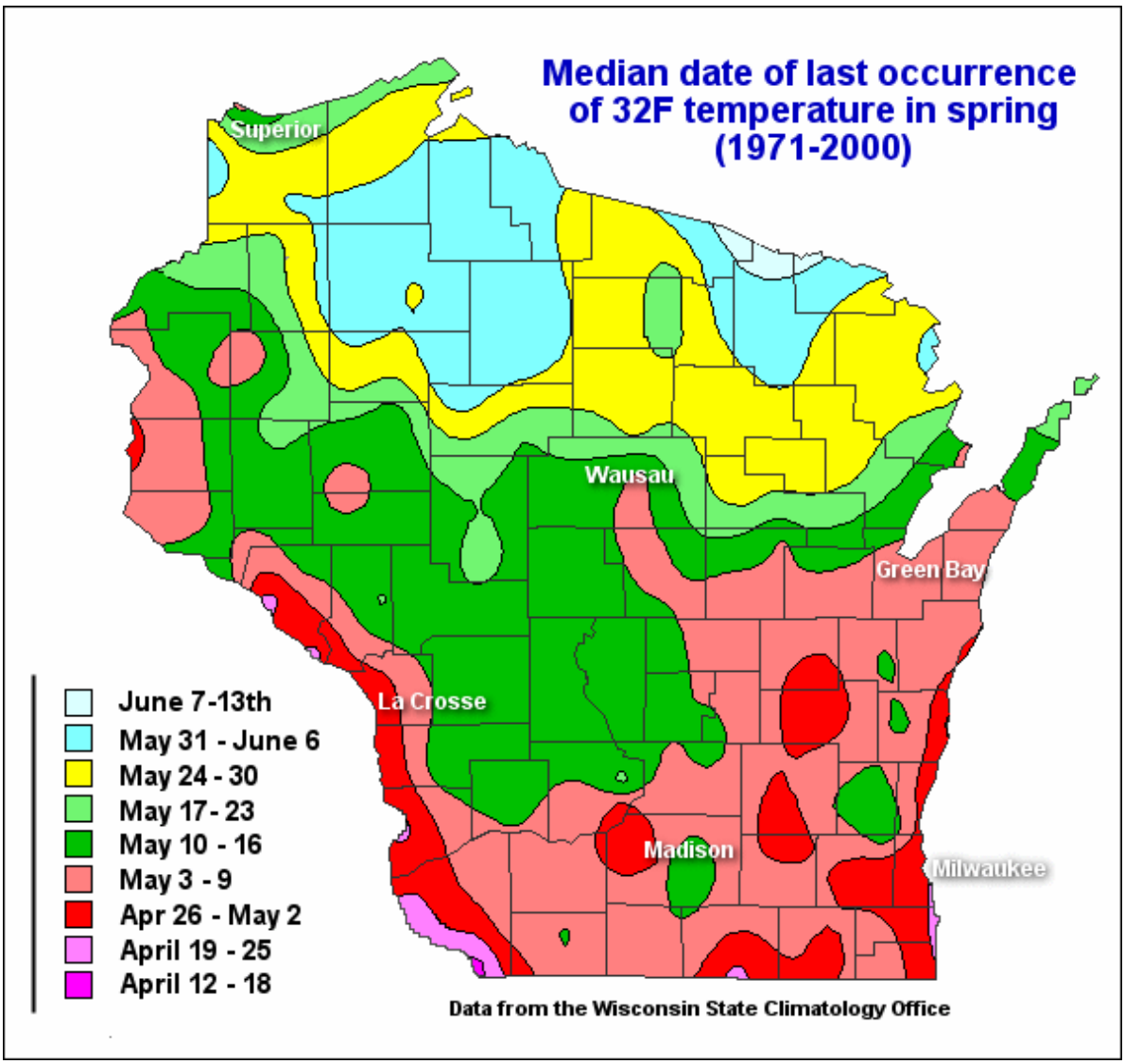
Appendix A: Maps



Winter Storm Events

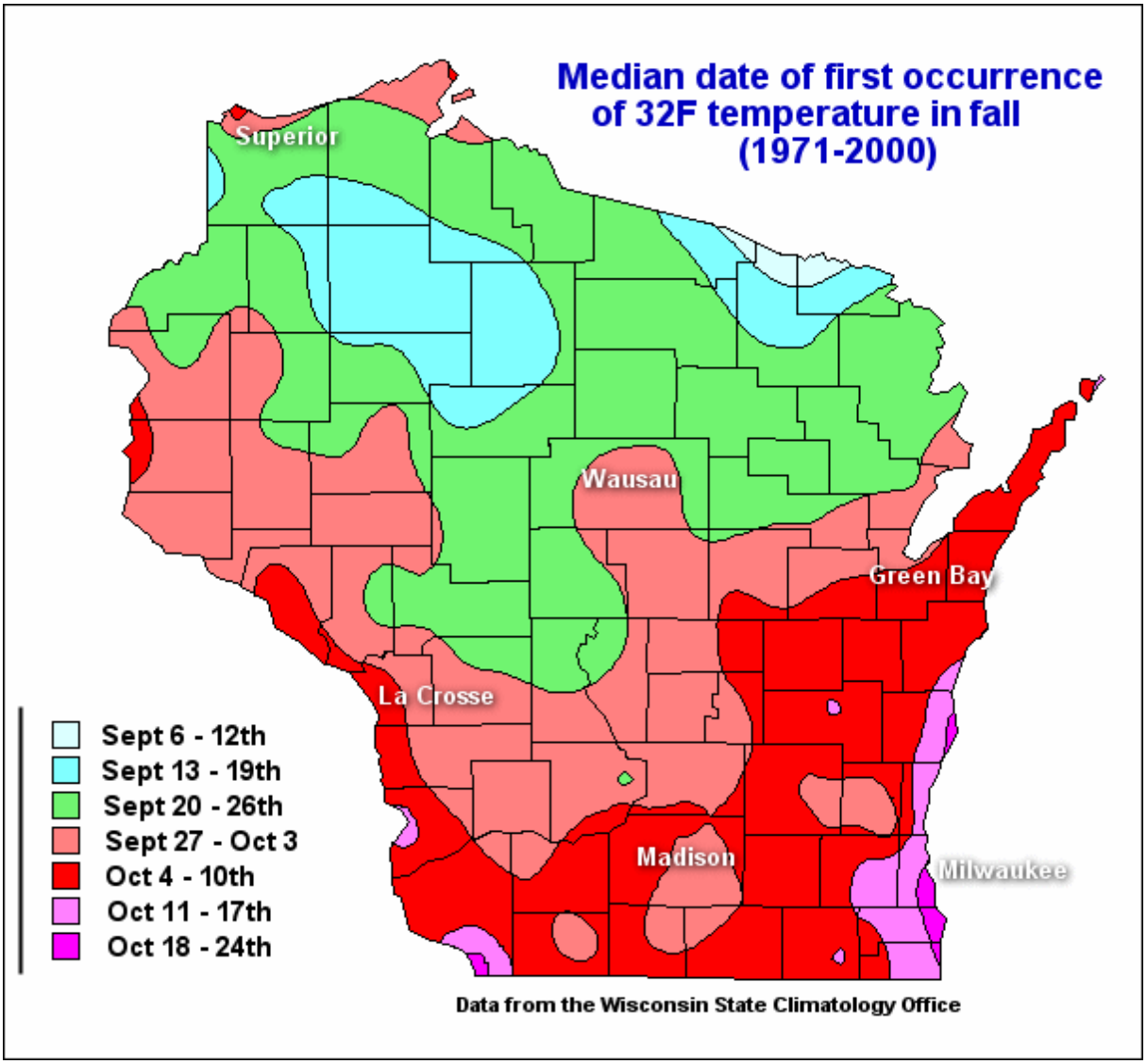


Median Date of Last Freeze[158]



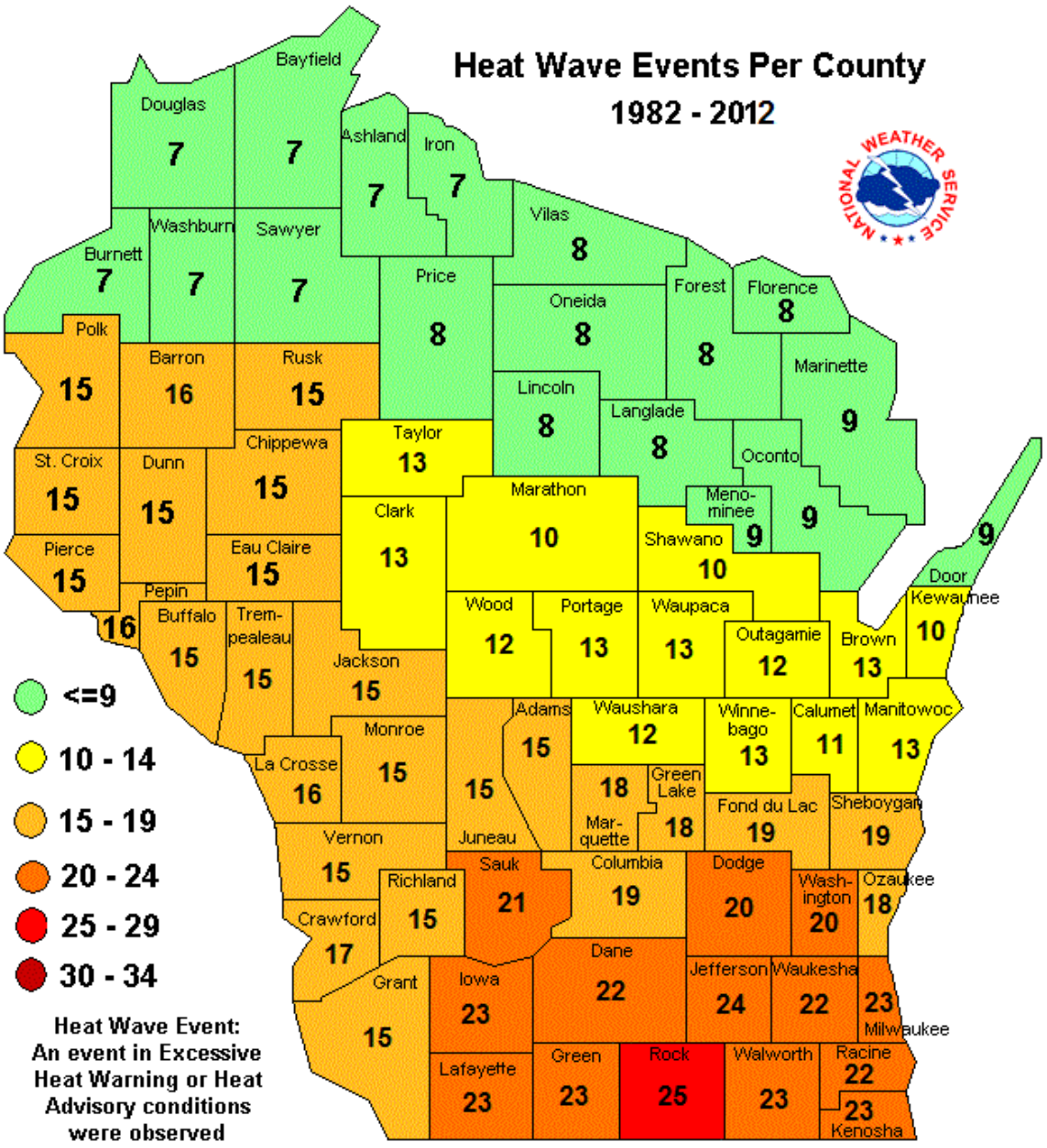
[158] http://www.crh.noaa.gov/mkx/climate/lastfrost.gif

Median Date of First Freeze[159]



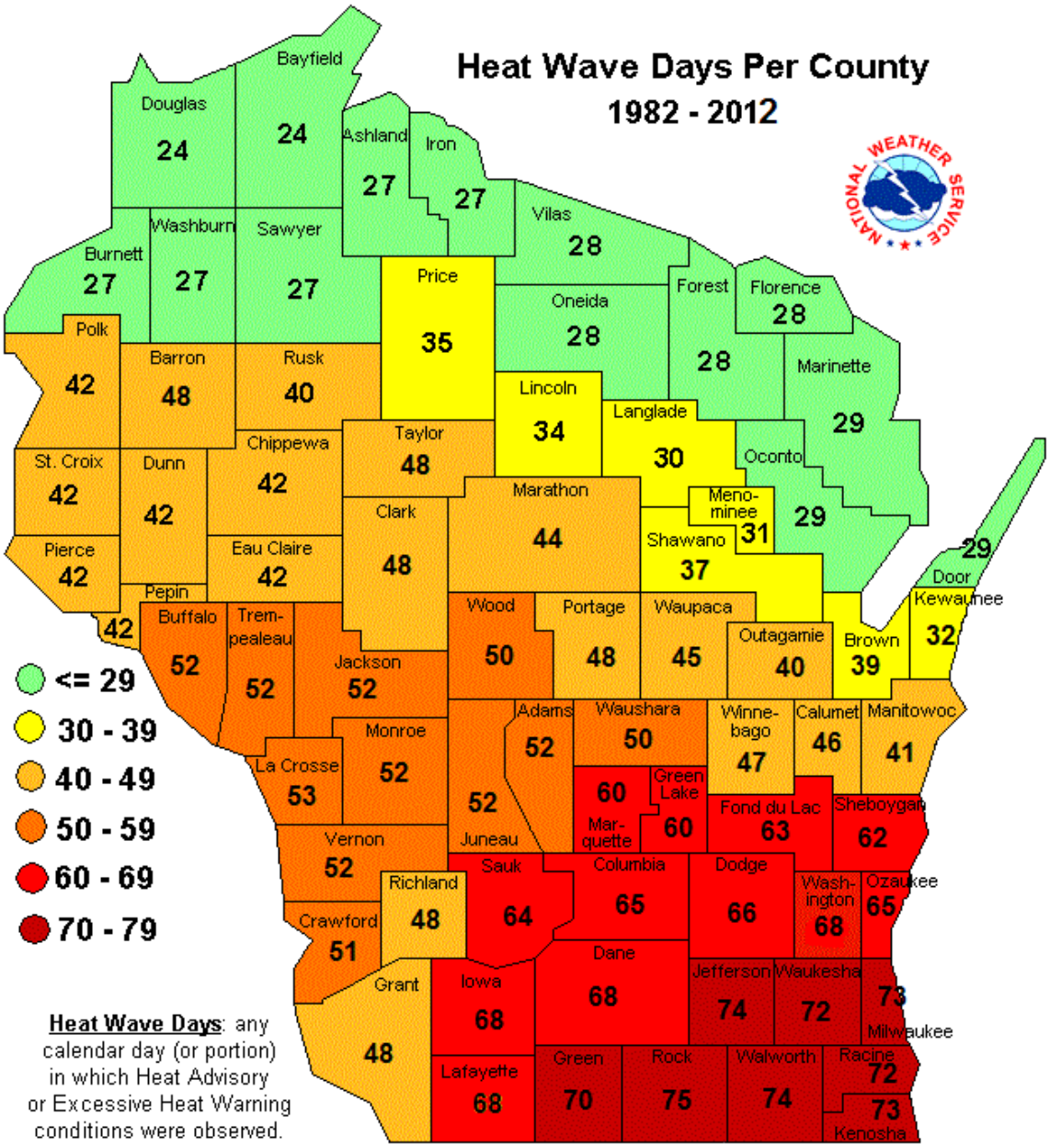
[159] http://www.crh.noaa.gov/mkx/climate/firstfrost.gif

Wisconsin Heat Wave Events[160]



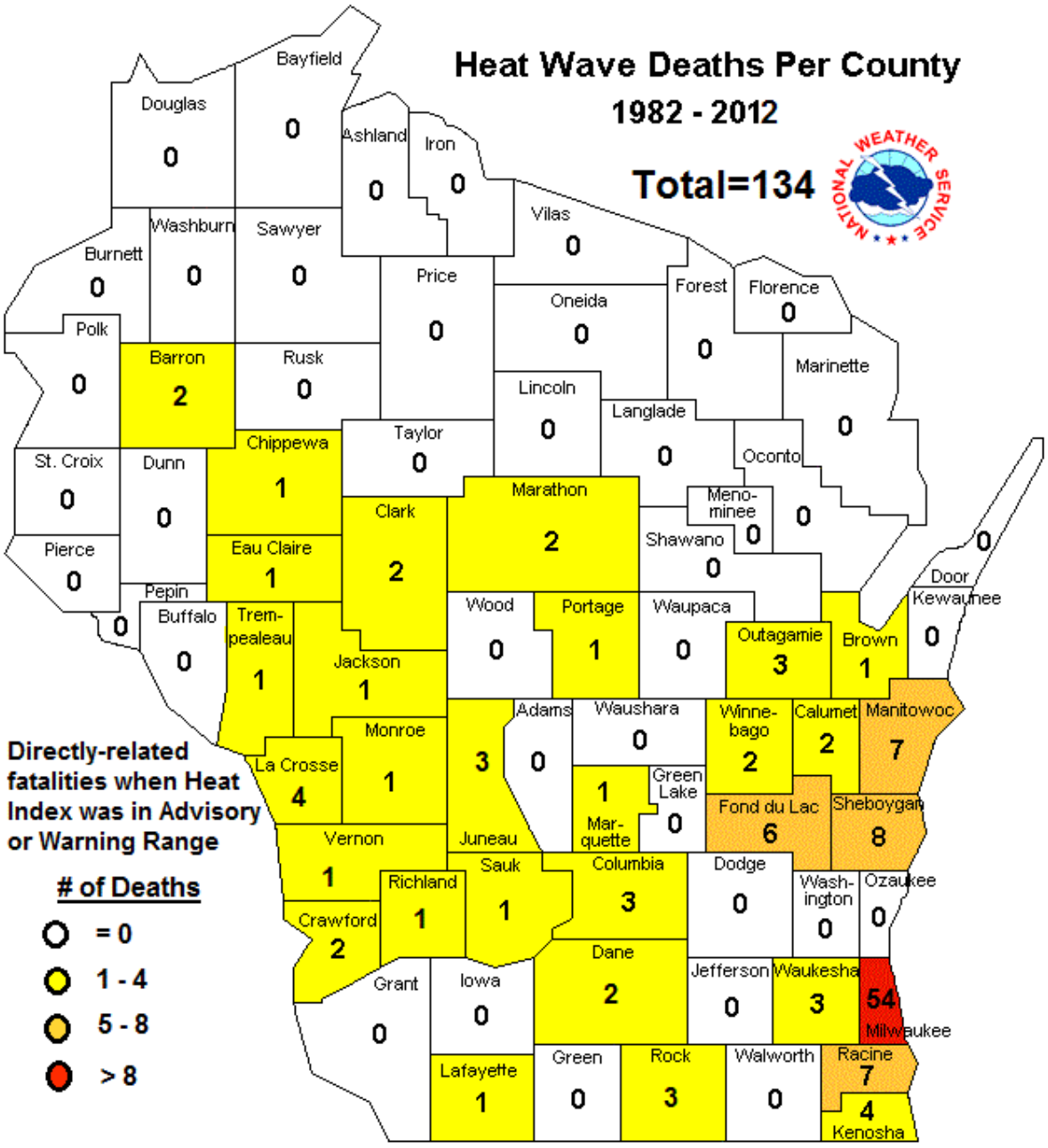
[160] The National Weather Service and Wisconsin Emergency Management

Wisconsin Heat Wave Days[161]



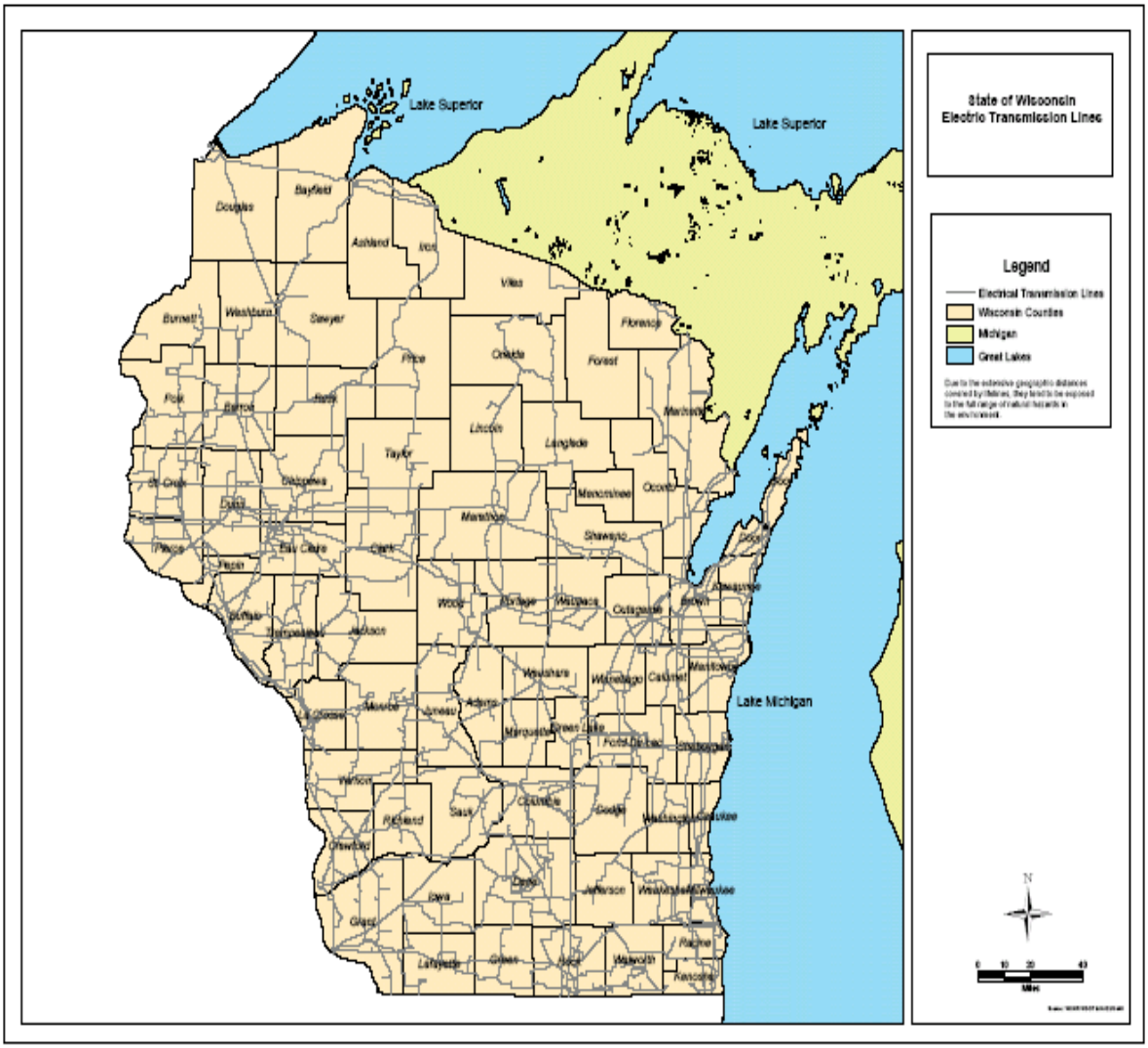
[161] The National Weather Service and Wisconsin Emergency Management

Wisconsin Heat Wave Deaths[162]



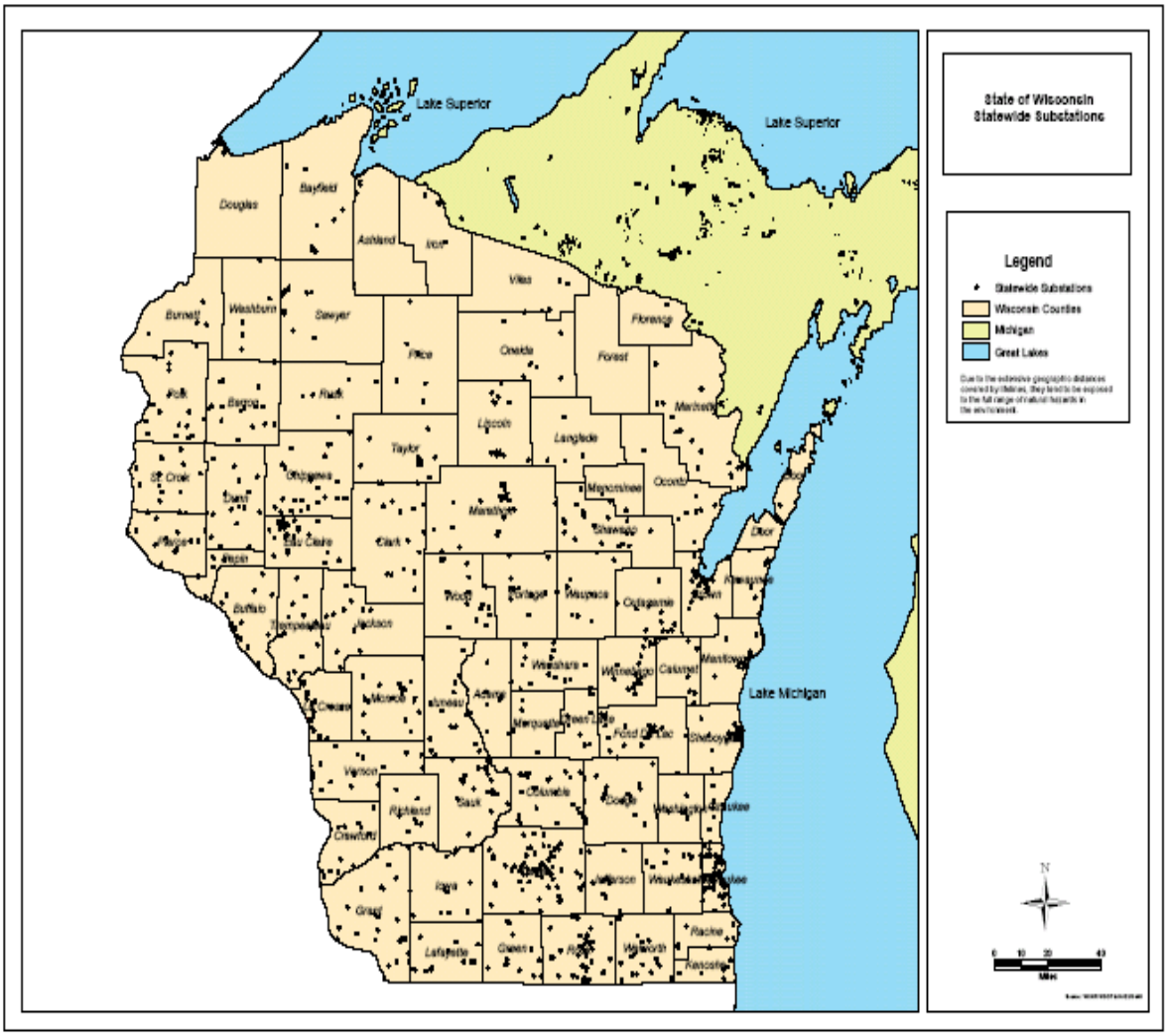
[162] The National Weather Service and Wisconsin Emergency Management

Electric Transmission Lines[163]



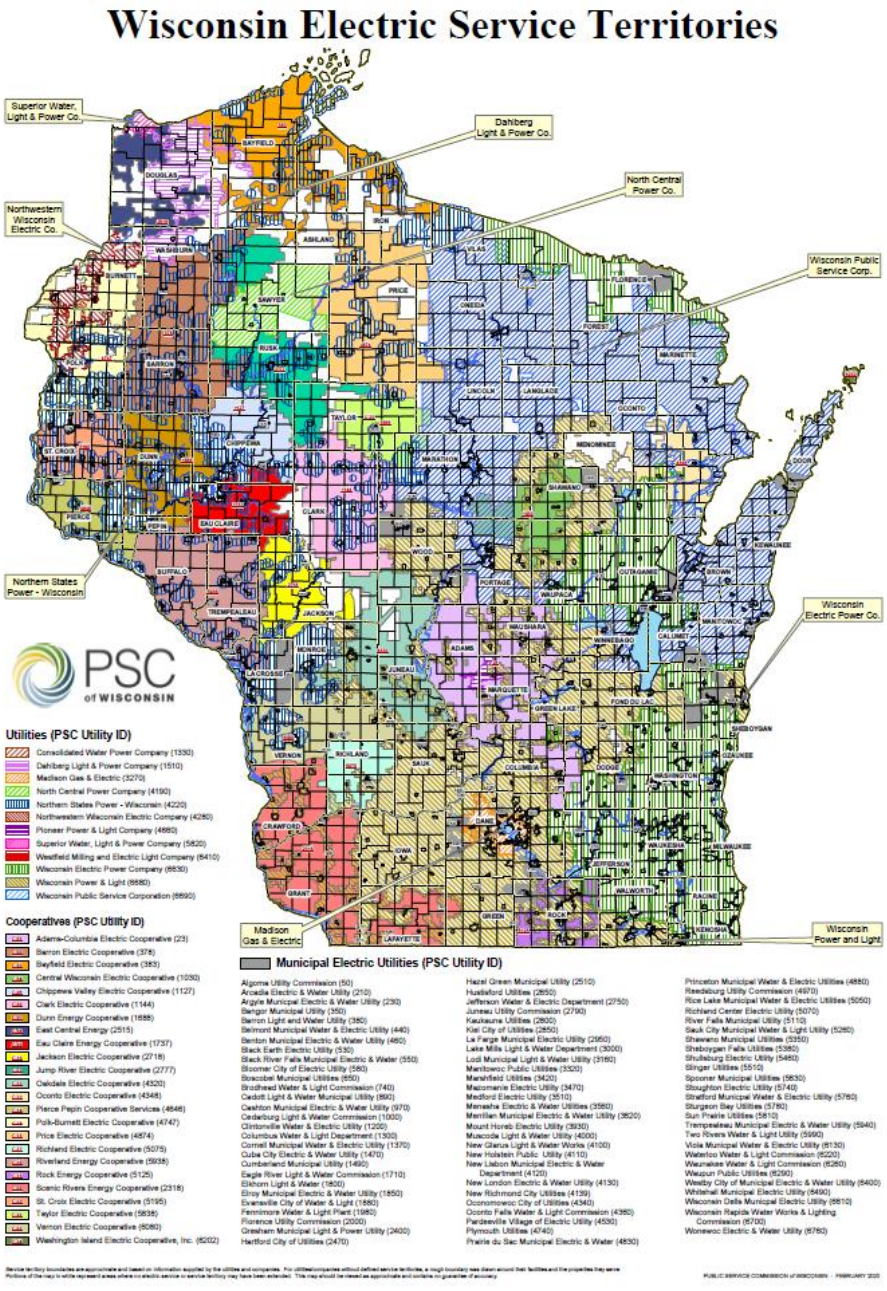
[163] Wisconsin State Hazard Mitigation Plan

Electrical Substations[164]



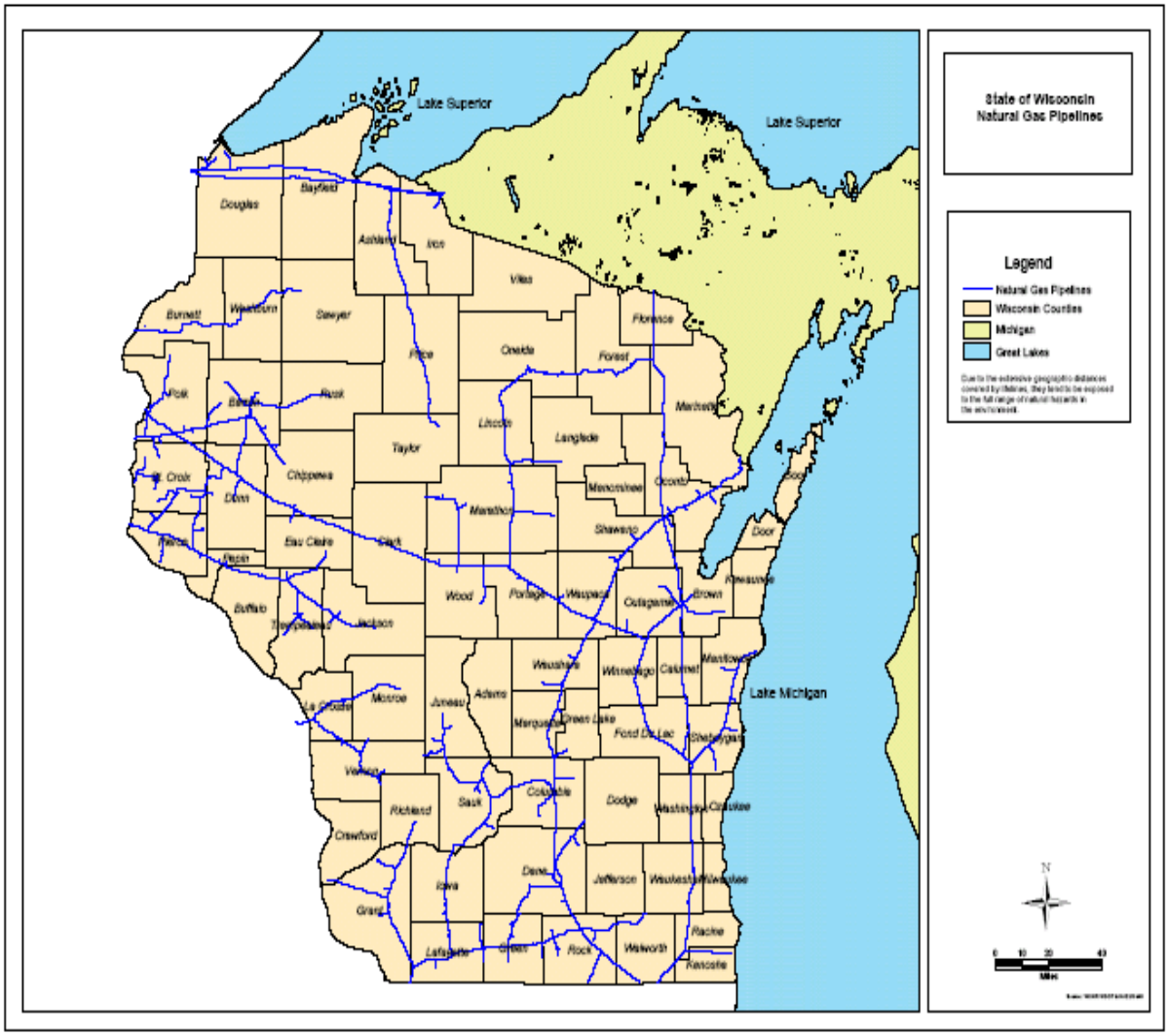
[164] Wisconsin State Hazard Mitigation Plan

Electrical Service Territories[165]



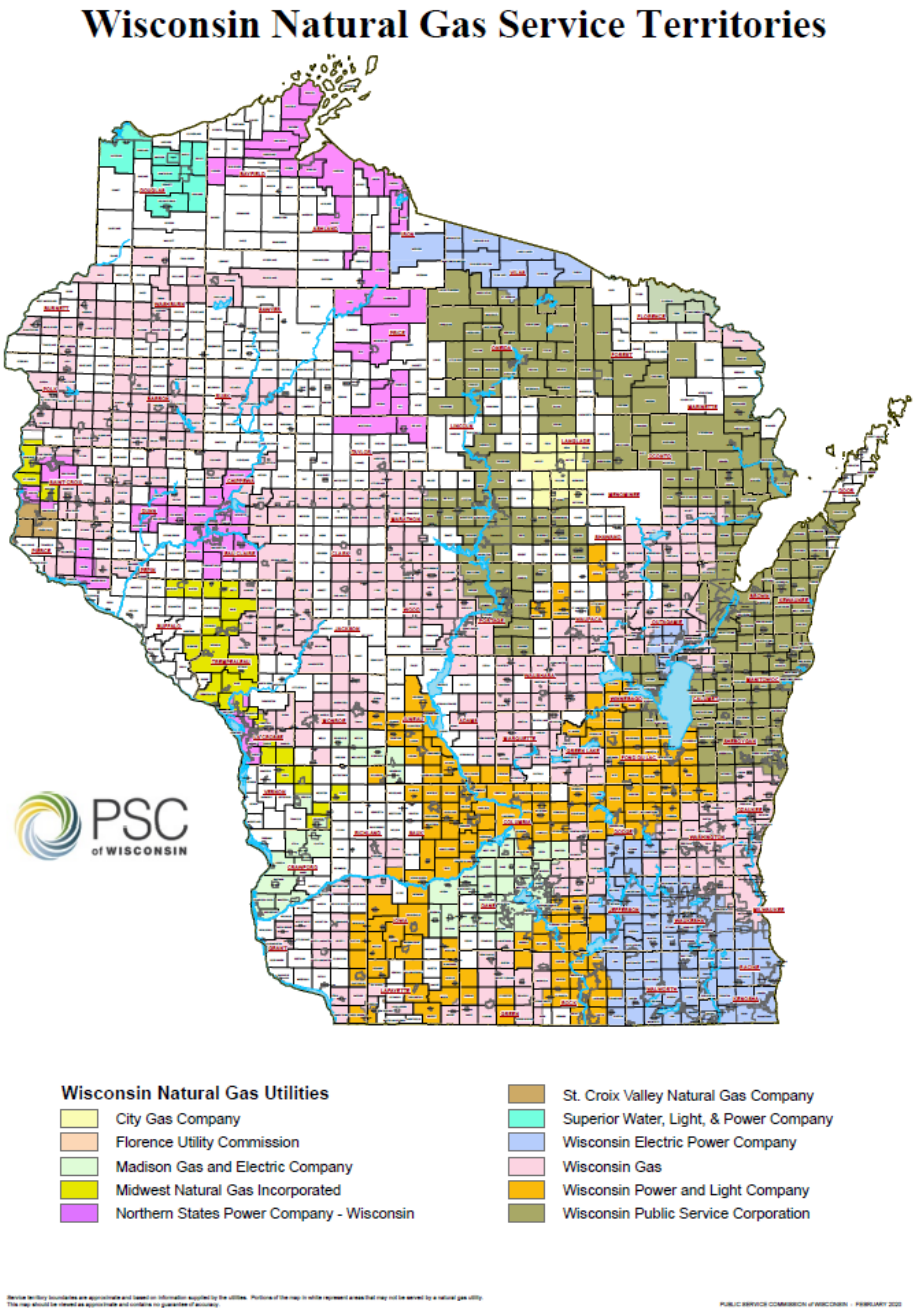
[165] Electric_Service_Territory_30x42_PUBLIC.pdf (wi.gov)

Natural Gas Pipelines[166]



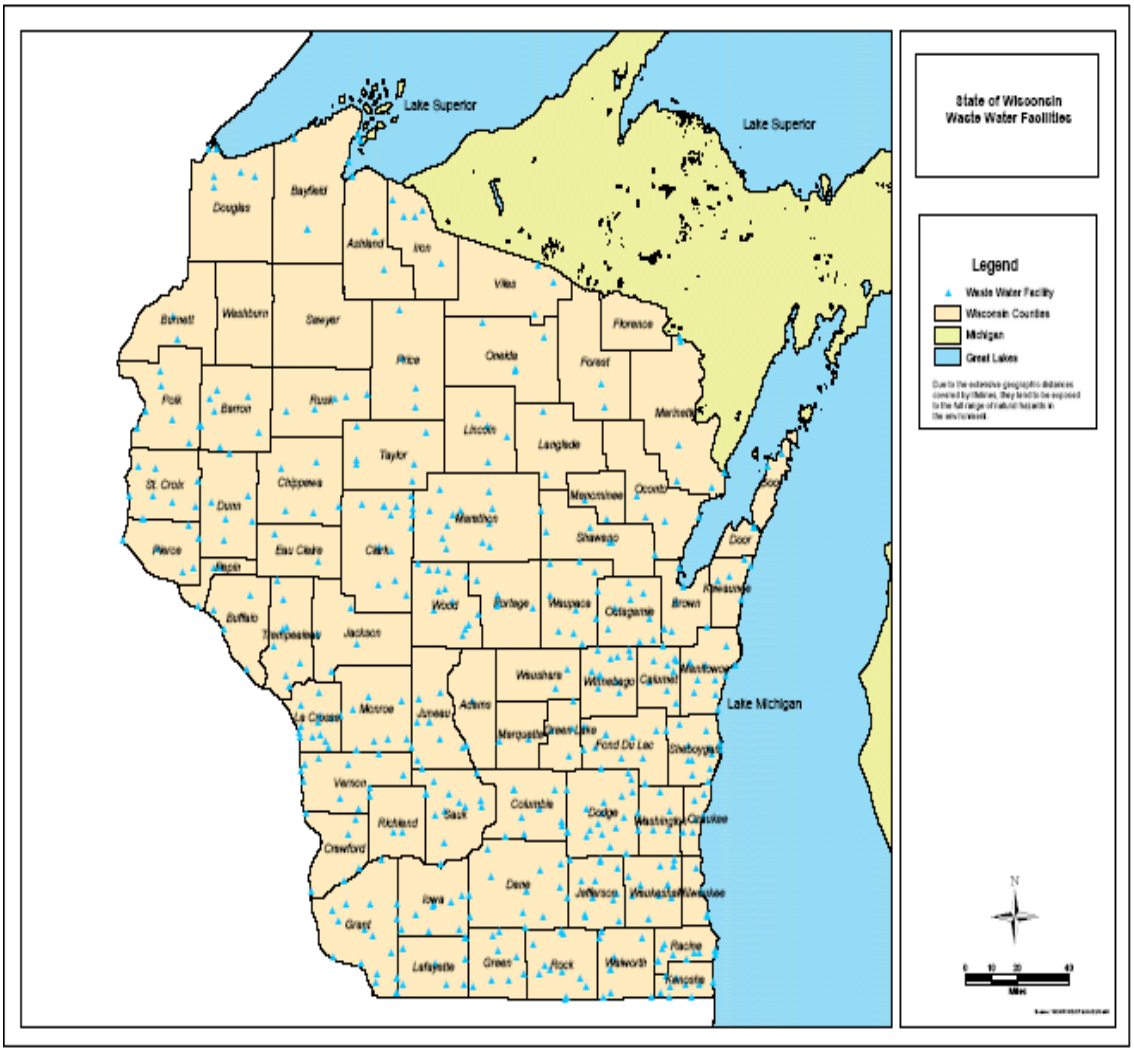
[166] Wisconsin State Hazard Mitigation Plan

Wisconsin Natural Gas Service Territories[167]



[167] Natural_Gas_30x42_PUBLIC.pdf (wi.gov)

Wastewater Facilities[168]



[168] Wisconsin State Hazard Mitigation Plan

Appendix B: Frequency of Occurrence [169]

As noted earlier in this plan, the Waupaca County Hazard Mitigation Plan Workgroup reviewed past events records and an internal workgroup consensus was reached on the anticipated probability of future events, as well as the severity of the effects of those events. The probabilities and severities were designated as "very high," "high," "medium," "low" or "very low" by the workgroup based on their evaluation and experience with the data. This is the main rating system used for this plan as it comes directly from those living in the area and reflects their current impressions, though they note that climate and weather systems are dynamic events.

The workgroup understands that historical weather data provided by the National Weather Service does not include events which may adversely affect their communities but fall below the reporting thresholds. Each weather event was analyzed for historic frequency and averages over the last 25 years (i.e., from 1 January 1994 through 1 January 2020) and is noted below with each hazard.

BLIZZARD

*There was **1** event reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	01/29/1996	0	0	0	0

COLD/WIND CHILL

*There were **7** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	01/30/1996	0	0	0	0
WAUPACA COUNTY	02/01/1996	0	0	0	0
WAUPACA COUNTY	06/14/1999	0	0	0	0
WAUPACA COUNTY	02/17/2006	0	0	0	0
WAUPACA COUNTY	02/04/2007	0	0	0	0
WAUPACA COUNTY	01/02/2018	0	0	0	0
WAUPACA COUNTY	01/29/2018	0	0	0	0

[169] https://www.ncdc.noaa.gov/stormevents/

DENSE FOG

*There were **9** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	05/09/1996	0	0	0	0
WAUPACA COUNTY	10/16/1996	0	0	0	0
WAUPACA COUNTY	01/02/1997	0	0	0	0
WAUPACA COUNTY	03/01/1997	0	0	0	0
WAUPACA COUNTY	02/11/1999	0	0	0	0
WAUPACA COUNTY	12/13/1999	0	0	0	0
WAUPACA COUNTY	01/09/2000	0	0	0	0
WAUPACA COUNTY	02/23/2000	0	0	0	0
WAUPACA COUNTY	02/24/2000	0	0	0	0

DROUGHT

*There were **10** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	03/01/1999	0	0	0	0
WAUPACA COUNTY	07/19/2005	0	0	0	0
WAUPACA COUNTY	09/30/2008	0	0	0	0
WAUPACA COUNTY	10/01/2008	0	0	0	0
WAUPACA COUNTY	11/01/2008	0	0	0	0
WAUPACA COUNTY	12/01/2008	0	0	0	0
WAUPACA COUNTY	01/01/2009	0	0	0	0
WAUPACA COUNTY	02/01/2009	0	0	0	0
WAUPACA COUNTY	03/01/2009	0	0	0	0
WAUPACA COUNTY	10/09/2012	0	0	0	0

EXCESSIVE HEAT

*There was **1** event reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	07/03/2012	0	0	0	0

EXTREME COLD/WINDCHILL

*There were **4** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	01/30/2008	0	0	0	0
WAUPACA COUNTY	02/10/2008	0	0	0	0
WAUPACA COUNTY	01/06/2014	0	0	0	0
WAUPACA COUNTY	01/27/2014	0	0	0	0

FLASH FLOOD

*There were **11** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA	08/03/2003	0	0	0	0
WAUPACA	07/16/2008	0	0	0	0
CLINTONVILLE	09/23/2010	0	0	0	0
WAUPACA	08/18/2014	0	0	0	0

FLOOD

*There were **6** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	06/16/1996	0	0	0	0
WAUPACA COUNTY	04/04/1998	0	0	0	0
NEW LONDON	07/08/1999	0	0	0	0
CLINTONVILLE ARPT	09/23/2010	0	0	0	0
CLINTONVILLE	06/12/2017	0	0	$1,000	0
NORTHLAND	03/15/2019	0	0	$87,500	0

FUNNEL CLOUD

*There were **3** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WEYAUWEGA	05/06/2002	0	0	0	0
NEW LONDON	06/13/2005	0	0	0	0
WEYAUWEGA	07/14/2010	0	0	0	0

HAIL

*There were **90** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Diameter*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	05/28/1991	1.75 in.	0	0	0	0
BIG FALLS	05/16/1995	0.75 in.	0	0	0	0
WAUPACA	06/29/1996	1.75 in.	0	0	0	0
WAUPACA	07/16/1997	0.88 in.	0	0	0	0
FREMONT	03/29/1998	1.75 in.	0	0	0	0
MARION	05/30/1998	0.75 in.	0	0	0	0
IOLA	08/23/1998	0.75 in.	0	0	0	0
NEW LONDON	08/23/1998	1.00 in.	0	0	0	0
NEW LONDON	08/23/1998	1.75 in.	0	0	0	0
NEW LONDON	08/23/1998	1.75 in.	0	0	0	0
WAUPACA	09/25/1998	1.50 in.	0	0	0	0
IOLA	09/26/1998	0.75 in.	0	0	0	0
WEYAUWEGA	09/26/1998	0.88 in.	0	0	0	0
WAUPACA	03/08/2000	1.75 in.	0	0	0	0
OGDENSBURG	03/08/2000	1.00 in.	0	0	0	0
CLINTONVILLE	06/01/2000	1.00 in.	0	0	0	0
CLINTONVILLE	06/11/2001	1.75 in.	0	0	0	0
WAUPACA	04/18/2002	0.88 in.	0	0	0	0
IOLA	05/06/2002	1.75 in.	0	0	0	0
WAUPACA	04/15/2003	1.00 in.	0	0	0	0
IOLA	04/15/2003	0.75 in.	0	0	0	0
CLINTONVILLE	04/15/2003	1.25 in.	0	0	0	0
IOLA	04/15/2003	1.50 in.	0	0	0	0
FREMONT	05/08/2004	0.75 in.	0	0	0	0
MARION	05/09/2004	0.75 in.	0	0	0	0
IOLA	07/13/2004	0.88 in.	0	0	0	0

WAUPACA	04/13/2006	0.88 in.	0	0	0	0
WAUPACA	04/13/2006	1.00 in.	0	0	0	0
WAUPACA	04/13/2006	1.00 in.	0	0	0	0
WAUPACA	05/27/2006	0.88 in.	0	0	0	0
WAUPACA	05/27/2006	1.50 in.	0	0	0	0
NEW LONDON	05/27/2006	0.75 in.	0	0	0	0
ROYALTON	06/06/2006	0.75 in.	0	0	0	0
WEYAUWEGA	07/24/2006	0.75 in.	0	0	0	0
NORTHLAND	06/20/2007	0.75 in.	0	0	0	0
NORTHLAND	07/18/2007	1.75 in.	0	0	0	0
OGDENSBURG	07/18/2007	0.75 in.	0	0	0	0
WAUPACA	07/18/2007	0.75 in.	0	0	0	0
WEYAUWEGA	07/18/2007	1.00 in.	0	0	0	0
IOLA	07/26/2007	1.00 in.	0	0	0	0
SCANDINAVIA	07/26/2007	1.00 in.	0	0	0	0
SCANDINAVIA	07/26/2007	1.75 in.	0	0	0	0
IOLA	07/26/2007	0.75 in.	0	0	0	0
SCANDINAVIA	07/26/2007	2.00 in.	0	0	0	0
IOLA	07/26/2007	0.75 in.	0	0	0	0
LIND CENTER	06/28/2008	0.75 in.	0	0	0	0
WEYAUWEGA	07/16/2008	0.75 in.	0	0	0	0
KING	07/16/2008	0.75 in.	0	0	0	0
CLINTONVILLE	07/20/2010	1.50 in.	0	0	0	0
MARION	07/27/2010	0.75 in.	0	0	0	0
WAUPACA	05/22/2011	0.75 in.	0	0	0	0
SHERIDAN	05/22/2011	1.75 in.	0	0	0	0
SCANDINAVIA	05/22/2011	1.00 in.	0	0	0	0
IOLA	05/22/2011	1.00 in.	0	0	0	0
PARTRIDGE LAKE	07/18/2011	0.75 in.	0	0	0	0
NORTH READFIELD	07/18/2011	1.00 in.	0	0	0	0
WAUPACA	07/31/2011	0.75 in.	0	0	0	0
CLINTONVILLE	05/28/2012	0.75 in.	0	0	0	0
CLINTONVILLE	05/28/2012	0.88 in.	0	0	0	0
KING	06/18/2012	1.00 in.	0	0	0	0
CLINTONVILLE	06/18/2012	1.25 in.	0	0	0	0
WAUPACA	06/18/2012	0.75 in.	0	0	0	0
CLINTONVILLE	07/02/2012	1.50 in.	0	0	0	0
NEW LONDON	07/02/2012	0.88 in.	0	0	0	0
NEW LONDON	07/02/2012	1.50 in.	0	0	0	0

NEW LONDON	07/02/2012	1.00 in.	0	0	0	0
CLINTONVILLE	07/30/2012	0.88 in.	0	0	0	0
NEW LONDON	09/19/2012	0.75 in.	0	0	0	0
FREMONT	09/19/2012	0.88 in.	0	0	0	0
FREMONT	09/19/2012	1.00 in.	0	0	0	0
IOLA	05/30/2013	0.75 in.	0	0	0	0
CLINTONVILLE	06/15/2013	0.88 in.	0	0	0	0
NORTHPORT	06/17/2013	1.00 in.	0	0	0	0
CLINTONVILLE	06/27/2013	0.88 in.	0	0	0	0
NEW LONDON	06/27/2013	0.88 in.	0	0	0	0
SYMCO	09/01/2013	1.00 in.	0	0	0	0
CLINTONVILLE ARPT	08/01/2014	1.00 in.	0	0	0	0
IOLA	08/01/2014	0.88 in.	0	0	0	0
IOLA	08/25/2014	0.75 in.	0	0	0	0
KING	08/02/2015	1.00 in.	0	0	0	0
IOLA	08/02/2015	1.00 in.	0	0	0	0
CLINTONVILLE	06/05/2016	0.88 in.	0	0	0	0
NORTH READFIELD	06/15/2016	1.00 in.	0	0	0	0
READFIELD	06/15/2016	1.75 in.	0	0	0	0
WAUPACA MUNI ARPT	05/17/2017	1.00 in.	0	0	0	0
WAUPACA	07/06/2017	1.50 in.	0	0	0	0
WAUPACA	07/06/2017	0.75 in.	0	0	0	0
RURAL	06/16/2018	1.25 in.	0	0	0	0
NORTHLAND	07/01/2018	1.75 in.	0	0	0	0
NORTHLAND	07/01/2018	1.75 in.	0	0	0	0
CLINTONVILLE	05/31/2019	0.75 in.	0	0	0	0
FREMONT	04/20/2020	1.00 in.	0	0	0	0

HEAT

*There were **4** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	02/11/1999	0	0	0	0
WAUPACA COUNTY	07/23/1999	0	0	0	0
WAUPACA COUNTY	07/31/2006	0	0	0	0
WAUPACA COUNTY	07/16/2012	0	0	0	0

HEAVY RAIN

*There were **31** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
IOLA	07/26/2007	0	0	0	0
NEW LONDON	03/31/2008	0	0	0	0
MARION	07/16/2008	0	0	0	0
WEYAUWEGA	06/21/2011	0	0	0	0
KING	06/02/2014	0	0	$500	0
IOLA	08/29/2014	0	0	0	0
NEW LONDON	06/15/2015	0	0	0	0
CLINTONVILLE	09/06/2015	0	0	0	0
SCANDINAVIA	12/13/2015	0	0	0	0

HEAVY SNOW

*There were **22** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	04/29/1996	0	0	0	0
WAUPACA COUNTY	12/23/1996	0	0	0	0
WAUPACA COUNTY	02/04/1997	0	0	0	0
WAUPACA COUNTY	03/13/1997	0	0	0	0
WAUPACA COUNTY	01/14/1998	0	0	0	0
WAUPACA COUNTY	04/16/1998	0	0	0	0
WAUPACA COUNTY	12/20/1998	0	0	0	0
WAUPACA COUNTY	01/12/2000	0	0	0	0
WAUPACA COUNTY	01/31/2002	0	0	0	0
WAUPACA COUNTY	02/01/2002	0	0	0	0
WAUPACA COUNTY	01/31/2003	0	0	0	0
WAUPACA COUNTY	02/05/2004	0	0	0	0
WAUPACA COUNTY	02/20/2005	0	0	0	0
WAUPACA COUNTY	03/18/2005	0	0	0	0
WAUPACA COUNTY	12/14/2005	0	0	0	0
WAUPACA COUNTY	02/23/2007	0	0	0	0
WAUPACA COUNTY	12/08/2008	0	0	0	0
WAUPACA COUNTY	04/19/2011	0	0	0	0
WAUPACA COUNTY	11/09/2011	0	0	0	0

WAUPACA COUNTY	02/17/2014	0	0	0	0
WAUPACA COUNTY	12/16/2016	0	0	0	0
WAUPACA COUNTY	12/12/2019	0	0	0	0
WAUPACA COUNTY	02/09/2020	0	0	0	0

HIGH WIND

*There were **7** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*KTS*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	04/06/1997		0	0	$2,000	0
WAUPACA COUNTY	06/28/1998		0	0	$3,000	0
WAUPACA COUNTY	11/10/1998		0	0	$5,000	0
WAUPACA COUNTY	04/07/2001	55	0	0	0	0
WAUPACA COUNTY	10/26/2010	50	0	0	0	0
WAUPACA COUNTY	07/01/2011	58	0	0	0	0
WAUPACA COUNTY	03/08/2017	57	0	0	0	0

ICE STORM

*There were **4** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	02/26/1996	0	0	0	0
WAUPACA COUNTY	01/04/1998	0	0	0	0
WAUPACA COUNTY	01/01/2005	0	0	0	0
WAUPACA COUNTY	04/09/2013	0	0	0	0

LIGHTNING

*There were **7** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
BIG FALLS	09/03/1996	0	0	0	0
WEYAUWEGA	08/14/1997	0	0	$50,000	0
FREMONT	06/27/1998	0	0	0	0
IOLA	06/27/1998	0	0	0	0
SCANDINAVIA	06/24/2006	0	0	0	0
NEW LONDON	08/22/2007	0	0	$7,500	0
NORTHPORT	03/15/2016	0	0	$20,000	0

STRONG WIND

*There were **16** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*KTS*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	10/30/1996		0	0	$10,000	0
WAUPACA COUNTY	03/09/1998		0	0	0	0
WAUPACA COUNTY	03/17/1999		0	0	0	0
WAUPACA COUNTY	12/25/1999		0	0	0	0
WAUPACA COUNTY	03/25/2000		0	0	0	0
WAUPACA COUNTY	04/05/2000		0	0	0	0
WAUPACA COUNTY	06/21/2000		0	0	0	0
WAUPACA COUNTY	10/25/2001		0	0	0	0
WAUPACA COUNTY	12/05/2001		0	0	0	0
WAUPACA COUNTY	02/11/2002		0	0	0	0
WAUPACA COUNTY	03/09/2002		0	0	0	0
WAUPACA COUNTY	05/09/2002		0	0	0	0
WAUPACA COUNTY	09/23/2002		0	0	0	0
WAUPACA COUNTY	05/05/2010	43	0	0	$1,000	0
WAUPACA COUNTY	10/14/2014	42	0	0	$15,000	0
WAUPACA COUNTY	12/23/2015	48	0	0	$1,000	0

THUNDERSTORM WIND

*There were **137** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*KTS*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	08/25/1992		0	0	0	0
WAUPACA COUNTY	08/25/1992		0	0	0	0
MARION	08/09/1993		0	0	$50,000	$50,000
WAUPACA	07/23/1994		0	0	$50,000	$5,000
ROTHSCHILD	07/31/1995		0	0	0	0
WAUPACA	07/31/1995		0	0	0	0
CLINTONVILLE	07/31/1995		0	0	0	0
EMBARRASS	07/31/1995		0	0	0	0
WAUPACA	08/09/1995		0	0	0	0
CLINTONVILLE	08/11/1995		0	0	0	0

WAUPACA	08/13/1995		0	0	0	0
WAUPACA	08/28/1995		0	0	0	0
IOLA	05/19/1996		0	0	$1,000	0
SCANDINAVIA	07/12/1996		0	0	$2,000	0
WAUPACA	07/18/1996	87	0	0	$180,000	$30,000
FREMONT	07/18/1996	52	0	0	0	0
WAUPACA	08/07/1996		0	0	$39,000	$8,000
WAUPACA	06/24/1997	65	0	0	$2,000	0
CLINTONVILLE	06/24/1997		0	0	$1,000	0
MARION	07/02/1997		0	0	$1,000	0
WAUPACA	07/02/1997		0	0	$1,000	0
NEW LONDON	07/16/1997		0	1	$20,000	0
WEYAUWEGA	07/16/1997		0	0	$10,000	0
BIG FALLS	06/24/1998		0	0	$5,000	0
CLINTONVILLE	06/24/1998		0	0	$1,000	0
OGDENSBURG	06/25/1998		0	0	$1,000	0
WAUPACA	06/25/1998		0	0	$1,000	0
CLINTONVILLE	06/25/1998	50	0	0	$10,000	0
NEW LONDON	08/23/1998	50	0	0	0	0
MARION	05/17/1999	60	0	1	0	0
WAUPACA	06/06/1999	50	0	0	0	0
CLINTONVILLE	06/06/1999	62	0	0	0	0
WAUPACA	07/08/1999	50	0	0	0	0
FREMONT	07/30/1999	54	0	0	0	0
CLINTONVILLE	07/30/1999	50	0	0	$50,000	0
MANAWA	09/19/1999	50	0	0	0	0
MARION	07/08/2000	50	0	0	0	0
WAUPACA	08/14/2000	50	0	0	0	0
ROYALTON	08/14/2000	50	0	0	0	0
FREMONT	08/14/2000	50	0	0	0	0
WAUPACA	04/12/2001	50	0	0	0	0
MANAWA	04/12/2001	50	0	0	0	0
IOLA	06/11/2001	64	0	0	$1.38M	0
CLINTONVILLE	08/02/2004	55	0	0	0	0
WAUPACA	08/26/2004	50	0	0	0	0
OGDENSBURG	08/26/2004	50	0	0	0	0
WAUPACA	08/26/2004	50	0	0	0	0
OGDENSBURG	08/26/2004	55	0	0	0	0
WEYAUWEGA	04/19/2005	56	0	0	0	0
NEW LONDON	04/19/2005	56	0	0	0	0

NEW LONDON	06/04/2005	50	0	0	0	0
IOLA	06/05/2005	50	0	0	0	0
NEW LONDON	06/05/2005	50	0	0	0	0
MARION	06/05/2005	50	0	0	0	0
WAUPACA	06/05/2005	56	0	0	0	0
FREMONT	06/10/2005	50	0	0	0	0
WAUPACA	06/11/2005	50	0	0	0	0
FREMONT	06/11/2005	50	0	0	0	0
CLINTONVILLE ARPT	06/11/2005	54	0	0	0	0
WAUPACA	07/23/2005	50	0	0	0	0
WEYAUWEGA	07/23/2005	50	0	0	0	0
FREMONT	09/13/2005	52	0	0	0	0
CLINTONVILLE	07/30/2006	55	0	0	0	0
WAUPACA	07/30/2006	51	0	0	0	0
WAUPACA	05/24/2007	52	0	0	0	0
NORTHLAND	07/18/2007	57	0	0	0	0
WAUPACA	07/18/2007	52	0	0	0	0
WEYAUWEGA	07/18/2007	65	0	0	$10,000	0
WAUPACA	07/18/2007	61	0	0	0	$50,000
RURAL	07/18/2007	52	0	0	0	0
IOLA	07/12/2008	43	0	1	0	0
BIG FALLS	07/16/2008	65	0	0	0	0
CLINTONVILLE	07/16/2008	56	0	0	0	0
IOLA	05/04/2010	52	0	0	0	0
WAUPACA	07/10/2010	56	0	0	0	0
MARION	07/14/2010	56	0	0	0	0
FREMONT	07/14/2010	78	0	0	0	0
WAUPACA	07/14/2010	52	0	0	0	0
NEW LONDON	07/20/2010	70	0	0	0	0
NEW LONDON	07/20/2010	56	0	0	0	0
NEW LONDON	08/20/2010	78	0	0	$100,000	0
WAUPACA	05/22/2011	52	0	0	0	0
SYMCO	06/27/2011	60	0	0	$10,000	0
RURAL	07/11/2011	52	0	0	0	0
IOLA	07/17/2011	52	0	0	0	0
WAUPACA	07/17/2011	52	0	0	0	0
LIND CENTER	07/18/2011	60	0	0	0	0
RURAL	07/18/2011	52	0	0	0	0
NEW LONDON	09/02/2011	52	0	0	0	0

FREMONT	09/02/2011	50	0	0	0	0
MARION	05/24/2012	52	0	0	0	0
BIG FALLS	09/04/2012	52	0	0	0	0
CLINTONVILLE	09/04/2012	52	0	0	0	0
SYMCO	05/30/2013	61	0	0	$75,000	0
EMBARRASS	05/30/2013	56	0	0	0	0
OGDENSBURG	06/21/2013	52	0	0	0	0
CLINTONVILLE	06/27/2013	61	0	0	0	0
KING	08/06/2013	61	0	0	$10,000	0
WAUPACA	08/06/2013	65	0	0	0	0
CLINTONVILLE	08/21/2013	52	0	0	0	0
NEW LONDON	06/01/2014	52	0	0	0	0
IOLA	08/25/2014	52	0	0	0	0
IOLA	08/25/2014	52	0	0	0	0
RURAL	05/26/2015	56	0	0	$75,000	0
CLINTONVILLE	07/13/2015	52	0	0	0	0
WAUPACA	07/18/2015	52	0	0	0	0
NORTHPORT	07/18/2015	52	0	0	0	0
BIG FALLS	06/05/2016	52	0	0	0	0
CLINTONVILLE	06/05/2016	61	0	0	0	0
NEW LONDON	06/05/2016	61	0	0	0	0
CLINTONVILLE	06/10/2016	52	0	0	0	0
CLINTONVILLE	06/26/2016	52	0	0	0	0
WAUPACA	07/21/2016	52	0	0	0	0
KING	07/21/2016	61	0	0	$1,000	0
IOLA	07/27/2016	61	0	0	$7,500	0
OGDENSBURG	07/27/2016	52	0	0	0	0
LITTLE HOPE	05/17/2017	52	0	0	0	0
MANAWA	05/17/2017	52	0	0	0	0
NEW LONDON	05/17/2017	50	0	0	0	0
CLINTONVILLE	05/17/2017	52	0	0	0	0
NORTHLAND	06/12/2017	52	0	0	0	0
NORTHLAND	06/12/2017	54	0	0	0	0
CLINTONVILLE	06/12/2017	52	0	0	0	0
KING	06/14/2017	61	0	0	0	0
WAUPACA	06/14/2017	61	0	0	0	0
SCANDINAVIA	06/14/2017	52	0	0	0	0
IOLA	06/14/2017	61	0	0	$150,000	0
NORTHPORT	06/14/2017	61	0	0	$30,000	0
NORTHLAND	07/01/2018	52	0	0	0	0

IOLA	07/25/2018	52	0	0	0	0
WAUPACA MUNI ARPT	08/26/2018	52	0	0	0	0
CLINTONVILLE	08/27/2018	52	0	0	0	0
WAUPACA	08/27/2018	52	0	0	0	0
FREMONT	08/27/2018	52	0	0	0	0
WAUPACA	6/27/2019	52	0	0	0	0
IOLA	7/19/2019	52	0	0	0	0
SHERIDAN	7/20/2019	52	0	1	$150,000	0
SCANDINAVIA	7/20/2019	61	0	0	$100,000	0
IOLA	7/20/2019	52	0	0	$100,000	0
EMBARRASS	8/5/2019	52	0	0	0	0
WAUPACA	4/20/2020	52	0	0	0	0
NEW LONDON	4/20/2020	52	0	0	0	0

TORNADO

*There were **12** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Strength*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	05/16/1992	F1	0	0	$25,000	0
FREMONT	07/04/1994	F0	0	0	0	0
WAUPACA	06/23/2004	F2	0	0	$915,000	0
CLINTONVILLE	06/10/2005	F0	0	0	0	0
NEW LONDON	08/18/2005	F0	0	0	$1,000	0
FREMONT	04/10/2011	EF1	0	0	0	0
PARTRIDGE LAKE	08/06/2013	EF1	0	2	$25,000	0
NEW LONDON	08/06/2013	EF2	0	0	$1M	0
MARION	07/06/2015	EF1	0	0	$100,000	0
SYMCO	06/26/2016	EF1	0	0	$200,000	0
WAUPACA	07/20/2019	EF1	0	0	$150,000	0
WEYAUWEGA	07/20/2019	EF0	0	0	$150,000	0
NEW LONDON	07/20/2019	EF)	0	0	$100,000	0

WINTER STORM

*There were **44** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	01/26/1996	0	0	0	0

WAUPACA COUNTY	01/08/1998	0	0	0	0
WAUPACA COUNTY	03/08/1998	0	0	0	0
WAUPACA COUNTY	01/02/1999	0	0	0	0
WAUPACA COUNTY	02/08/2001	0	0	0	0
WAUPACA COUNTY	02/20/2002	0	0	0	0
WAUPACA COUNTY	03/02/2002	0	0	0	0
WAUPACA COUNTY	04/03/2003	0	0	0	0
WAUPACA COUNTY	12/09/2003	0	0	0	0
WAUPACA COUNTY	12/20/2004	0	0	0	0
WAUPACA COUNTY	01/21/2005	0	0	0	0
WAUPACA COUNTY	02/16/2006	0	0	0	0
WAUPACA COUNTY	02/24/2007	0	0	0	0
WAUPACA COUNTY	03/01/2007	0	0	0	0
WAUPACA COUNTY	04/11/2007	0	0	0	0
WAUPACA COUNTY	12/01/2007	0	0	0	0
WAUPACA COUNTY	12/23/2007	0	0	0	0
WAUPACA COUNTY	01/17/2008	0	0	0	0
WAUPACA COUNTY	01/29/2008	0	0	0	0
WAUPACA COUNTY	02/17/2008	0	0	0	0
WAUPACA COUNTY	02/26/2009	0	0	0	0
WAUPACA COUNTY	03/08/2009	0	0	0	0
WAUPACA COUNTY	12/08/2009	0	0	0	0
WAUPACA COUNTY	12/24/2009	0	0	0	0
WAUPACA COUNTY	12/11/2010	0	0	0	0
WAUPACA COUNTY	02/20/2011	0	0	0	0
WAUPACA COUNTY	03/22/2011	0	0	0	0
WAUPACA COUNTY	12/20/2012	0	0	0	0
WAUPACA COUNTY	01/30/2013	0	0	0	0
WAUPACA COUNTY	01/14/2014	0	0	0	0
WAUPACA COUNTY	11/24/2014	0	0	0	0
WAUPACA COUNTY	12/28/2015	0	0	0	0
WAUPACA COUNTY	02/02/2016	0	0	0	0
WAUPACA COUNTY	03/23/2016	0	0	0	0
WAUPACA COUNTY	01/09/2017	0	0	0	0
WAUPACA COUNTY	01/16/2017	0	0	0	0
WAUPACA COUNTY	02/24/2017	0	0	0	0
WAUPACA COUNTY	04/03/2018	0	0	0	0
WAUPACA COUNTY	04/13/2018	0	0	0	0
WAUPACA COUNTY	01/28/2019	0	0	0	0

WAUPACA COUNTY	02/23/2019	0	0	0	0
WAUPACA COUNTY	04/10/2019	0	0	0	0
WAUPACA COUNTY	12/01/2019	0	0	0	0
WAUPACA COUNTY	01/17/2020	0	0	0	0

WINTER WEATHER

*There were **8** events reported over the 25-year period from 1/1/94-1/1/20.*

Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
WAUPACA COUNTY	01/16/1996	0	0	0	0
WAUPACA COUNTY	02/07/1996	0	0	0	0
WAUPACA COUNTY	04/03/1996	0	0	0	0
WAUPACA COUNTY	12/27/1996	0	0	0	0
WAUPACA COUNTY	01/01/1997	0	0	0	0
WAUPACA COUNTY	01/22/1999	0	0	0	0
WAUPACA COUNTY	04/28/2008	0	0	0	0
WAUPACA COUNTY	12/19/2008	0	0	0	0

Appendix C: Plan Adoption

This plan has been adopted by Waupaca County and its major municipal bodies including the Cities of Clintonville, Manawa, Marion, New London, Waupaca, and Weyauwega; the Villages of Big Falls, Embarrass, Fremont, Iola, Ogdensburg, and Scandinavia; and the Towns of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, Scandinavia, Union, Weyauwega, and Wyoming. The Towns of Larrabee, St. Lawrence, and Waupaca did not independently adopt the plan but, as towns, may participate in hazard mitigation projects with the county.

Appendix D: Report on Previous Mitigation Strategies

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
All Hazards	Continue to promote the increased use of National Oceanic and Atmospheric Administration (NOAA) weather radios.	Covered by Dept. annual budget	EM Dept. CI of Waupaca	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming. CI of Waupaca	*Weather radios have been promoted on the radio, township newsletters, local newspapers, every spring and after storms. Will be kept going forward.* City of Waupaca promotes weather radio use on website, FB and utility stubs. *Information was provided at community events. Item will be kept going forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Continue to add/update Emergency Management Department links on the existing county web site (e.g., ARC, Homeland Security/FEMA, WEM) especially focusing on preparedness bulletins. Publicize the website to inform the community.	Covered by Dept. annual budget	EM Dept.	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Completed as needed and will be carried forward.*
	Continue promoting, supporting and updating the use of the CodeRED citizen notification system.	Covered by Dept. annual budget	EM Dept.	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union,	*Completed as needed and will be carried forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Waupaca, Weyauwega and Wyoming.	
	Examine possible expanded use of the public notification system, Nixel.	Unknown	CI of Waupaca	Ongoing	High	CI of Waupaca	CI of Waupaca received the service for free in 2011 but is now expanding and considering going in with the county on the CodeRed service. *The City of Waupaca changed to the CodeRed public notification service. This item is closed.*
	Design website and regularly update information.	Covered by Dept. annual budget	CI of Waupaca CI of Marion CI of Manawa TN of Mukwa TN of Wyoming	Ongoing Ongoing	Medium Low	CI of Waupaca CI of Marion CI of Manawa TN of Mukwa TN of Wyoming	CI of Waupaca regularly updates their website. *The website was updated regularly, as new information became available. Item will be kept going forward.* *All four of these communities have built a website and are reviewing emergency information for inclusion on their pages. They will update as needed. This item will go forward, edited to show that they will be updating (not creating) sites.*
	Open discussions with municipalities concerning updating and improving tornado sirens and other emergency facilities and equipment.	Unknown	EM Dept. / municipalities	2014	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison,	Each municipality activates their own sirens. CI of Waupaca is the only municipality that can be activated by the county as well as the city. • The county is looking into obtaining solar chargers. • The county is also considering installing external power panels or generators for EOC, lift stations, sirens and wells.

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Discussions about improvements has been ongoing and this item will be carried forward.*
Drought and Dust Storms	Provide information to farmers via website links and brochures regarding water conservation measures that can be employed during a drought.	Covered by Dept. annual budget	UW-Ext. / FSA	As needed	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information is available to farmers and updated as needed. *Done as needed, will carry forward.*
	Prepare/publicize water usage regulations for non-farm areas during drought.	Covered by Dept. annual budget	UW-Ext. / LWC	As needed	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton,	Information is available to public and updated as needed. *No droughts in this period. 2012/13-drought led to surveys on water conservation. Has helped efficiency in water system.* *Will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Provide public information via website links and brochures regarding water conservation measures that can be employed during a drought.	Covered by Dept. annual budget	UW-Ext. / LWC	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information is available to public and updated regularly. *Done as needed, will carry forward.*
Earthquakes	Provide public information via website links and brochures regarding safety measures that can be employed during an earthquake to increase public awareness.	Covered by Dept. annual budget	EM Dept.	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and	Information is available to public and updated regularly. *Public information will be provided as needed.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
Fire: Forest and Wildfire	Provide ample training for fire fighters and fire departments for larger fires.	Covered by Dept. annual budget	Local Fire Departments / WI DNR	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Fire fighters train regularly within the local departments and with WI DNR annually each spring. *DNR training is done annually. Fire departments also do annual storm spotter training. Will carry forward.*
	Explore options for firefighting training with WI DNR and local fire departments.	Unknown	Co Hwy / CI Marion DPW / CI Manawa	2018	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass,	*This is rolled in with fire department training, so will be dropped moving forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Update DNR zone book.	Grant funded	EM Dept. / WI DNR / Local Fire Departments	2018	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	• Zone book was last done in 2009. • Apply for grant funding. *Not much to update, so re-printed 2009 book in April 2019. Will evaluate if updates needed in 5 years.* *Will carry forward.*
	Examine options for self-funding zone book.	$5,000	CI of Waupaca FD / EM	2018	High	CI of Waupaca	*Going to use app instead – will drop moving forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Explore improving zoning regulations and work with towns on increasing width of roads, especially in subdivisions which have roads one-car-width.	Unknown	P&Z	2018	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	County cannot get fire, ambulance and other emergency vehicles into narrower roads within some subdivisions. Hoping to get 33% of road access / right-of-way. *Discussion have continued and this item will be carried forward.*
Flooding and Dam Failure	Explore options for dealing with stormwater issue by hospital in the City of New London.	Unknown	City Admin. / DPW	2018	High	Waupaca Co; Outagamie Co; CI of New London	Drain is too small and there is no place for water to go. *Upgrade project completed; problem was remediated – will not carry forward.*
	Conduct floodproofing measures (acquisition, demolition, elevation, etc.) within the City of Marion. Possible projects include: • Senior Center and Garfield Ave – there are two storm sewers under low income housing which need to be moved • School bus garage area – there are three houses within 200 yards below a high-hazard dam	Costs vary per project	CI of Marion	Ongoing	Medium	CI of Marion	*These projects have not been completed. They will continue to be evaluated for funding and/or grant requests as able. They will be carried forward to the next planning period.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Examine feasibility of installing river gauge in the Village of Freemont.	$500, Local funding	VI of Freemont	2018	Medium	VI of Freemont	*The village is considering possibly marking a piling. This will be carried forward with the timeline changed to 2021-2025.*
	Evaluate options for upgrading or replacing the earthen dam in the Village of Ogdenburg.	Unknown local funding	VI of Ogdenburg	2018	High	VI of Ogdenburg	*This item was completed during the last plan period and the hazard has now been mitigated. It will be removed from the list of strategies going forward.*
	*Using maps and hydrology studies to ensure that properties at risk are identified and, as available, appropriate grants are sought and secured to mitigate losses.	Costs vary per project	Municipal elected officials	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Using maps and hydrology studies to ensure that properties at risk are identified and, as available, appropriate grants are sought and secured to mitigate losses. *Maps were updated regularly, as new information became available. Item will be kept going forward.*
	*Targeting old structures for buy-out and converting the land to open, public lands.	Costs vary per project	Municipal elected officials	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola,	*Targeting old structures for buy-out and converting the land to open, public lands. *No structures were targeted in the previous plan period. Item will be kept going forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	*Pre-identifying infrastructure (roads, bridges, culverts, shoulders) prone to flooding and directing current and future budgetary dollars towards making the infrastructure disaster-resistant as it is scheduled for routine maintenance	Costs vary per project	Municipal elected officials	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Pre-identifying infrastructure (roads, bridges, culverts, shoulders) prone to flooding and directing current and future budgetary dollars towards making the infrastructure disaster-resistant as it is scheduled for routine maintenance. *No structures were identified in the previous plan period. Will continue to monitor.* *VI Embarrass notes culvert repairs are ongoing and they are limited in that they do not have the funds to repair all.* *Item will be kept going forward.*
Fog	Provide public information via website links or brochures regarding safe driving procedures in the fog.	Covered by Dept. annual budget	EM Dept. / CO HWY	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big	Information available in display rack and on website.

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Done as needed. Will be removed as this chapter is no longer included in this plan.*
Severe Temperatures	Continue public informational campaigns about severe weather on the website and during Winter and Heat Awareness Weeks.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Completed annually during campaigns in April and November. *Done annually on Facebook and will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Coordinate cooling and warming shelters within communities.	Covered by Dept. annual budget	PH	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Continue to update as needed *Shelters not opened but public information is provided about open, cool public buildings.* *Will carry forward.*
Storms: Hail	Place hail storm safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union,	Information available in display rack and on website. *Done as needed, will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Waupaca, Weyauwega and Wyoming.	
	Provide information regarding the purchase of crop insurance	Covered by Dept. annual budget	UW Ext.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information available in display rack and on website. *Done as needed, will carry forward.*
Storms: Lightning	Place lightning safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa,	Information available in display rack and on website. *Done as needed, will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Install lightning arrestor at Mount Tom Water Tower and communication tower.	$10,000	CI of Waupaca DPW	2018	High	CI of Waupaca	CI of Waupaca has arrestor and phase detectors at the waste water treatment plant. *This item was completed and the problem has been mitigated during the last planning period. It will be dropped going forward.*
Storms: Thunderstorm	Place thunderstorm safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information available in display rack and on website. *Done as needed, will carry forward.*
Storms: Tornadoes and High Winds	Promote tornado awareness, including safety measures.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big	• Completed during tornado awareness week in April and by sponsoring annual spotter classes.

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	• Information included on the website for homes, schools and business safety measures. *Done annually, will carry forward.*
	Continue preventative tree removal.	Covered by Dept. annual budget	CO Parks and Rec	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Done as needed, will carry forward.*
	Explore the feasibility of constructing tornado shelters in areas where	Costs vary	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London,	Use Department of Commerce's CDBG for funding assistance.

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	deficient, especially in mobile home parks and campgrounds. Keller Lakes Vic-To-Rea Park WGNSA on Walnut Street Athletic Field Bertram Street Trailer Park Northgate Estates Trailer Park Swan Park Oak Street Mobile Home Park County Fairgrounds Car Show Campground Rodeo Grounds County TTF (transfer facility) Oakwood Trailer Court Huckleberry Campground Wolf River Campground		Waupaca CO CI of Manawa CI of Marion CI of New London CI of Waupaca CI of Weyauwega VI of Iola / TNs of St Lawrence and Scandinavia TN of Little Wolf TN of Mukwa			Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Adding one shelter and restroom in each. *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.* *No funds or private owners have not had match. Will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Debris Removal	*$39,611.39*	*John Miller, Town Chairman*	*2019-2020 Completed 2/27/2020*	*High*	*Town of Dayton*	*Storm damage 8/27/19. FEMA Disaster Declaration 4459-WI-DR Project Certification form P.4 on 8/5/2020 awaiting Federal /State cost share payment of $34,659.97* *Will be removed going forward.*
	Upgrade and reinforce the bathroom facilities in Ellison Park to make it suitable as a storm shelter structure.	Unknown	VI and TN of Scandinavia	2018	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*The park has block structure restrooms that will need to be reinforced to make it suitable as a storm shelter. Will carry forward.*
Storms: Winter	Promote winter hazards awareness, including home and travel safety measures (including website.)	Covered by Dept. annual budget	EM Dept. / CO HWY	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear	Completed during winter weather awareness week in November. *Done annually, will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Examine options for planting living fences to keep snow from roadway.	Unknown	CO HWY / DPW	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Few landowners or farmers are interested or willing. *Continuing to provide public information but still a challenge. Will carry forward.*
	Explore road sign upgrades for electronic signs that can be turned on and off during hazardous weather.	Unknown	CO HWY	2018	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola,	*Not high enough volume for state/federal DOT to install permanent signs. Hwy 10 especially. Have some portables. Will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Explore installing ramp barricades.	Unknown	CO HWY	2018	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*No money to do this yet, will carry forward.*
	Explore options for increased salt storage facilities.	$200,000 each	CO HWY	2018	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big	Four salt storage facilities are needed. (One for the county, one for the state and one each for the Cities of Manawa and Waupaca.)

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*The county built theirs in 2019.* *Waupaca is planning to build in 2020.* *State has not budgeted it yet.* *Will carry forward, dropping the county from the benefitting communities.*
Utility Failure	Open discussion with service providers about burying power, cable and phone lines.	Covered by Dept. annual budget	EM Dept. / DPW	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*WPS doing burying in Dayton and south of the City of Waupaca.* *Central Wisconsin Co-op is pursing projects in the NW portion of the county.* *Will carry forward.*
	Explore possibility and options of building a fiber ring around county and	Covered by Dept.	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London,	*Will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	offsite back-up to improve emergency communications.	annual budget				Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Examine options and costs of purchasing generators for county use during utility failure.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*City of Clintonville added 2 portables (~$50K each) for water system and 1 stationary for wastewater ($150K).* *No money – not done.* *Will carry forward.*

Report on Previous Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Obtain back-up generator for wastewater plan(permanent, on-site)	*$100K*	*CI Weyauwega*	*2016*	*Medium*	*CI Weyauwega*	*Protects whole system; completed in 2016 and will not be carried forward.*
	Explore options for burying power lines in high risk areas.	Unknown	CIs of Clintonville and New London DPW	Ongoing	Medium	CI of Clintonville and CI of New London	*Not done, no money. Will carry forward.*

Appendix E: Summary of Mitigation Strategies

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
All Hazards	Continue to promote the increased use of National Oceanic and Atmospheric Administration (NOAA) weather radios.	Covered by Dept. annual budget	EM Dept. CI of Waupaca	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming. CI of Waupaca	Weather radios have been promoted on the radio, township newsletters, local newspapers, every spring and after storms. City of Waupaca promotes weather radio use on website, FB and utility stubs.
	Continue to add/update Emergency Management Department links on the existing county web site (e.g., ARC, Homeland Security/FEMA, WEM) especially focusing on preparedness bulletins. Publicize the website to inform the community.	Covered by Dept. annual budget	EM Dept.	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear	

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Continue promoting, supporting and updating the use of the CodeRED citizen notification system.	Covered by Dept. annual budget	EM Dept.	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Regularly update information on websites.	Covered by Dept. annual budget	CI of Waupaca	Ongoing	Medium	CI of Waupaca	CI of Waupaca regularly updates their website.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
			CI of Marion CI of Manawa TN of Mukwa TN of Wyoming	Ongoing	Low	CI of Marion CI of Manawa TN of Mukwa TN of Wyoming	All four of these communities have built a website and are reviewing emergency information for inclusion on their pages. They will update as needed.
	Permanent Generators	Unknown	CI Weyauwega	2021-2023	High	CI Weyauwega	City Hall and lift stations do not have emergency back-up generators and the need for permanent standby generators is crucial for emergency operations.
	Open discussions with municipalities concerning updating and improving tornado sirens and other emergency facilities and equipment.	Unknown	EM Dept. / municipalities	2025	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Each municipality activates their own sirens. CI of Waupaca is the only municipality that can be activated by the county as well as the city. • The county is looking into obtaining solar chargers. • The county is also considering installing external power panels or generators for EOC, lift stations, sirens and wells.
Drought and Dust Storms	Provide information to farmers via website links and brochures regarding water conservation measures that can be employed during a drought.	Covered by Dept. annual budget	UW-Ext. / FSA	As needed	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola,	Information is available to farmers and updated as needed.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Prepare/publicize water usage regulations for non-farm areas during drought.	Covered by Dept. annual budget	UW-Ext. / LWC	As needed	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information is available to public and updated as needed.
	Provide public information via website links and brochures regarding water conservation measures that can be employed during a drought.	Covered by Dept. annual budget	UW-Ext. / LWC	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big	Information is available to public and updated regularly.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
Earthquakes	Provide public information via website links and brochures regarding safety measures that can be employed during an earthquake to increase public awareness.	Covered by Dept. annual budget	EM Dept.	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information is available to public and updated regularly.
Fire: Forest and Wildfire	Provide ample training for fire fighters and fire departments for larger fires.	Covered by Dept.	Local Fire Departments / WI DNR	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London,	Fire fighters train regularly within the local departments and with WI DNR annually each spring.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
		annual budget				Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Update DNR zone book.	Grant funded	EM Dept. / WI DNR / Local Fire Departments	2023	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	• Zone book was last done in 2009. • Apply for grant funding.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Explore improving zoning regulations and work with towns on increasing width of roads, especially in subdivisions which have roads one-car-width.	Unknown	P&Z	2023	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	County cannot get fire, ambulance and other emergency vehicles into narrower roads within some subdivisions. Hoping to get 33% of road access / right-of-way.
Flooding and Dam Failure	Conduct floodproofing measures (acquisition, demolition, elevation, etc.) within the City of Marion. Possible projects include: • Senior Center and Garfield Ave – there are two storm sewers under low income housing which need to be moved • School bus garage area – there are three houses within 200 yards below a high-hazard dam	Costs vary per project	CI of Marion	Ongoing	Medium	CI of Marion	
	Examine feasibility of installing river gauge in the Village of Freemont.	$500, Local funding	VI of Freemont	2021-2025	Medium	VI of Freemont	The village is considering possibly marking a piling.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Address flooding concerns on Spring Street	$1M	CI Clintonville	2025	Medium	CI Clintonville	Floods with heavy rains. Storm sewers need to be enlarged and relocated to properly handle flow. Would require road replacement due to location of drains and rerouting needs. Affects City's two largest industrial businesses.
	Response required to keep roads passable following a severe storm.	Unknown	TN Bear Creek	Ongoing	High	TN Bear Creek and surrounding areas	The Town Board is concerned for residents and businesses in the town that the roads are passable following a severe storm. Need to continue working with the County Highway Department on roads and ditches are maintained properly.
	Roadway flooding – Akron Rd off of Hwy K, road build-up 18" and addition of two culverts to a section of roadway around 250 feet in length	$55K	John Miller, Town Chair	2019-2021	Medium	TN Dayton	Continued high water build-up on ponds on both sides of roadway has not allowed the two culverts to be put in. The final road build-up with black top cannot take place until the culverts are in and roadway has settled. Initial costs $1,500 DNR permit; $18,700 initial road build-up; plus $7,500 additional road build-up and road widening
	Comet Road has washed out the past 2 years during Spring flooding. Add culvert/bridge to correct issues	Unknown	TN Harrison	2-5 years	Medium	TN Harrison	Will monitor situation to see if the road continues to wash out
	Possibly raise road surface and install culvert	Unknown	TN Lind	Monitoring	Medium	TN Lind	Flooding of several roads has occurred in the last 2 years. Will monitor during upcoming Spring thaws.
	Address erosion of riverbank, exposing underground pipes.	$100K	VI Embarrass	2020	High	VI Embarrass	Recent high water has exposed sewer pipes crossing the Embarrass River.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
							This project involves covering or moving the pipes to a safe location under the river. They are in the investigation stage of this project and will not have the funds on hand to complete this project.
	Repair leaks in sewer pipes in low-lying areas to prevent overflowing the sewage treatment process.	$10K	VI Embarrass	2020	High	VI Embarrass	High water table near the river is infiltrating into the sewer system. Multiple leaks must be repaired. Limited funds available. Repairs are ongoing.
	*Using maps and hydrology studies to ensure that properties at risk are identified and, as available, appropriate grants are sought and secured to mitigate losses.	Costs vary per project	Municipal elected officials	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Using maps and hydrology studies to ensure that properties at risk are identified and, as available, appropriate grants are sought and secured to mitigate losses.
	*Targeting old structures for buy-out and converting the land to open, public lands.	Costs vary per project	Municipal elected officials	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass,	*Targeting old structures for buy-out and converting the land to open, public lands.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	*Pre-identifying infrastructure (roads, bridges, culverts, shoulders) prone to flooding and directing current and future budgetary dollars towards making the infrastructure disaster-resistant as it is scheduled for routine maintenance	Costs vary per project	Municipal elected officials	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	*Pre-identifying infrastructure (roads, bridges, culverts, shoulders) prone to flooding and directing current and future budgetary dollars towards making the infrastructure disaster-resistant as it is scheduled for routine maintenance. VI Embarrass notes culvert repairs are ongoing and they are limited in that they do not have the funds to repair all.
Severe Temperatures	Continue public informational campaigns about severe weather on the website and during Winter and Heat Awareness Weeks.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and	Completed annually during campaigns in April and November.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Coordinate cooling and warming shelters within communities.	Covered by Dept. annual budget	PH	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Continue to update as needed

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
Storms: Hail	Place hail storm safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information available in display rack and on website.
	Provide information regarding the purchase of crop insurance	Covered by Dept. annual budget	UW Ext.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union,	Information available in display rack and on website.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Waupaca, Weyauwega and Wyoming.	
Storms: Lightning	Place lightning safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Information available in display rack and on website.
Storms: Thunderstorm	Place thunderstorm safety materials in county display rack, on the website and during severe weather week.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa,	Information available in display rack and on website.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
Storms: Tornadoes and High Winds	Promote tornado awareness, including safety measures.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	• Completed during tornado awareness week in April and by sponsoring annual spotter classes. • Information included on the website for homes, schools and business safety measures.
	Continue preventative tree removal.	Covered by Dept. annual budget	CO Parks and Rec	Ongoing	High	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee,	

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Explore the feasibility of constructing tornado shelters in areas where deficient, especially in mobile home parks and campgrounds. Keller Lakes Vic-To-Rea Park WGNSA on Walnut Street Athletic Field Bertram Street Trailer Park Northgate Estates Trailer Park Swan Park Oak Street Mobile Home Park County Fairgrounds Car Show Campground Rodeo Grounds County TTF (transfer facility)	Costs vary	EM Dept. Waupaca CO CI of Manawa CI of Marion CI of New London CI of Waupaca CI of Weyauwega VI of Iola / TNs of St Lawrence and Scandinavia TN of Little Wolf	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Use Department of Commerce's CDBG for funding assistance. Adding one shelter and restroom in each.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
	Oakwood Trailer Court Huckleberry Campground Wolf River Campground		TN of Mukwa				
	Upgrade and reinforce the bathroom facilities in Ellison Park to make it suitable as a storm shelter structure.	Unknown	VI and TN of Scandinavia	2025	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	The park has block structure restrooms that will need to be reinforced to make it suitable as a storm shelter.
Storms: Winter	Promote winter hazards awareness, including home and travel safety measures (including website.)	Covered by Dept. annual budget	EM Dept. / CO HWY	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee,	Completed during winter weather awareness week in November.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Examine options for planting living fences to keep snow from roadway.	Unknown	CO HWY / DPW	Ongoing	Low	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	Few landowners or farmers are interested or willing.
	Explore road sign upgrades for electronic signs that can be turned on and off during hazardous weather.	Unknown	CO HWY	2025	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington,	Not high enough volume for state/federal DOT to install permanent signs. Hwy 10 especially. Have some portables.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Explore installing ramp barricades.	Unknown	CO HWY	2025	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Explore options for increased salt storage facilities.	$200,000 each	CO HWY	2025	Medium	CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton,	Four salt storage facilities are needed. (One for the county, one for the state and one each for the Cities of Manawa and Waupaca.) Waupaca is planning to build in 2020. State has not budgeted it yet.

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
Utility Failure	Open discussion with service providers about burying power, cable and phone lines.	Covered by Dept. annual budget	EM Dept. / DPW	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	WPS doing burying in Dayton and south of the City of Waupaca. Central Wisconsin Co-op is pursing projects in the NW portion of the county.
	Explore possibility and options of building a fiber ring around county and offsite back-up to improve emergency communications.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and	

Summary of Mitigation Strategies							
Hazard Type	**Mitigation Measures**	**Costs of Project**	**Responsible Management**	**Project Timetable**	**Project Priority**	**Community(ies) Benefitting**	**Comments**
						Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	
	Examine options and costs of purchasing generators for county use during utility failure.	Covered by Dept. annual budget	EM Dept.	Ongoing	Medium	Waupaca County; CIs of Clintonville, Manawa, Marion, New London, Waupaca and Weyauwega; VIs of Big Falls, Embarrass, Fremont, Iola, Ogdensburg and Scandinavia; TNs of Bear Creek, Caledonia, Dayton, Dupont, Farmington, Fremont, Harrison, Helvetia, Iola, Larrabee, Lebanon, Lind, Little Wolf, Matteson, Mukwa, Royalton, St. Lawrence, Scandinavia, Union, Waupaca, Weyauwega and Wyoming.	City of Clintonville added 2 portables (~$50K each) for water system and 1 stationary for wastewater ($150K).
	Explore options for burying power lines in high risk areas.	Unknown	CIs of Clintonville and New London DPW	Ongoing	Medium	CI of Clintonville and CI of New London	

Appendix F: HAZUS Vulnerability Assessment

Waupaca County Vulnerability Report

Identify Hazards

Seven detailed Flood Insurance Studies were prepared for the incorporated areas of Waupaca, New London, Marion, Manawa, Fremont, and Clintonville, Wisconsin and the unincorporated areas of Waupaca County. The areas studied within the Flood Insurance Studies by detailed methods were selected with priority given to all known flood hazard areas.

Waupaca County is located in east-central Wisconsin. The topography of the county is gently rolling and the climate is characteristic of central Wisconsin. The flood plains of Waupaca County currently are used as agricultural, residential, and recreational environments. Residential development is heavier around the incorporated communities of Waupaca, Clintonville, Fremont, and New London. However, rural development is increasing significantly.

The streams studied are spread throughout the county. All are tributaries to the Wolf River, which flows into the Fox River at Lake Poygan, then into Green Bay via Lake Winnebago. These streams are crossed by numerous bridges throughout the county. Significant backwaters are created by County Trunk Highway C and the Little Falls footbridge on the Little Wolf River, County Trunk Highway Q on the South Branch of the Little Wolf River, and Parfreyville Road and Rural Road on the Crystal River.

Waupaca County contains six major rivers that are subject to severe flooding. Typical of rivers and streams in southern Wisconsin, flooding poses the greatest threat in the spring when melting snow, frozen ground, and heavy spring rains combine to swell the basins to flood stage. Most major flooding in the past has been confined to the Wolf, Little Wolf, and Waupaca Rivers. Nevertheless, if development along the smaller rivers is left unchecked, more extensive property damage could be anticipated.

Flooding on the Wolf River within the county is uncontrolled, although the Shawano Dam upstream at Shawano, Wisconsin does provide some relief. Constructed primarily for hydroelectric purposes, its retention characteristics, coupled with the retention characteristics of Shawano Lake, help control the flood waters of the Wolf River downstream.

HAZUS-MH Hazard Analysis

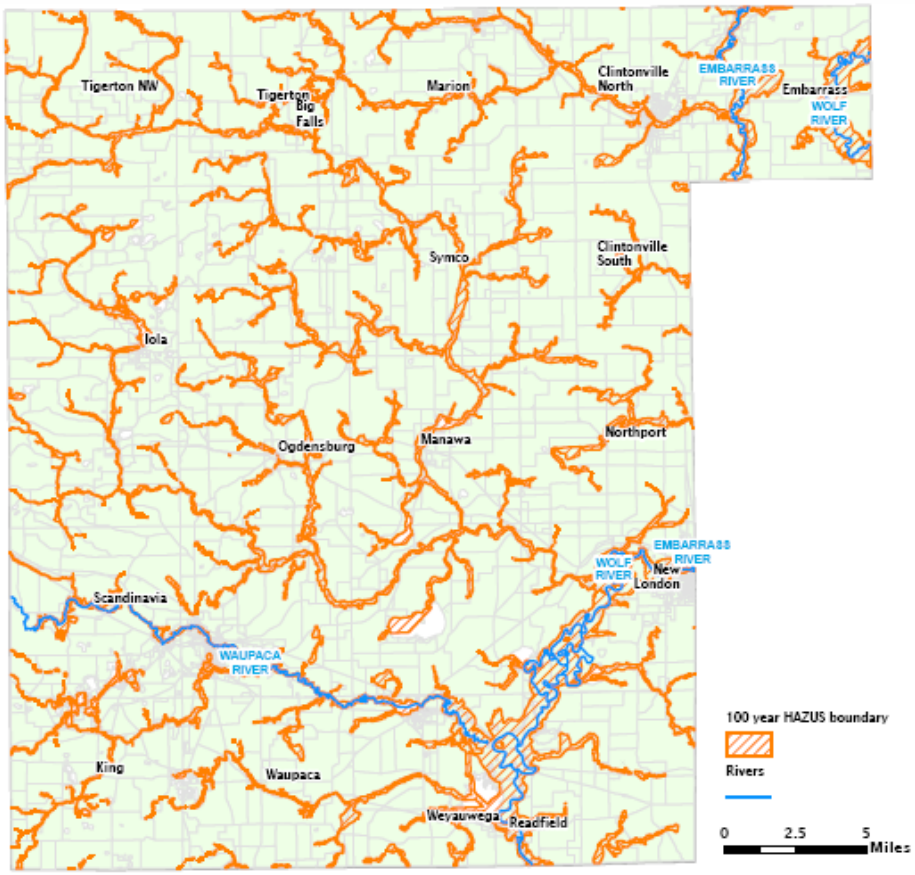
Flood analysis for Waupaca County was performed using HAZUS-MH MR3 released in July 2007. The bundled aggregated general building stock was updated to Dun & Bradstreet 2006. Building valuations were updated to R.S. Means 2006. Building counts based on census housing unit counts are available for RES1 (single-family dwellings) and RES2 (manufactured housing) instead of calculated building counts.

The site specific inventory (specifically Schools, Hospitals, Emergency Operation Centers, Fire Stations and Police Stations) was updated using the best available statewide information.

HAZUS-MH was used to generate the flood depth grid for a 100-year return period calculated for 1 square mile drainage areas. The riverine model was determined from a user provided USGS 30m DEM and peak discharge values obtained for 15 reaches tabulated in the Waupaca County Flood Insurance Study.

Figure 1 depicts the flood boundary from the HAZUS-MH analysis. The majority of damages due to flooding occur along the Wolf, Embarrass, and Waupaca Rivers.

Figure 1: Waupaca County HAZUS-MH Analysis (100-Year Flood)



HAZUS-MH Aggregate Loss Analysis

HAZUS-MH was used to estimate the damages for a 100-year flood event in Waupaca County. An estimated 248 buildings will be damaged totaling $54 million in building losses and $146 million in total economic losses. The total estimated number of damaged buildings, total building losses, and estimated total economic losses are shown in Table 1.

HAZUS-MH estimates 41 census blocks with losses exceeding $1 million. The distribution of losses is shown in Figure 2.

HAZUS-MH aggregate loss analysis is evenly distributed across a census block. Census blocks of concern should be reviewed in more detail to determine the actual percentage of facilities that fall within the flood hazard areas. The aggregate losses reported in this study may be overstated. Examples are provided in Figure 3.

Table 1: Waupaca County Total Economic Loss - 100-Year Flood

General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure X 1000	Total Economic Loss X 1000	Building Loss X 1000
Agricultural	5	0	$52,399	$2,649	$581
Commercial	166	8	$557,758	$56,284	$13,245
Education	0	0	$48,468	$2,271	$311
Government	15	0	$42,154	$7,849	$1,007
Industrial	20	0	$238,025	$15,946	$3,839
Religious/Non-Profit	8	0	$135,203	$4,856	$631
Residential	19,441	240	$3,088,589	$56,473	$34,778
Total	**19,655**	**248**	**$4,162,596**	**$146,328**	**$54,392**

The reported building counts should be interpreted as degrees of loss rather than as exact numbers of buildings exposed to flooding. These numbers were derived from aggregate building inventories which are assumed to be dispersed evenly across census blocks. HAZUS-MH requires that a predetermined amount of square footage of a typical building sustain damage in order to produce a damaged building count. If only a minimal amount of damage to buildings is predicted, it is possible to see zero damaged building counts while also seeing economic losses.

Figure 2: Waupaca County Total Economic Loss - 100-Year Flood

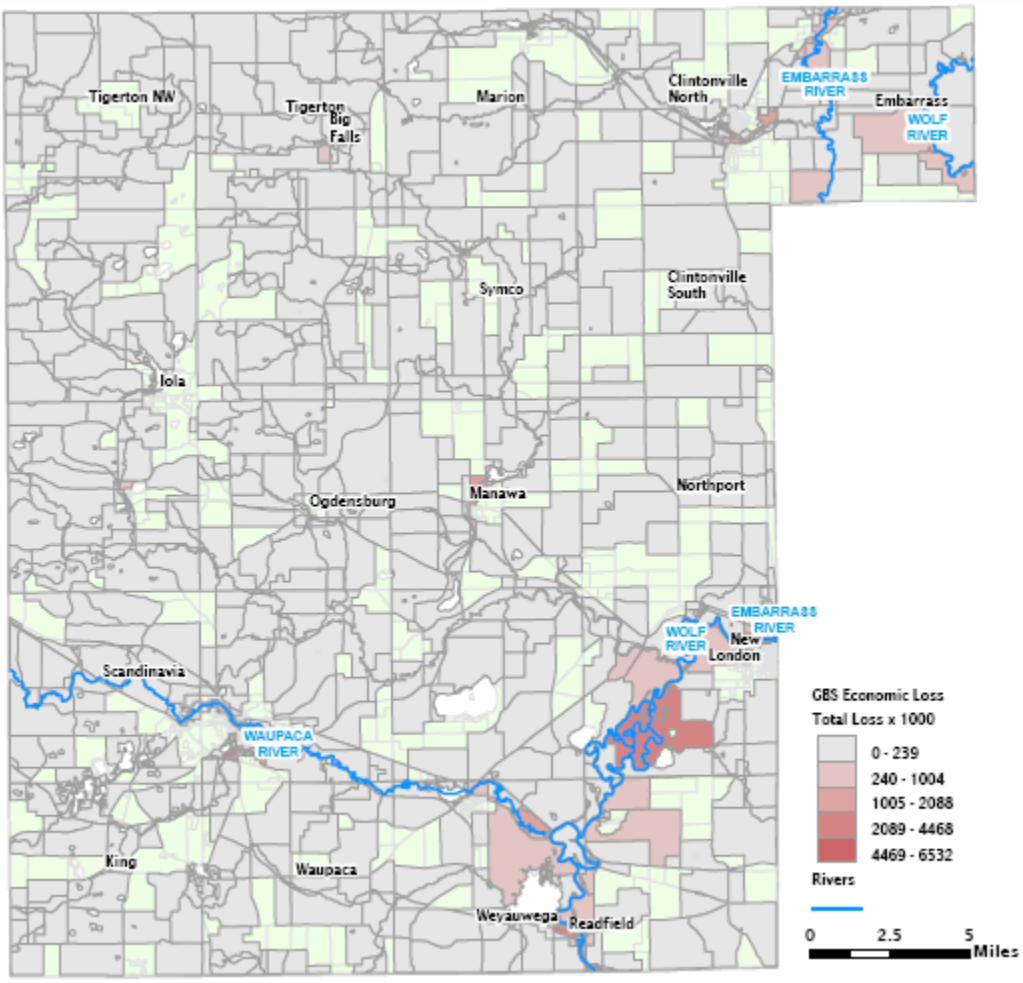


Figure 3a: Flood Damage Exposure in Larrabee

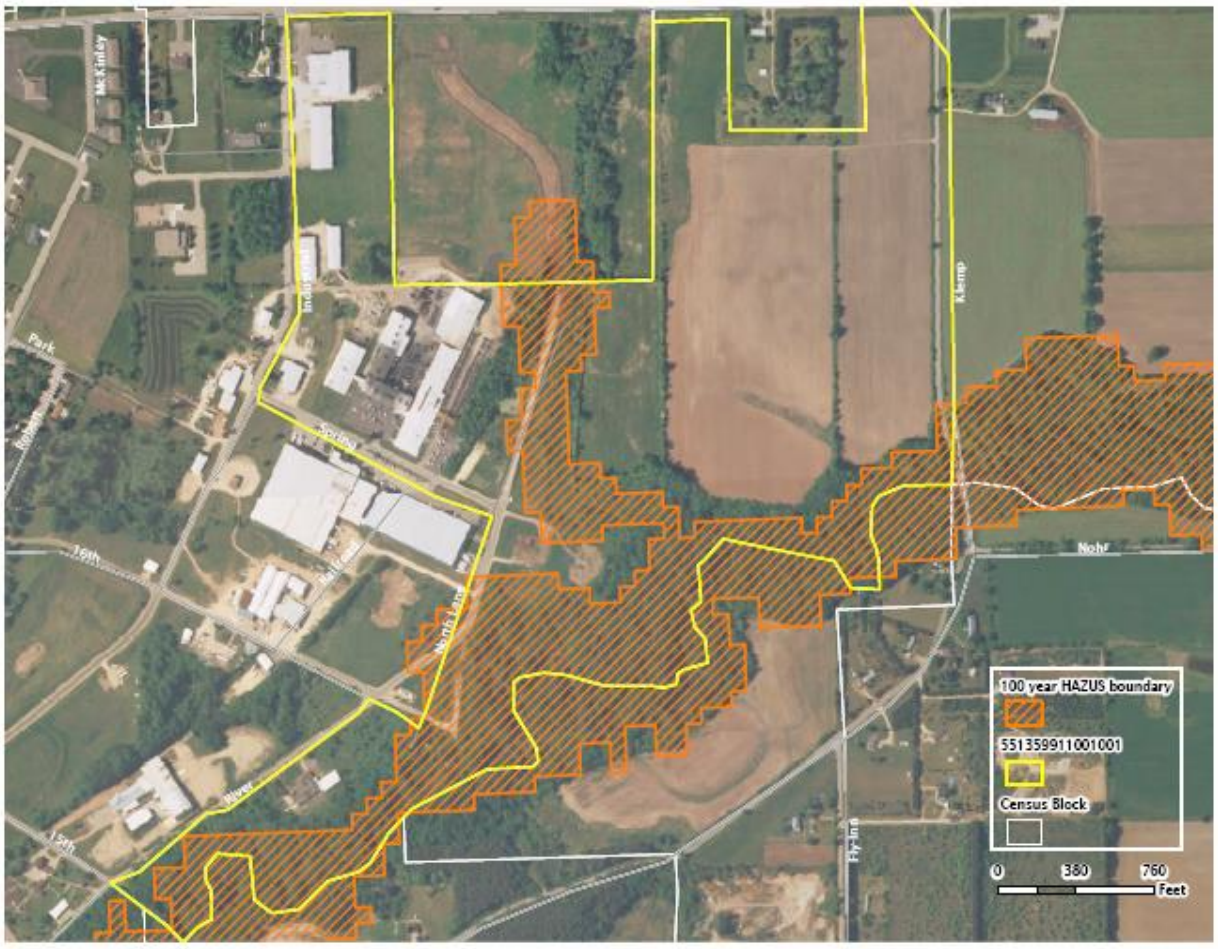


Figure 3a shows census blocks overlaid with the flood boundary and orthophoto of Larrabee. Census block 551359911001001 has an estimated building loss of $428 thousand with a combined replacement cost of $2.1 million. HAZUS-MH estimates that 1 residence is located within the calculated flood boundary for this block and the orthophoto shows the floodplain to be mainly forest.

Figure 3b: Flood Damage Exposure in Waupaca

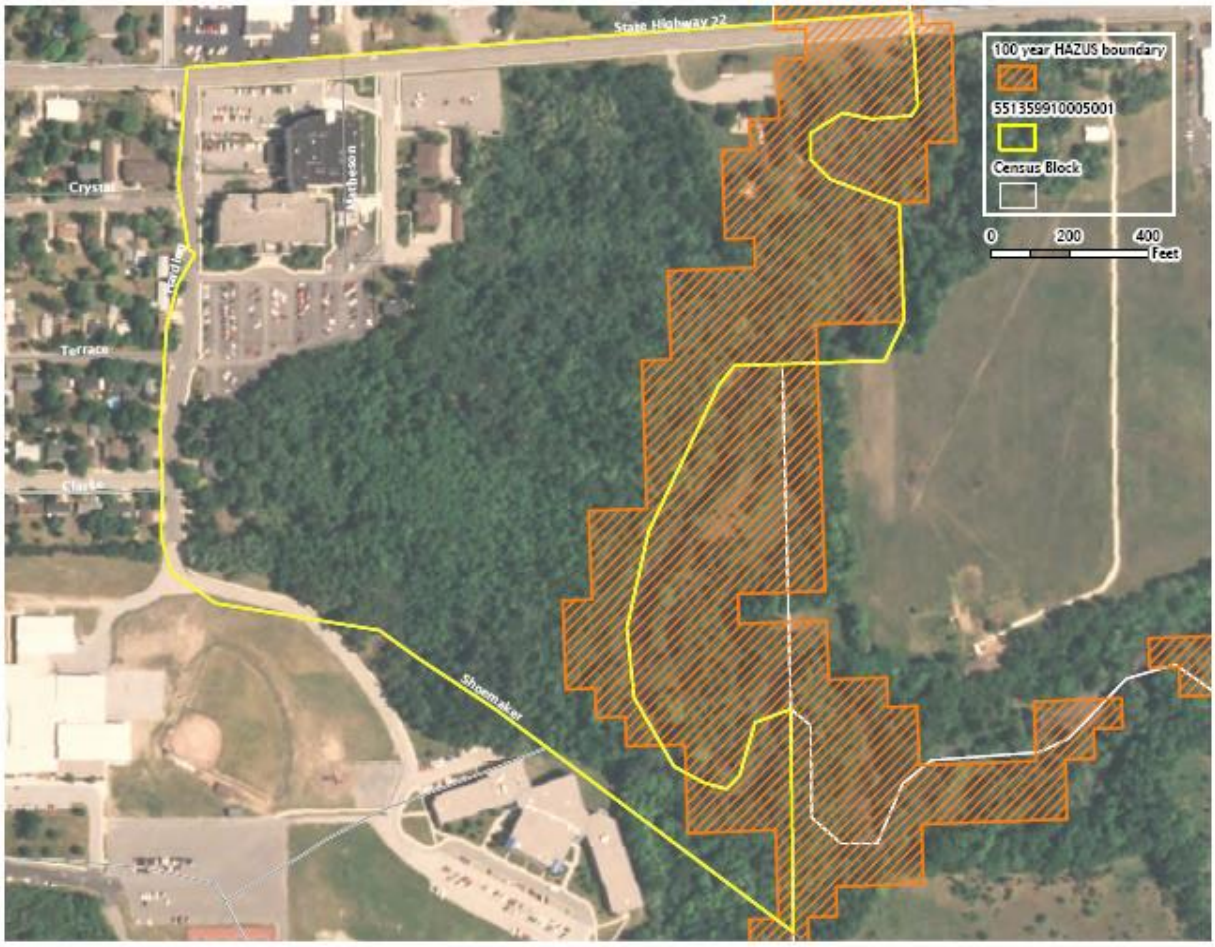


Figure 3b shows census blocks overlaid with the flood boundary and orthophoto of Waupaca. Census block 551359910005001 has an estimated building loss of $328 thousand with a combined replacement cost of $2.6 million. HAZUS-MH estimates that 16 buildings are within the calculated flood boundary for this block. However, the orthophoto shows this area to be mainly forest, with few buildings.

HAZUS-MH Essential Facility Loss Analysis

Essential facilities encounter the same impacts as other buildings within the flood boundary: structural failure, extensive water damage to the facility, and loss of facility functionality (i.e. a damaged police station will no longer be able to serve the community).

The HAZUS-MH analysis identified 0 essential facilities that may be subject to flooding. A list of the essential facilities within Waupaca County is included in Table 2.

Table 2: Waupaca County Essential Facility Loss - 100-Year Flood

Class	Building Count	At Least Moderate Damage	At Least Substantial Damage	Loss of Use
Care Facilities	15	0	0	0
EOC	0	0	0	0
Fire Stations	11	0	0	0
Police Stations	13	0	0	0
Schools	42	0	0	0
Total	**81**	**0**	**0**	**0**

HAZUS-MH Shelter Requirement Analysis

HAZUS-MH estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS-MH also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,247 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these 1,523 people (out of a total population of 51,731) will seek temporary shelter in public shelters.

HAZUS-MH State Property Loss Analysis

The flood boundaries were overlaid with the State of Wisconsin property boundaries as provided by the Department of Natural Resources. Table 3 provides a list of state properties impacted by the flood boundary. Figures 4a and 4b show examples of the inundated areas.

Table 3: Waupaca County State Property Flood Inundation

State Property	Percent Inundated	Acres Inundated
Mukwa Wildlife Area	78%	1021
Navarino Wildlife Area	4%	628
Little Wolf River Fishery Area	16%	431
Statewide Habitat Areas	5%	350
Lower Wolf River Bottomlands Natural Resource Area	13%	336
Rem-Wolf River-Colic Slough	93%	258
Radley Creek Fishery Area	12%	169
Rem-Whitcomb Creek	21%	115
Rem-Leer And Griffen Creek	28%	103
Rem-Peterson And Sannes Creek	18%	83
Trout-Nace Creek Fishery Area	47%	81
Wolf River Bottoms Wildlife Area	2%	73
Wolf River Fishery Area	31%	64
Waupaca River Fishery Area	57%	51
Rem-Doty Creek	46%	50
Hartman Creek State Park	3%	43
Emmons Creek Fishery Area	3%	40
Myklebust Lake Natural Area	19%	33
Rem-South Branch Pigeon River	33%	26
Tomorrow River State Trail	5%	18
Rem-South Branch Blake Creek	48%	7
Wiouwash State Trail	2%	6
Embarrass River Fishery Area	27%	1

Figure 4a: Boundary of 100-Year Flood Overlaid with State of Wisconsin Properties

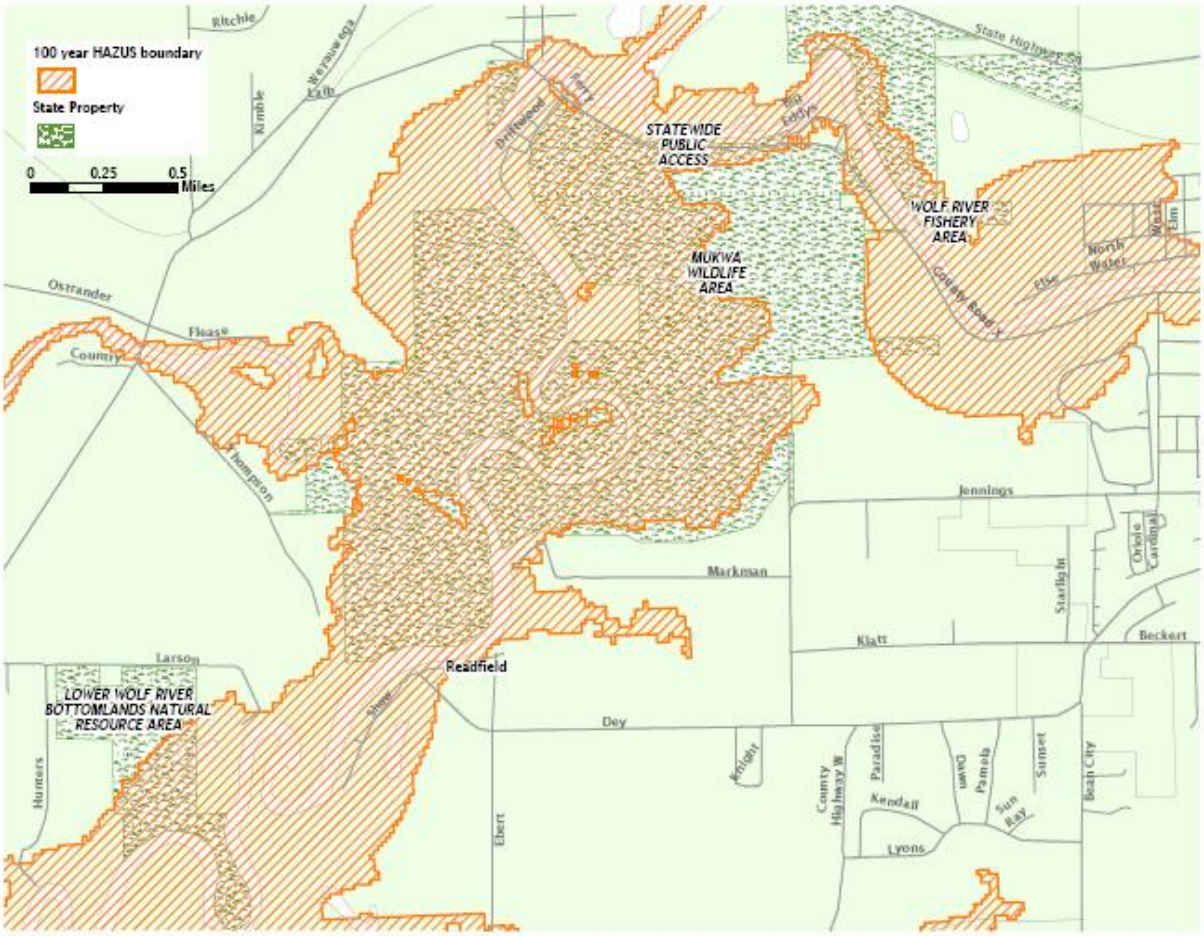
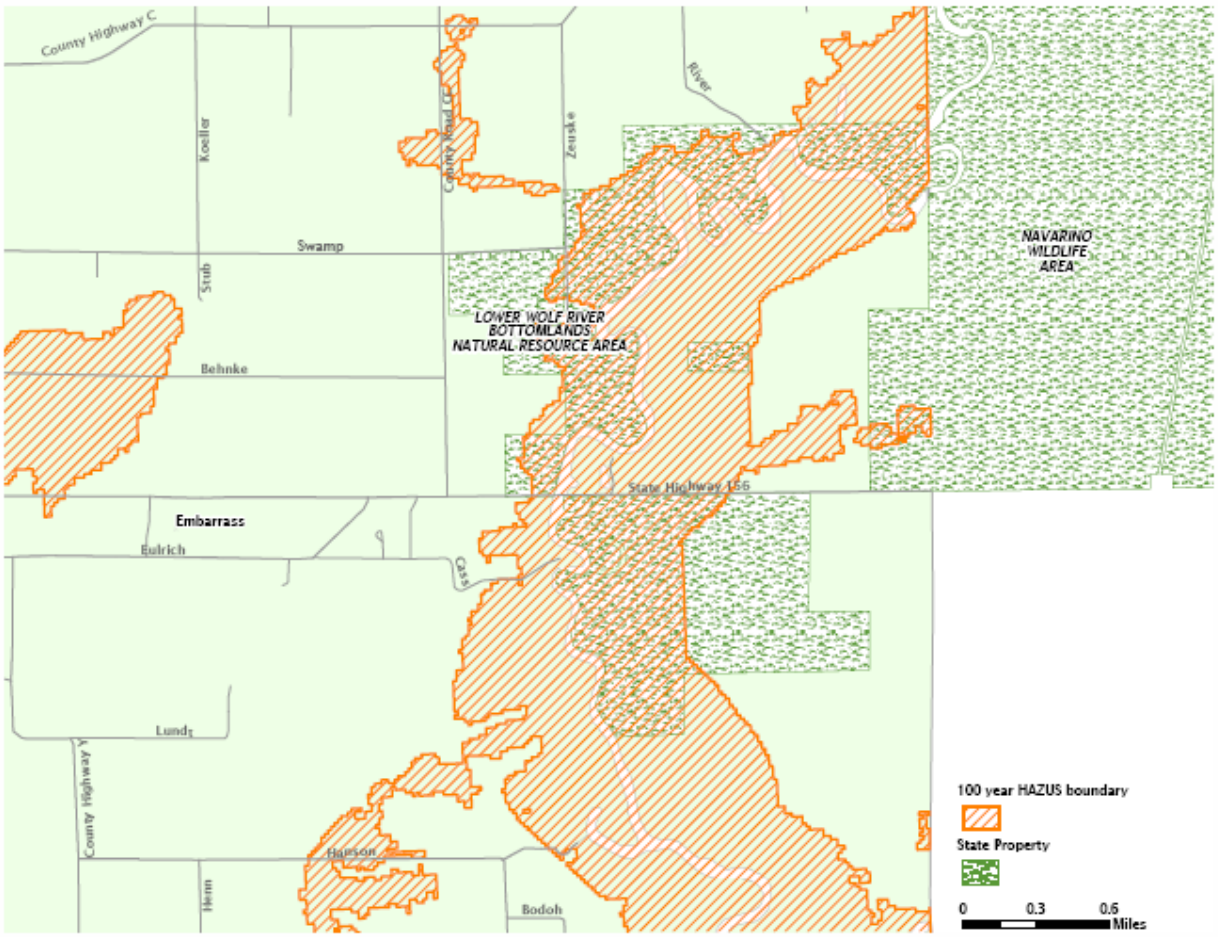


Figure 4b: Boundary of 100-Year Flood Overlaid with State of Wisconsin Properties



Appendix G: Community Input

Waupaca County believes in the importance of gathering public input from interested parties in the community. To achieve this goal, the Emergency Management Office took every opportunity available to use various methods to publicize the opportunity for people to participate in the planning process and to gather input from interested parties. The table that follows outlines the major opportunities that were created to discuss the plan. The table includes dates of workgroup meetings, meetings with public officials and media opportunities.

DATE	SUMMARY OF OPPORTUNITY
Q4 2018	The project brochure was put in public areas informing people of the project and mitigation in general.
Q4 2018	Initial press release to the public inviting people from the general public to become part of the PDM workgroup.
Q4 2018	Survey on mitigation ideas, development, etc. sent to all municipalities and applicable county departments. The letter with the survey (see below) requests that municipalities discuss the survey and mitigation at their meetings, which per the WI Open Meetings Law, is noticed to the public, with the agenda, prior to the meeting. Meetings are open to the public and minutes are also publicly posted after the meeting.
5/15/2019	Waupaca County PDM Workgroup Meeting
Q2 & 3 2020	Due to the COVID-19 pandemic, the second workgroup meeting was cancelled in Q1 2020. It was rescheduled for Q2 and was also cancelled as the pandemic continued. In late Q2 and Q3, individual calls were made to communities to gather the needed strategies and other information so that the plan could be completed.
Date	Message sent to contiguous county emergency management directors inviting them to review and comment on the draft plan.
Date	Press release notifying the public of the end of the plan and the open comment period. Printed in several community papers (see scans following).
Date	Public notice released notifying the public of the open comment period on the draft plan.
Date	Adoption meetings at municipalities, which per the WI Open Meetings Law, are noticed to the public, with an agenda, prior to the meetings. Meetings are open to the public and minutes are also publicly posted

	after the meeting. See samples of agendas and minutes following. Adoptions are in Appendix B.

One of the main ways people were made aware of the plan was the publication of a brochure (following) that was widely distributed in the public buildings around the community including the City/County Courthouse and the library. The purpose of this brochure was to provide a general overview of the mitigation planning process, the impetus for planning and the scope of the final result.

It should be noted that the COVID-19 pandemic period overlapped with the work period of this plan. This delayed the completion of the plan after in-person meetings were cancelled and it took time to determine if the workgroup would be able to meet. Once it was determined that in-person meetings would not be scheduled in the near-term and guidance on remote meetings was received from FEMA Region V and WEM, individual meetings were conducted with communities to determine the final strategies and to complete the plan. The restrictions on in-person meetings have necessarily reduced the ability to have workgroup meetings open to the public. The public has been invited to review the plan online and to provide comments via electronic mail.

For More Information, Contact Andrew Carlin (715-258-4464)
For Immediate Release

Waupaca County Receives A Hazard Mitigation Planning Update Grant

(Waupaca, WI) Waupaca County, like the rest of the State of Wisconsin, is vulnerable to a variety of disasters. According to the National Oceanographic and Atmospheric Administration (NOAA), 2017 was the costliest year ever for weather and climate disasters in the United States, totaling $215 billion in disasters or, to look at it another way, $5.9 million dollars every week! Closer to home, Wisconsin has also incurred billions of dollars of disaster-related damages in the last couple of decades. These losses can be reduced through mitigation activities. A 2017 study has estimated that mitigation saves society an average of $6 for every $1 spent through federal agency grant programs by breaking the cycle of damage and repair.

Mitigation actions reduce or eliminate the long-term risk to human life and property from hazards. These preventative actions can be simple such as elevating a furnace in a basement that sometimes has water on the floor. Mitigation can also have a comprehensive approach such as relocating buildings out of the floodplain or strengthening critical facilities to prevent wind damage and provide stronger shelter.

In an effort to better prepare Waupaca County to manage its vulnerability to disaster, Andrew Carlin, Waupaca County Emergency Management Director, applied for and received a hazard mitigation planning update grant. This goal of this grant is to update an approvable plan, which will serve as a roadmap that outlines potential cost-effective hazard mitigation activities, some of which might be available for future grant funding.

The plan is designed to look at the risks and vulnerabilities that the county faces from natural disaster and to highlight mitigation strategies that might reduce future losses. As part of this planning process, Carlin is assembling a workgroup to review and guide the planning activities. The workgroup is reviewing initial background information about Waupaca County and has begun identifying strategies that might help.

Carlin stated, “I am very excited about this part of the planning process. The input from the workgroup can have long-lasting impacts, making Waupaca County safer and more disaster resistant.”

FEMA has recognized the importance of having members of the community involved in the process and Carlin would like to ensure that all interested members of the community have an opportunity to provide input into the plan. If you are interested in more information about the plan or would like to provide input into the plan, please contact Andrew Carlin at 715-258-4464.

###

Municipality and/or Department Completing the Survey:

_____

Date: 16 September 2018
To: Town, Village or City Leader
County Department Manager
From: Andrew Carlin, EM Director
Re: Hazard Mitigation Plan Update

Waupaca County, like the rest of the State of Wisconsin, is vulnerable to a variety of disasters. According to the National Oceanographic and Atmospheric Administration (NOAA), 2017 was the costliest year ever for weather and climate disasters in the United States, totaling $215 billion in disasters or, to look at it another way, $5.9 million dollars every week! Closer to home, Wisconsin has also incurred billions of dollars of disaster-related damages in the last couple of decades. These losses can be reduced through mitigation activities. A 2017 study has estimated that mitigation saves society an average of $6 for every $1 spent through federal agency grant programs. Hazard mitigation breaks the cycle of damage and repair.

Mitigation actions reduce or eliminate the long-term risk to human life and property from hazards. These preventative actions can be simple such as elevating a furnace in a basement that sometimes has water on the floor. Mitigation can also have a comprehensive approach such as relocating buildings out of the floodplain or strengthening critical facilities to prevent wind damage and provide stronger shelter.

In an effort to better prepare Waupaca County to manage its vulnerability to disaster Waupaca County Emergency Management applied for and received a hazard mitigation planning update grant. This goal of this grant is to complete an approvable updated plan, which will serve as a roadmap that outlines potential cost-effective hazard mitigation activities, some of which might be available for future grant funding.

The plan is designed to look at the risks and vulnerabilities that the county faces from natural disaster and to highlight mitigation strategies that might reduce future losses to life and property. As part of this planning process, I need your help.

The first step is asking that you please place an item on your **next** municipal meeting agenda to complete the attached survey. This very short survey will help us to identify the concerns that you have in your municipality and to capture ideas that you have for making your community safer and more disaster resistant. Please return your completed surveys to me **by November 30th**.

After receiving your surveys, the information will be incorporated into the draft plan, which is being guided by a workgroup of interested agencies and public members. I would like to extend an offer for anyone from your leadership council, your municipal staff or your general community to contact me if they would like to join the workgroup.

Finally, after the workgroup has a final draft, we will be sending copies of the plan to each of you for final review and adoption. It is important to note two things:

- Adoption of this plan will <u>not</u> cost your community anything. You will not be committing to completing any of the projects listed; instead, it is a list of triaged ideas that can be accomplished should the funding and will to complete them become available.

- If you do not adopt this plan, your community will not be eligible to apply for and receive mitigation project funding in the future.

Let me thank you in advance for the assistance that you are providing. This small investment of your time will help make our community a safer, healthier and more disaster-resistant community for years to come.

If you are interested in more information about the plan or would like to provide input into the plan, please feel free to contact me at (715) 258-4464 or by email at Andrew.carlin@co.waupaca.wi.us.

Municipality and/or Department Completing the Survey:

_____

WAUPACA COUNTY, WISCONSIN
NATURAL HAZARDS PREPAREDNESS & MITIGATION QUESTIONNAIRE

1. **Name of person completing the survey**

   _____

   Contact number of person completing survey_____

2. **In the past five years, has your community experienced a natural disaster such as a severe windstorm, flood, wildfire, earthquake, etc.?**

   - ○ **NO……. (If NO, skip to Question 2)**
   - ○ **YES…….(If YES, please check all that apply below)**

Event	When event last occurred:				
	Within past year	1-5 years ago	5-15 years ago	More than 15 years ago	Never
Drought					
Dust Storm					
Earthquake					
Flood					
Lakeshore Erosion					
Landslide/ Debris Flow					
Wildfire					
Windstorm/ Tornado					
Severe Winter Storm					
Other:					
Other:					

3. **For which of the following natural disasters do you think your community is at risk? (Check the appropriate box for each hazard.)**

Event	Extremely Concerned	Very Concerned	Concerned	Somewhat Concerned	Not Concerned
Drought					
Dust Storm					
Earthquake					
Flood					
Erosion					
Landslide/ Debris Flow					
Wildfire					
Windstorm/ Tornado					
Severe Winter Storm/ Ice Storm					
Other:					
Other:					

4. **Has your community had damage to facilities or infrastructure? If yes, please describe the damage.**
   (e.g., roads, public buildings, utilities)

5. **What facilities or infrastructure in your community do you think are especially vulnerable to damage during a natural disaster?**

6. **How important do you think each of the following projects are in mitigating (i.e., lessening the impacts of) a natural disaster in your community?**

Project	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important

Municipality and/or Department Completing the Survey:

_____

Protecting private property					
Protecting critical facilities (hospitals, fire stations, etc.)					
Preventing development in hazard areas					
Enhancing the function of natural features (streams, wetlands)					
Protecting historical and cultural landmarks					
Promoting cooperation among public agencies, citizens, non-profit organizations and businesses					
Protecting and reducing damage to utilities					
Strengthening emergency services					

7. **Do you have any community building projects (e.g., subdivisions, office/industrial parks, roads) slated to be built in the near future? If so, please describe it (e.g., project name, location, type, size)?**

8. **What ideas do you have for your community to mitigate natural disasters?**

Please return to Waupaca County Emergency Management by email to Andrew Carlin at Andrew.carlin@co.waupaca.wi.us *by mail to:*

Waupaca County Emergency Management
1402 Royalton Street
Waupaca, WI 54981

Waupaca County
Emergency Management Office
1402 Royalton Street
Waupaca, WI 54981

Andrew Carlin, Director
Phone (715) 258-4464
Fax (715) 256-4589
andrew.carlin@co.waupaca.wi.us

April 10, 2019

City Mayors, Admin, Clerks & DPW
Village Presidents & Clerks
Co Hwy
Co Parks/Solid Waste
Co Planning & Zoning

Waupaca County Emergency Management is updating the county-wide Pre-Disaster Mitigation (PDM) plan. Completion of this FEMA-funded plan will make the county and its municipalities eligible for certain kinds of federal grants. We are asking for participants (particularly planners, DPW and other infrastructure staff) from the municipalities to assist us with serving on a workgroup; it is important to know that participation in the planning process is a requirement for participation (and therefore grant eligibility) for cities and villages. This workgroup may need meet a few times as the plan update is completed; the time commitment will be minimized as much as possible. Following is our agenda:

1. Welcome/Introductions
2. Review/Overview of Hazard Mitigation (HazMit) Planning and Grants
3. General Introduction/review of the Waupaca County HazMit Plan
    - Vulnerability Analysis
4. Incorporation of the HazMit Plan into Other Community Plans
5. Selecting HazMit Strategies
6. Questions/Closing

The meeting will be held on May 15th from 10:00 am until 12:00 pm in the lower level of the courthouse room - lower level 0041.

Please feel free to contact me with any questions and I look forward to working with you.

Sincerely,

Andrew Carlin, Director
Waupaca Co Emergency Management

Municipality and/or Department Completing the Survey:

_____

SIGN-IN

Event: WAUPACA CO **Date:** 15MAY19 **Location:** PDM MTG.

Name (Please Print)	Agency/Department	Email/Phone Number
LENORA BORCHARDT	WAUPACA CO EM-EPTEC	608-358-4267
Henry Vekeber	City of Waupaca	715-258-4411
David Tichinel	City of Clintonville	715-250-0358
Chad Hoerth	City of New London	920-982-8503
Don Anzia	City of Weyauwega	920-707-4025
Jeremy Schroeder	City of Weyauwega	920-867-2630
John Francis	Waupaca Co. Parks/Rec	715-258-6240
Steven Gall	Lind	715-281-7478
Dan Herzberg	City of Marion	920-405-3825
DAVE Matter	City of Marion	715-250-3754
Andrew Carlin	Waupaca EM	715 412 2807
Sharon Eveland	City of Clintonville	715 823 7600
Kyan Brown	City of Clintonville	715-250-0220
Dick Dorn	Waupaca County	715-853-4410
Eric Halverson	Waupaca EM	715-412-2800

Participants in the workgroup meeting.

GOVERNMENTAL & PUBLIC INPUT

Planning creates a way to solicit and consider input from diverse interests. Successful community mitigation begins with a commitment from government officials throughout the county.

Involving stakeholders is essential to building community-wide support for the plan. In addition to emergency managers, the planning process involves other government agencies (e.g., zoning, floodplain management, public works, community and economic development), businesses, civic groups, environmental groups and schools. Vital information provided by these groups helps insure that the plan is workable within the framework of the community's priorities.

ADOPTION OF THE PLAN

Local units of government participating in a multi-jurisdictional planning process must adopt the final plan for the municipality to be eligible for future mitigation funds including grants available through FEMA. **Local units (i.e., towns, villages, cities) that do not participate would be ineligible to receive such funds** until such time that they meet these requirements and adopt a plan.

HISTORY

Since 1993 more than 400 disasters have occurred in the United States, affecting communities in all 50 states, costing the country over **$500 million dollars per WEEK and killing over 24,000 people**.

MITIGATION PLANNING FACTS

► A recent study by the Multi-hazard Mitigation Council shows that each dollar spent on mitigation saves society an average of four dollars.

► The rigorous building standards adopted by 20,000 communities across the country are saving the nation more than $1.1 billion a year in prevented flood damages.

► Hazard mitigation plans and projects reduce overall risks to the population and structures while also reducing reliance on funding from actual disaster declarations.

► Since 1993 more than 400 disasters have occurred in the United States, affecting communities in all 50 states, costing the country over **$500 million dollars per WEEK and killing over 24,000 people**.

NOTES:_____

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For further information please contact:

Waupaca County

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Pre-Disaster Mitigation Planning

Creating Safe,

Sustainable

Communities

Prepared by:
Waupaca County Emergency Management
1402 E. Royalton Street
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What is Hazard Mitigation?

Hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.

Floods, ice storms, tornadoes and forest/wild fires – these are all functions of the natural environment and only become hazardous when they threaten our "built" environment with destruction. These hazards will occur one day. When this happens, the results can be appreciably different from past outcomes if our community takes action today.

Risk Reduction

The goal of risk reduction is to reduce the risk to life and property, which includes existing structures and future construction, in the pre- and post-disaster environments. This is achieved through regulations, local ordinances, land use and building practices and mitigation projects that reduce or eliminate long-term risk from hazards and their effects.

Why Develop A Plan?

Mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction and repeated damage. The planning process is as important as the plan itself. It creates a framework for risk-based decision-making to reduce damages to lives, property and the economy from future disasters.

State, tribal and local governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000, provides the legal basis for state, local and tribal governments to undertake a risk-based approach to reducing risks from natural hazards through mitigation planning.

Like many other people, the residents of Merkel, Texas didn't think much about flooding. Besides, it had not flooded in Merkel for 45 years. It wasn't until the heavy rains in the summer of 2007 that residents realized flooding can hit anyone, at any time. After the flooding finally subsided, officials knew they had to do something: mitigate.

Required Information

- Flood maps
- Identification of potential hazards
- History of occurrences
- Hazard impact projections
- Location of critical facilities
- Identification of high-risk facilities (schools, fire station, nursing homes, etc.)
- Location of repetitive loss structures
- Development & prioritization of mitigation projects
- Other materials as identified

Hazard Mitigation Planning Process

1. Organize Resources- From the start, communities should focus the resources needed for a successful mitigation planning process. Essential steps include identifying and organizing interested members of the community, particularly those with the technical expertise required during the planning process.

2. Assess Risks- Communities next need to identify the characteristics and potential consequences of natural hazards. It is important to understand how much of the community can be affected by specific hazards and what the likely impacts would be for important community assets.

3. Develop a Mitigation Plan- Armed with an understanding of the risks posed by natural hazards, communities need to determine what their priorities should be and then look at possible ways to avoid or minimize the undesired effects. The result is a natural hazard mitigation plan and strategy for implementation.

4. Implement the Plan & Monitor Progress- Communities can bring the plan to life in a variety of ways ranging from implementing specific mitigation projects to changes in the day-to-day operation of the local government. To ensure the success of an on-going program, it is critical that the plan remains effective. Thus, it is important to conduct periodic evaluations and make revisions as needed.

Appendix H: Inter-Revision Updates

This plan will undergo major revisions every five years per the FEMA requirements. Waupaca County has recognized that there may be information that should be added to the plan between the five year updates but that the costs of continuous updates, printing and distribution can be excessive. This section is designed to hold that information that is gathered between the five year updates. It is felt that only having to reproduce and distribute one section between updates will lessen the costs to the county.

Potential Areas of Concern Identified:

- No additional concerns have been identified to date