



Natural Hazards Mitigation Plan

Polk County, Wisconsin

2011-2016



POLK COUNTY NATURAL HAZARDS MITIGATION PLAN

PREPARED BY:

Polk County Natural Hazards Mitigation Plan Steering Committee
Polk County Emergency Management
Polk County communities

WITH ASSISTANCE BY:

West Central Wisconsin Regional Planning Commission

ADOPTED MARCH 20, 2012
BY THE POLK COUNTY BOARD OF SUPERVISORS

Recvd 4-2-12

U.S. Department of Homeland Security
Region V
536 South Clark Street, Floor 6
Chicago, IL 60605

MAR 28 2012



FEMA

Ms. Roxanne Gray
State Hazard Mitigation Officer
Wisconsin Div. of Emergency Management
2400 Wright Street, P. O. Box 7865
Madison, WI 53707-7865

Rev.
Dear Ms. Gray:

Thank you for submitting the adoption documentation for the Polk County Hazard Mitigation Plan. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. Polk County met the required criteria for a local hazard mitigation plan and the plan is now approved for the county. However, formal approval of this plan for the remaining participating jurisdictions is contingent upon their adoption of this plan.

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

We encourage Polk County to follow the plan's schedule for monitoring and updating the plan, and continue their efforts to implement the mitigation measures. The plan must be reviewed, revised as appropriate, resubmitted, and approved within five years in order to continue project grant eligibility.

Please pass on our congratulations to the county on completing this significant action. If you or the community has any questions, please contact Tom Smith at (312) 408-5220.

Sincerely,

A handwritten signature in cursive script that reads "Christine Stack".

Christine Stack, Director
Mitigation Division



STATE OF WISCONSIN
DEPARTMENT OF MILITARY AFFAIRS
DIVISION OF EMERGENCY MANAGEMENT

Brian M. Satula
Administrator

Scott Walker
Governor

April 3, 2012

Ms. Kathy Poirier
Polk County Emergency Management Director
1005 W. Main Street, Suite 900
Balsam Lake, WI 54810

Dear Kathy:

It gives me great pleasure to inform you that the *Polk County Natural Hazards Mitigation Plan* update has officially been approved by the Federal Emergency Management Agency. The plan complies with the requirements of the Disaster Mitigation Act of 2000. Formal approval for the remaining participating jurisdictions is contingent upon the adoption of the plan by those communities. The County and participating jurisdictions are eligible to apply for funding through the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, the Flood Mitigation Assistance Program, and the Repetitive Flood Claims Program through March 28, 2017, for projects identified in the Plan. Per the regulations, the Plan is required to be updated and resubmitted for approval every five years to remain eligible for mitigation funding.

With the FEMA Meets Requirements letter you also received the Local Hazard Mitigation Plan Review Crosswalk which includes recommended revisions for the five-year update.

Congratulations on the approval of the plan. I also want to commend the County for its commitment to mitigation and reducing future disaster losses, and I look forward to working with you in the future.

If you have any questions, please feel free to call me at 608-242-3222 or Roxanne Gray at 608-242-3211.

Sincerely,

Katie Sommers
Disaster Response and Recovery Planner
Wisconsin Division of Emergency Management

TABLE OF CONTENTS

SECTION I. INTRODUCTION	1
A. PURPOSE OF THE PLAN	1
B. PLANNING PROCESS	1
C. MULTI-JURISDICTIONAL PLANNING APPROACH	3
D. COMMUNITY INVOLVEMENT.....	5
SECTION II. COMMUNITY PROFILE – POLK COUNTY	7
A. GEOGRAPHIC LOCATION.....	7
B. NATURAL FEATURES AND ENVIRONMENT	8
i. Watersheds	9
ii. Lakes, Rivers and Streams	10
iii. Wetlands and Floodplains	11
iv. General Climate	13
C. DEMOGRAPHIC AND ECONOMIC PROFILE	13
i. Population	13
ii. Housing	20
iii. Economic Overview.....	21
iv. Property Values.....	23
D. GENERAL DEVELOPMENT PATTERN	24
E. CRITICAL FACILITIES & EMERGENCY SERVICES	28
F. HAZARDOUS MATERIAL STORAGE AND USE	31
G. TRANSPORTATION SYSTEMS	31
H. HISTORIC PROPERTIES AND DISTRICTS.....	33
SECTION III. ASSESSMENT OF HAZARD CONDITIONS	34
A. HAZARD IDENTIFICATION	34
i. Hazard Events Historical Summary.....	34
ii. Hazard Risk and Vulnerability Assessment Survey	36
iii. Polk County Natural Hazards Prioritization	37
iv. Other Natural Hazards of No Significant Risk	38
v. Possible Hazard Impacts of Climate Change	42
B. RISK AND VULNERABILITY ASSESSMENT	46
Special Threat Analysis – Long-Term Power Loss	47
i. Tornadoes	54
ii. Winter Storms and Extreme Cold.....	69
iii. Thunderstorms and High Winds.....	80
iv. Flooding.....	92
v. Drought.....	122
vi. Wildfire	129
SECTION IV. CURRENT MITIGATION ACTIVITIES	143
A. PLANNING AND REGULATORY ACTIVITIES	143
B. PHYSICAL CONSTRUCTION ACTIVITIES	147
C. EMERGENCY PREPAREDNESS AND COMMUNICATIONS ACTIVITIES	148
D. EDUCATIONAL ACTIVITIES.....	153
E. STRATEGIC PARTNERSHIPS.....	155
F. OTHER MITIGATION AND EMERGENCY MANAGEMENT CHALLENGES.....	157
SECTION V. PROGRESS ON 2006 MITIGATION PLAN STRATEGIES.....	159

SECTION VI. MITIGATION GOALS AND STRATEGIES	164
A. MITIGATION GOALS	164
B. EVALUATION OF ALTERNATIVE MITIGATION STRATEGIES.....	165
C. RECOMMENDED MITIGATION STRATEGIES (ACTION PLAN)	167
i. Physical Infrastructure Strategies	167
ii. Planning and Policy Strategies	168
iii. Communications and Coordination Strategies.....	169
iv. Education and Outreach Strategies	170
v. Multi-Jurisdictional Strategies	170
D. IMPLEMENTATION OF PRIORITY PROJECTS	173
E. ADDITIONAL IMPLEMENTATION GUIDANCE	176
SECTION VII. PLAN ADOPTION AND MAINTENANCE PROCESS.....	177
A. PLAN COORDINATION	177
B. PLAN MAINTENANCE	178
i. Plan Monitoring and Annual Plan Review	179
ii. Special Plan Review.....	179
iii. Plan Update.....	180
C. PLAN ADOPTION	180

LIST OF APPENDICES

APPENDIX A. Adopting Resolutions.....	182
APPENDIX B. Flood Assessment Methodology	198
APPENDIX C. Stakeholder Interview List	204
APPENDIX D. Public Informational Meeting Notice	228
APPENDIX E. Inventory of Critical Facilities.....	230
APPENDIX F. Vulnerability Assessment for Critical Facilities	235
APPENDIX G. Unique Risks and Vulnerabilities by Incorporated Community	237
APPENDIX H. Hazard Mitigation Activities by Incorporated Community	250
APPENDIX I. 2000-2002 FEMA Project Application for Polk County	252
APPENDIX J. Polk County Dam Inventory.....	255
APPENDIX K. Hazard Mitigation Toolbox.....	258
APPENDIX L. Feasibility Analysis of Alternative Mitigation Strategies.....	268
APPENDIX M. Potential State and Federal Grant Programs for Mitigations Projects	276
APPENDIX N. Summary of Plan Changes since the 2006 County Plan.....	280

LIST OF TABLES

1. Polk County Natural Hazards Mitigation Plan Steering Committee	2
2. Population Trends • 1970 to 2009	15
3. Population Projections • 2000 to 2030	18
4. Housing Unit Change • 1980 to 2000	20
5. Housing Unit Forecast • 2000 to 2025	20
6. Polk County Acres in Farmland • 1987 to 2007.....	21
7. Polk County 2009 Assessed Total Values.....	23
8. Assessed Value by Land Use • 2009	23

9.	Natural Hazard Events • Jan 1993 to Sept 2010.....	35
10.	Overall Average Hazard Ratings	36
11.	Town Ratings of Natural Hazard Risks in Polk County.....	37
12.	Heat Index Table	40
13.	Apparent Temperature Heat Stress Index.....	42
14.	Polk-Burnett Electric Cooperative Power Outages • 2007-2009	48
15.	Tornado Magnitude Measurement – Enhanced Fujita Scale.....	56
16.	Tornado Events • 1950-Sept 2010	59
17.	Polk County Tornado & Straight-Line Wind Loss Estimates.....	64
18.	Wind Chill Table.....	71
19.	Winter Storm Events • Jan 1993-Sept 2010.....	73
20.	Severe Thunderstorms Events • 1957-Sept 2010.....	83
21.	Flood Events in NCDC Database • Jan 1993-Sept 2010	98
22.	Principal Structures potentially in 100-year Floodplain.....	108
23.	Cash Crop Receipts Comparison	126
24.	Communities-at-Risk (Wildfire)	138
25.	Population & Improvements of Communities Most At-Risk	141
26.	Progress on 2006 Plan Strategies	159

LIST OF FIGURES

1.	Polk County Natural Hazards Mitigation Planning Process Diagram	6
2.	Geographic Location • Polk County	7
3.	Polk County Watersheds	9
4.	Polk County Surface Waters.....	10
5.	Polk County Floodplains & Wetlands.....	12
6.	Polk County Historical Population • 1900 to 2009.....	13
7.	Polk County Population Change • 1970 to 2000	14
8.	Polk County Population Distribution • 1950 to 2000.....	16
9.	Polk County Age Group Projections • 2005 to 2030	17
10.	Employment by Industry in Polk County • 2009	22
11.	Polk County Land Cover	25
12.	Polk County Critical Facilities	29
13.	Primary Fire Department Service Areas in Polk County.....	30
14.	Primary Ambulance Service Areas in Polk County.....	30
15.	Polk County Transportation System	32
16.	Landslide Hazards in Wisconsin.....	38
17.	U.S. Geologic Survey Earthquake Hazard-Shaking Map	39
18.	Wisconsin Temperature Change	43
19.	Wisconsin Precipitation Change	45
20.	Wisconsin Summer Precipitation Change	45
21.	Wisconsin Heavy Precipitation Change (projected).....	45
22.	Areas Prone to Power Loss Due to Storm Events.....	51
23.	Design Wind Speed Map of Wisconsin.....	57
24.	Wisconsin Tornado Events by Month • 1844 to 2001	57
25.	Wisconsin Tornado Density • 1950 to 2005	58
26.	Storm Sirens and Licensed Mobile Home Parks in Polk County	63
27.	Reported Hail Events in Wisconsin.....	88
28.	Elements of a Floodplain	95

29.	Areas Prone to Flooding (Unincorporated Towns Only)	103
30.	Polk County Floodplains & Potentially Floodplain Structures	107
31.	HAZUS 100-Year Flood Scenario.....	109
32.	Polk County Dams by Hazard Rating	118
33.	North Central Wisconsin Drought Severity Index	124
34.	Reported Wildfires in Polk County • 1982 to 2003	134
35.	Polk County Communities-at-Risk Map (Wildfire).....	137

SECTION I. INTRODUCTION

A. PURPOSE OF THE PLAN

The Polk County Natural Hazards Mitigation Plan has been prepared as a result of the County's application for, and award of, Pre-Disaster Mitigation (PDM) Grant Program funds. These funds are disbursed by the Federal Emergency Management Agency (FEMA) through Wisconsin Emergency Management (WEM).

The primary focus of the plan is to evaluate the County's potential exposure to natural disasters and identify appropriate mitigation strategies. Consistent with the Code of Federal Regulations, the County decided to limit the scope of this planning effort to natural hazards at this time, though this plan conforms with Federal all hazards mitigation planning requirements.

The Code of Federal Regulations states...

"The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards."

(44 CFR Part 201.6, pp 8851)

Development of the plan will help the County and its communities locate its areas of risk, assess the magnitude of the risk, and develop strategies for reducing the risk. Through this process, the County can address issues related to the protection of life, property, and critical services, and the reduction of costs associated with natural disaster relief and rescue efforts. Completion and approval of the plan will also continue to make Polk County and participating jurisdictions eligible to apply for future hazard mitigation project funds through the Federal Emergency Management Agency.

B. PLANNING PROCESS

Polk County contracted with West Central Wisconsin Regional Planning Commission to update its all hazards mitigation plan previously adopted by Polk County in April 2005 and approved by FEMA in 2006. This updated plan identifies strategies to mitigate the risks and vulnerabilities associated with natural hazards in the County, including its incorporated communities. Since FEMA requires plans be updated on a five-year cycle from the date of their approval, the former plan which is being updated will be referred to as the 2006 plan.

Development of the *Polk County Natural Hazards Mitigation Plan* was based on the planning requirements and guidance provided by the Federal Emergency Management Agency¹ (FEMA) and the Wisconsin Department of Military Affairs, Wisconsin Emergency Management.² As

¹ Federal Emergency Management Agency, Hazard Mitigation Planning and Hazard Mitigation Grant Program, 44 CFR Parts 201 and 206 (Washington: Government Printing Office, February 26, 2002) 8844-8854.

² Wisconsin Emergency Management, Resource Guide to All Hazards Mitigation Planning in Wisconsin. April 2003.

such, the plan meets the requirements of the Disaster Mitigation Act of 2000. The plan's scope is inclusive of all of Polk County and is considered a multi-jurisdictional plan under Federal guidelines, with the exception of the Village of Turtle Lake. The Village of Turtle Lake primarily lies within Barron County and has been included as part of the Barron County Natural Hazards Mitigation Plan update. This is a change since the 2006 plan when Turtle Lake was included in, and adopted both the Polk County and Barron County plans. However, Turtle Lake was consulted during this plan update and Polk County Emergency Management will continue to coordinate with the Village and Barron County Emergency Management on hazard mitigation issues as required.

To guide the plan's development, the County established a Natural Hazards Mitigation Plan Steering Committee, shown in **Table 1** below. Committee members were selected from those County departments involved in emergency management issues, in addition to representatives from local municipalities and the private sector. In addition to bringing insight on their respective roles, the Committee members also are very knowledgeable of the issues and concerns of the County's residents. The Committee was responsible for overseeing the development of the plan, providing input and review of information and materials, and reviewing and approving the release of the draft plan prior to the start the adoption process.

**Table 1. Polk County
Natural Hazards Mitigation Plan Steering Committee**

Name	Representative of:
James Beistle	Supervisor, Town of St. Croix Falls
Kristina Handt	Administrator, Village of Luck
Sara McCurdy	Director, Polk County Land Information Department
Emil Norby	Technical Support Manager, Polk County Highway Dept.
Deb Peterson	Director, Polk County Parks, Buildings, & Solid Waste Dept.
Kathy Poirier	Coordinator, Polk County Emergency Management
Tim Ritten	Director, Polk County Land & Water Resources Department
Neil Soltis	Administrator, Village of Osceola
Steve Warndahl	Commissioner, Polk County Highway Department

Update of the plan began in January 2010. A total of four (4) steering committee meetings were held to discuss the plan's development, identify local natural hazard issues, formulate strategy recommendations, and review the draft plan.

The general stages of plan development included: (1) initial data collection and development of the community profile; (2) review of the hazard risks and 2006 plan strategies by the steering committee and stakeholders; (3) community vulnerability and risk assessment; (4) development of the mitigation plan [goals, objectives, strategies, and action plan]; and (5) development of the plan maintenance and coordination strategy. This process is further summarized in **Figure 1** at the end of this section.

A summary of plan changes since the 2006 plan is provided in **Appendix N**, and includes a brief synopsis of how the steering committee reviewed and analyzed each section of the plan. Committee members also reviewed the full draft version of the plan during the planning process and these comments were discussed at their fourth meeting.

The community profile contains a mix of 2000 and 2010 census data. The newer 2010 census was just beginning to become available while this document was being developed, so 2010 census data is provided for select characteristics. The mapping work as part of the community profile (**Section II**) and assessment of hazard conditions (**Section III**) was performed using the ArcView Geographic Information System, allowing greater manipulation and analysis from the use of a consistent base map. Maps included in this plan are for general planning purposes only and do not constitute legal documents or formal surveys. The flood assessment methodology is further detailed in **Appendix B**.

A series of key stakeholder interviews, including both public and private sectors, was performed by West Central Wisconsin Regional Planning Commission (WCWRPC) staff to further complement the issue and strategy identification process. These interviews included discussions with emergency management personnel from adjacent counties. The complete list of these interviews is included in **Appendix C**. Additional input was received from local town, village, and city governments as described within **Section I.C.** below.

During the assessment of hazard conditions in the 2006 plan, a risk assessment survey was sent to each town. Based on the results of this survey, and with consideration of National Weather Service historical data, the LEPC/steering committee agreed upon the following natural hazards to be the focus of the 2006 plan: flooding, tornadoes, thunderstorms, winter storms and extreme temperatures. The steering committee re-evaluated these hazard risks for the 2010 plan update and decided to further focus the extreme temperatures discussion on drought, while adding wildfire as an additional section.

With the guidance provided by these interviews, meetings, and previous planning steps, the steering committee discussed and reviewed the changes to each plan section since the 2006 plan and developed the updated goals and strategies. On July 19, 2011, the steering committee released the draft plan for public review and submittal to Wisconsin Emergency Management for pre-review. On March 20, 2012, the County Board considered and adopted the *Natural Hazards Mitigation Plan* update at a duly called and noticed public meeting. A copy of the adopting resolution and related meeting minutes are included in **Appendix A**.

C. MULTI-JURISDICTIONAL PLANNING APPROACH

The *Polk County Natural Hazards Mitigation Plan* is a multi-jurisdictional plan and encompasses all incorporated and unincorporated jurisdictions within Polk County, with the exception of the Village of Turtle Lake which is part of the Barron County planning effort as mentioned previously. All municipalities in Polk County with 100-year floodplains identified on Flood Insurance Rate Maps (FIRMs) are participants in good standing in the National Flood

Insurance Program (NFIP), except for the Village of Clear Lake which was mapped for the first time in 2011 and required additional time to address this status.

All participating jurisdictions in Polk County were actively involved in the planning process through the following means:

- The steering committee included representation from different areas in the County and numerous organizations.
- A presentation on the planning effort was made to the Polk County Towns Association on 1/26/10. A customized risk assessment survey with hazard risk map was then mailed to each town to identify hazards and potential mitigation strategies. A sign-in sheet for this meeting is included in Appendix C.
- A meeting was held with each participating village and city on the planning effort, and input was obtained on issues or potential strategies. Unique hazard-related issues or strategies for each community were identified. Sign-in sheets for these meetings are included in Appendix C.
- Additional follow-up contacts were made with local jurisdictions as needed. In July 2011, draft strategies were sent to each town, village, and city for further comment, accompanied by an invitation to the public informational meeting.

The following jurisdictions have adopted this plan update by resolution:

<u>Jurisdiction</u>	<u>Adoption Date</u>
Polk County (encompasses all unincorporated areas)	March 20, 2012
Village of Balsam Lake	May 7, 2012
Village of Centuria	April 9, 2012
Village of Clayton	August 6, 2012
Village of Clear Lake	July 10, 2012
Village of Dresser	May 7, 2012
Village of Frederic	May 14, 2012
Village of Luck	May 9, 2012
Village of Milltown	May 14, 2012
Village of Osceola	August 14, 2012
City of Amery	July 11, 2012
City of St. Croix Falls	May 14, 2012

Adopting resolutions for all of the above jurisdictions are in **Appendix A**. Polk-Burnett Electric Cooperative also actively participated in this plan update, but chose not to adopt the plan at this time. Electric cooperatives and municipal utilities are potentially eligible for FEMA hazard mitigation grant funding much like a municipality.

D. COMMUNITY INVOLVEMENT

The planning process included the following activities to encourage community input and involvement:

- **Steering Committee Meetings.** The four (4) steering committee meetings were properly noticed and open to the public. Agendas and sign-in sheets for the steering committee meetings are included in Appendix C.
- **Key Stakeholder Interviews.** The key stakeholder interviews obtained input from many local public and private stakeholders who are also community members.
- **Review of Local Plans.** Local comprehensive plans, ordinances, and other documentation was reviewed, discussed, and considered when available and pertinent. When appropriate, guidance and clarification from these other documents and plans were integrated into this document.
- **Town Government Meetings and Input.** On April 28, 2010, a presentation on the planning effort was made to the Polk County Towns Association. This was followed by a brief, customized survey to each town to obtain local input on hazard “hotspots”, vulnerabilities, and potential mitigation strategies. Once the steering committee developed the draft strategy recommendations, the draft strategies were sent to each town for review and comment.
- **Public Information and Plan Review Meeting.** On August 29, 2011, a public informational and plan review meeting was held to allow the public the opportunity to review and comment on the proposed plan update. Advertisement of this meeting included a notice in the local newspaper and posting in the standard places per County procedures and in accordance with State of Wisconsin law. Copies of the meeting notice, as well the draft plan strategies and other selected sections, were also sent to each municipality for comment. A copy of the meeting notice is included in **Appendix D**.

Based on input received at the public informational meeting, some descriptive changes to the Polk County ARES/RACES group’s activities were made within the current mitigation activities section. Strategy #4 was amended to include campgrounds as potential storm shelter projects. Strategy #28 was amended to include ARES/RACES and hospitals in the list of organizations to continuing involving in exercises. And Strategy #29 was amended to include the potential installation of ARES/RACES informational signage.

- **Plan Adoption.** Following conditional approval of the plan by Wisconsin Emergency Management, this natural hazards mitigation plan was adopted via resolution by the Polk County Board, nine villages, and two cities in duly called and noticed public meetings.

Figure 1. Polk County Natural Hazards Mitigation Planning Process Diagram

Plan Initiation

scope: local decision to proceed, contract w/ WCWRPC
 County roles: mandate to proceed, establish steering committee
 RPC roles: facilitate process and pre-planning
 Cmte roles: initial meeting; discuss process and scope

Community Profiling

scope: data-collection phase (inventory, stats, uses, trends)
 local roles: assist w/ data collection, including existing plans
 RPC roles: data collection, analysis, & compilation
 Cmte roles: review and discuss findings; additional direction if needed
 other issues: identification of critical facilities; initial contacts

Hazard Identification

scope: update data and re-confirm key hazards
 local roles: assist w/ data collection (historical records on events)
 RPC roles: data collection (w/ NOAA data) & facilitation
 Cmte roles: review and confirm key hazards

Risk & Vulnerability Assessment

scope: identify risks (full history & trends), and vulnerabilities (estimate potential losses to assets)
 local roles: identify issues, concerns, and “hotspots”
 RPC roles: data collection, analysis, & facilitation
 Cmte roles: review and discuss findings; provide addition insights

Mitigation Planning

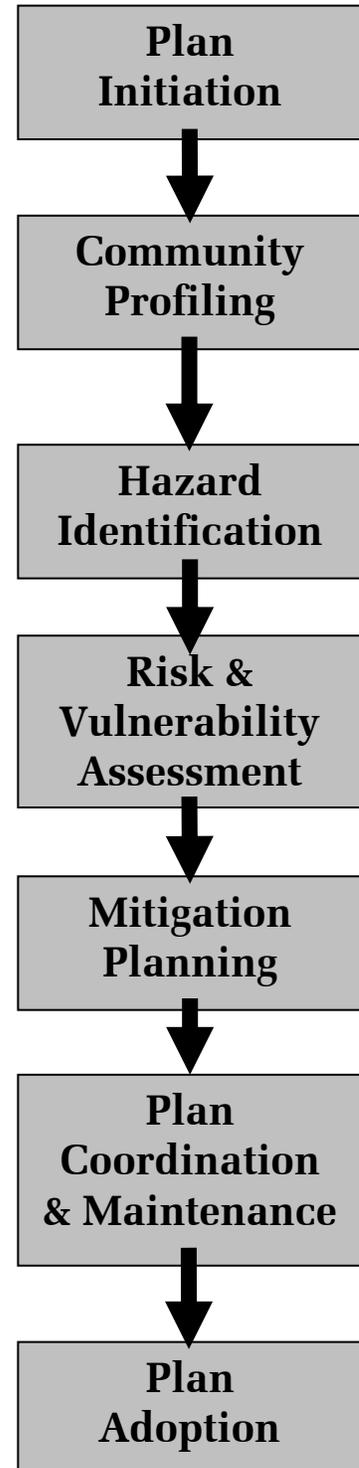
scope: goals, objectives, strategies, & action plan
 local roles: input on current activities and progress on 2006 plan
 RPC roles: facilitation, analysis & guidance on strategies
 Cmte roles: update goals; review and prioritize strategies
 other issues: cost-benefits analysis; resource/action plan

Plan Coordination & Maintenance

scope: relationship to other plans & future plan review/updates
 local roles: help identify links to other plans; vision for reviews
 RPC roles: facilitation & suggestions
 Cmte roles: review & modify/amend recommendations
 other issues: re-assess evaluation process

Plan Adoption

scope: Cmte review-> local review-> public info meeting-> Cmte approval if amended->State pre-review -> County & local adoption-> formal State & FEMA approval
 local roles: facilitate public meetings, notifications, & adoption
 RPC roles: assist w/ public hearings & modifications to plan
 Cmte roles: consider public input & approve draft plan
 other issues: special mailings; media



SECTION II. COMMUNITY PROFILE – POLK COUNTY

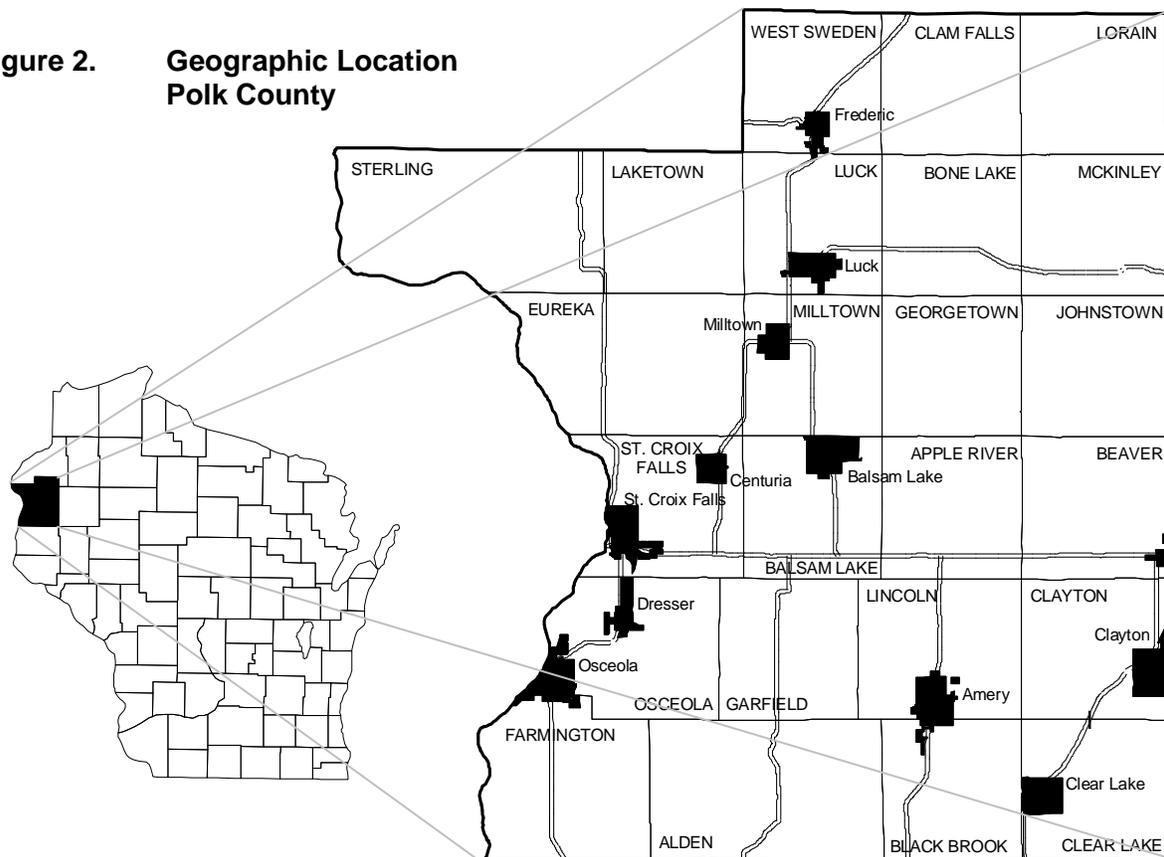
The community profile section of the plan provides background data for a better understanding of the general characteristics of Polk County. Included in this section is a description of natural and demographic characteristics, general development trends, and an inventory of critical facilities.

A. GEOGRAPHIC LOCATION

Polk County is located in west-central Wisconsin along the Minnesota-Wisconsin border (see **Figure 2**). The County has a total surface area of 619,520 acres, or 968 square miles, of combined land and water area. The County is bordered on the west by the St. Croix River, the north by Burnett County, the east by Barron County and the south by St. Croix County. The Minneapolis/St. Paul Metropolitan Statistical Area borders Polk County to the south and west.

Polk County is comprised of all or parts of 36 civil divisions, consisting of 24 towns, 10 villages and 2 cities. The Village of Balsam Lake, population 1,082, is the county seat. During the past decade, the Town of Alden (population 2,959) surpassed the City of Amery as the largest community in Polk County.

**Figure 2. Geographic Location
Polk County**



B. NATURAL FEATURES AND ENVIRONMENT

Generally, the topography of Polk County is moderately rolling, becoming increasingly more rugged in the western portion of the County, particularly in the St. Croix River valley.

Surface features in the County have been formed or modified by two distinct periods of glaciation. Pitted glacial outwash covers much of the County, resulting in many lakes, wetlands, and areas of uneven topography. A series of glacial end moraines traverse the County from southwest to northeast. The area between the moraines is quite level and much of the County's best agricultural land is found here.

A band of trap rock (an intrusive igneous rock) is exposed at several points between Dresser and the Clam Falls area. Exposed dolomite limestone is found in the southwest part of the County, and the exposed sandstone bedrock in the area known as The Dalles of the St. Croix is largely responsible for the scenic beauty in this area.

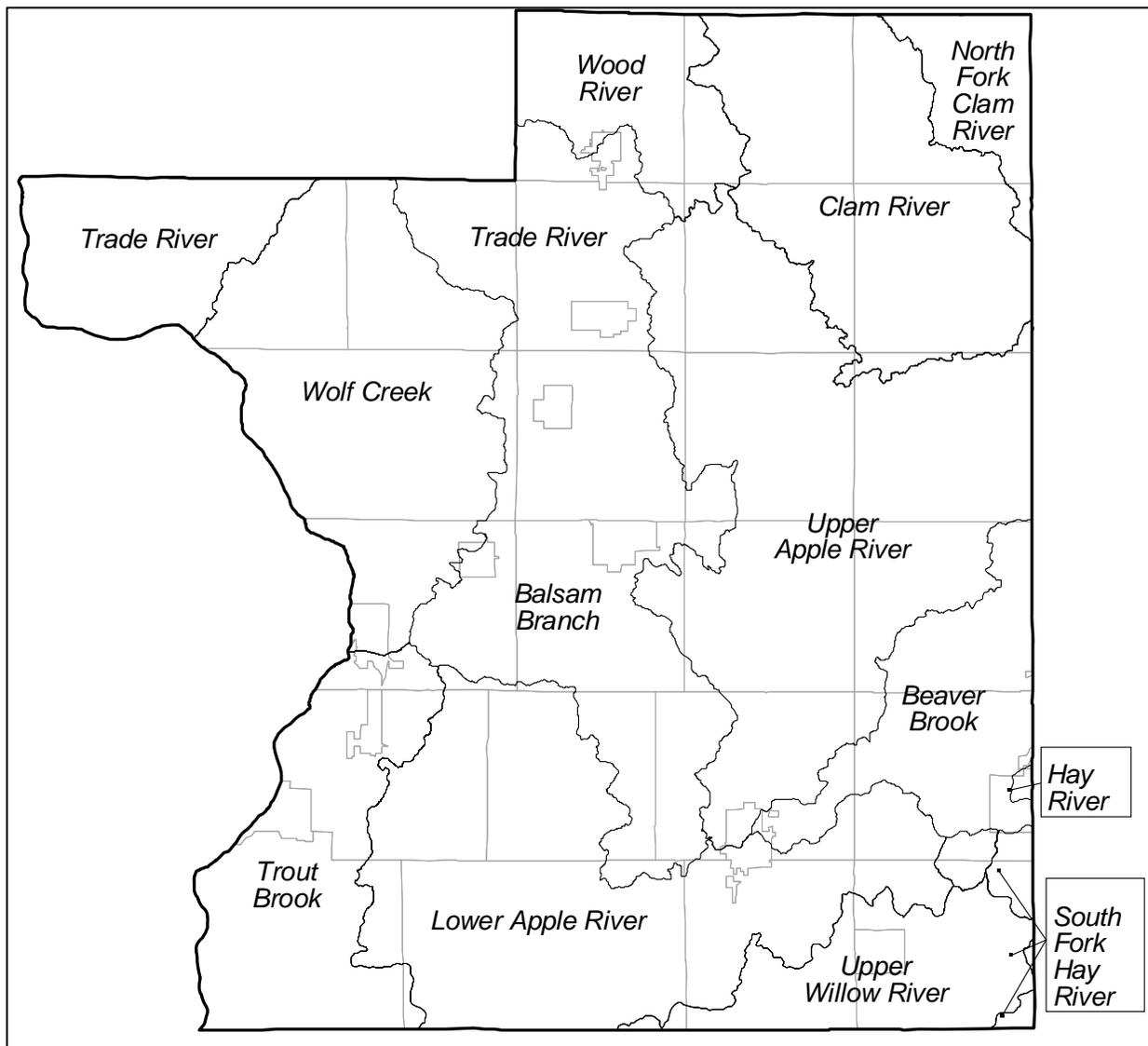
Local relief in Polk County is over 600 feet, ranging from 680 feet above mean sea level at the St. Croix River on the County's western extreme to over 1,400 feet in the north-central and eastern areas.

i. Watersheds

Shown in **Figure 3** are the watersheds that are wholly or partially located within Polk County. A watershed is an area of land that drains or “sheds” its water to a lake, river, stream, or wetland. Some watersheds encompass several hundred square miles, while others may be small, covering only a few square miles that drain into a lake.

Watersheds are important to understand since the effects of natural and man-made activities in one area can have a direct impact on other areas. For example, runoff from a heavy rainfall upstream in a watershed will eventually reach the down stream part of the watershed. Polk County almost entirely drains into the St. Croix River, with the exception of a small part of the southeast corner of the County lying within the Chippewa River Basin.

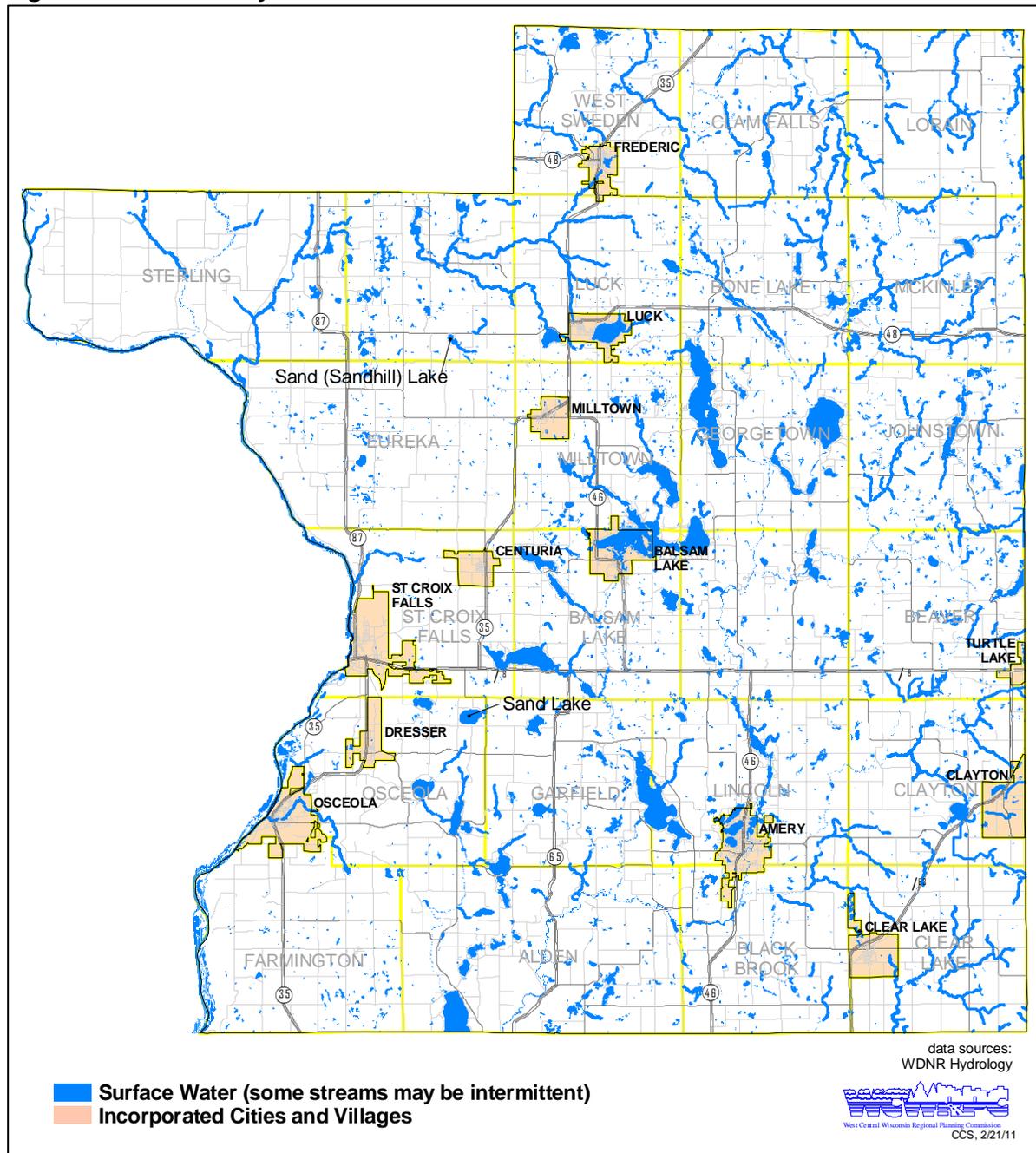
Figure 3. Polk County Watersheds



ii. Lakes, Rivers, and Streams

Polk County has a total surface water area of 22,626 acres consisting of 437 lakes (20,900 acres) and about 200 miles of rivers and streams as shown in **Figure 4**. The St. Croix River is the County's most significant surface water feature, bordering the County along the length of its western border. The river has been designated by Congress as the Lower St. Croix National Scenic Riverway under the National Wild and Scenic Rivers Act.

Figure 4. Polk County Surface Waters

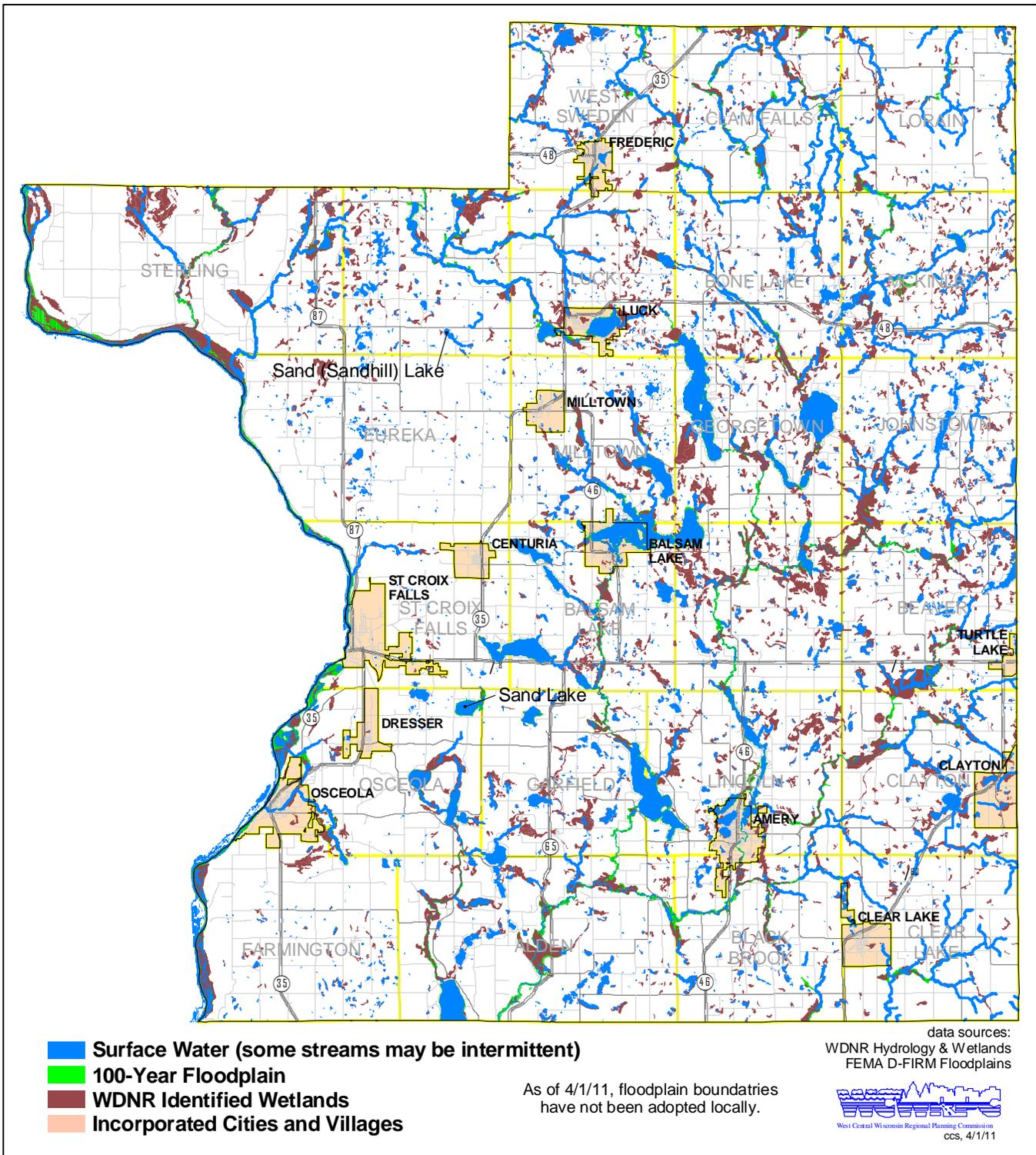


iii. Wetlands and Floodplains

Wetland areas within the watersheds can affect the water levels of rivers and creeks flowing through Polk County. Wetlands are defined by the State Statute as “an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water-loving) vegetation and which has soils indicative of wet conditions.” Wetlands may be seasonal or permanent and are commonly referred to as swamps, marshes, or bogs. Wetland plants and soils have the capacity to store and filter pollutants, replenish groundwater supplies, store floodwaters, and maintain stream flows. The wetland areas within Polk County are delineated on **Figure 5** on the following page.

Figure 5 also delineates the 100-year floodplain areas of Polk County as identified in the final Flood Insurance Rate Maps (D-FIRMS) as of April 1, 2011, at which time the Letters of Final Determination had been distributed to the County, cities, and villages requesting their adoption of the updated maps. Figure 5 shows that wetlands constitute a large portion of the County’s floodplains. These areas perform an important flood storage function. The floodplain and flood-hazard areas within the County associated with these water bodies are discussed later within **Section III. Assessment of Hazard Conditions** of this report.

Figure 5. Polk County Floodplains & Wetlands



iv. General Climate

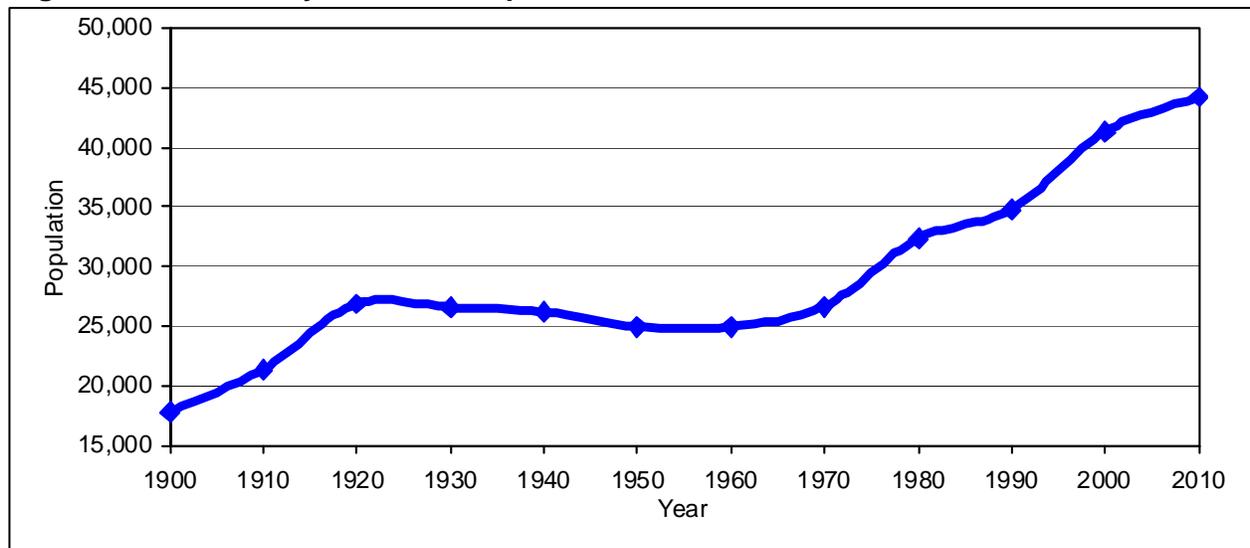
The climate of Polk County is classified as mid-latitude continental. Warm, humid summers and cold snowy winters are the main characteristics. The average monthly temperature ranges from 15 degrees Fahrenheit in January to 73 degrees Fahrenheit in July. Annual precipitation averages 32 inches, with approximately two-thirds of this occurring as rain. Seasonal snowfall ranges from 12 to 75 inches. Polk County is susceptible to a range of natural hazards, including flooding. A description of these natural hazards, along with historical trends and current risks, is included in **Section III** of this report.

C. DEMOGRAPHIC AND ECONOMIC PROFILE

i. Population

Polk County had a 2010 population estimate of 46,231, which is a seven percent increase since 2000 and a significant decrease in the growth rate compared to the previous decade. After increases for the first two decades of the 20th Century (see Figure 6), Polk County's population has remained fairly steady through 1960. Since 1960, the County's population has increased significantly, with the County's highest growth decade in the 1970s (21.3%). The population growth rate declined somewhat in the 1980s (7.5%) only to have the 1990s (18.8%) approach the growth of the 1970s.

Figure 6. Polk County Historical Population • 1900 to 2009

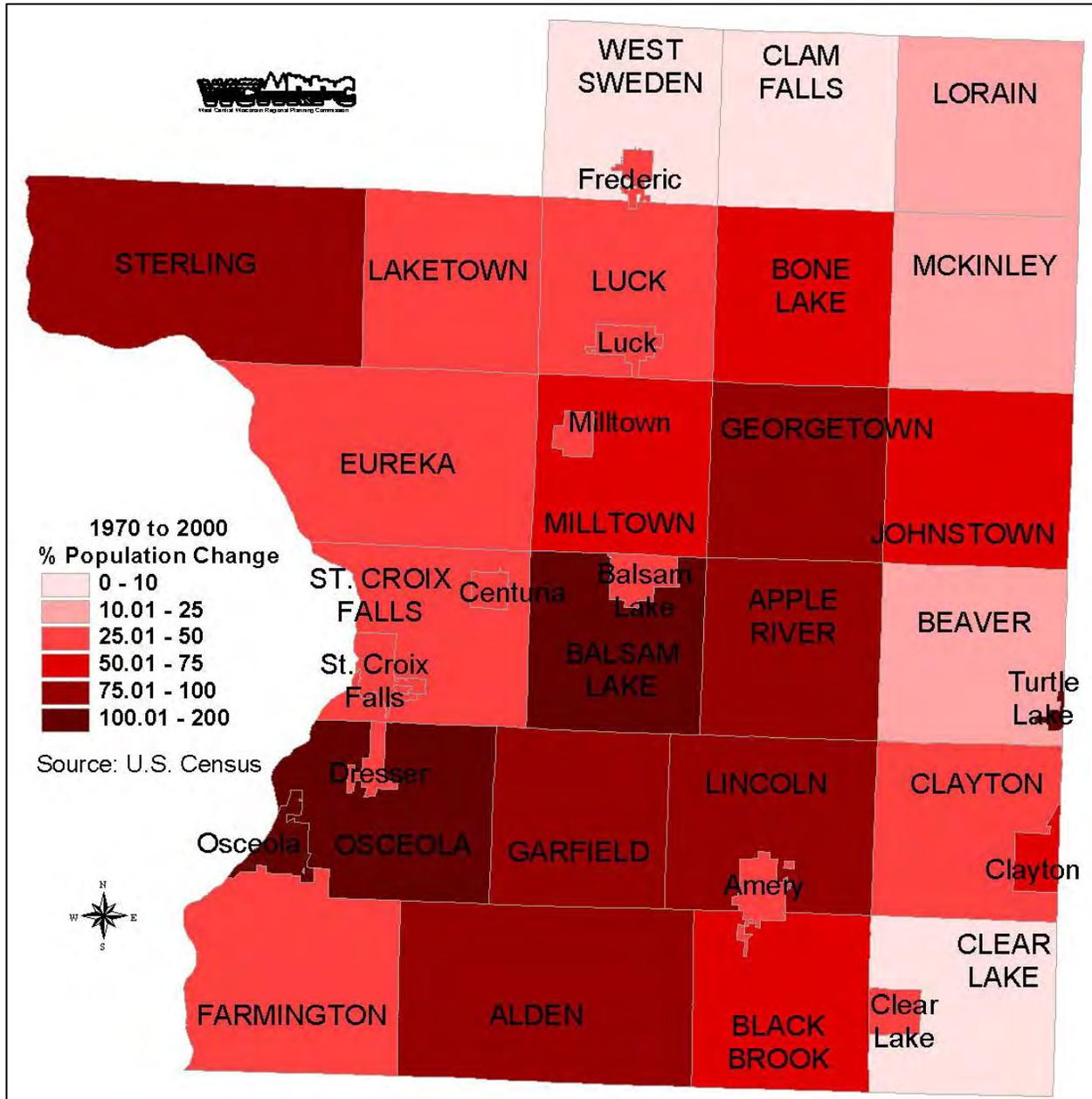


source: U.S. Census Bureau; Wisconsin Department of Administration

Figure 7 on the following page shows the population change for Polk County communities between 1970 and 2000. The highest growth during this period occurred in the Town of Osceola, Town of Balsam Lake, and Village of Balsam Lake. But two trends are apparent. The highest growth since the 1970s has largely occurred in unincorporated areas, with the exception of the Village of Osceola and that portion of the Village of Turtle Lake within Polk County which has experienced significant growth in recent years. The towns with the highest growth

also tended to be located in the southwestern portions of the County (closest to the Minneapolis/St. Paul MSA) or with attractive lakeshore development areas.

Figure 7. Polk County Population Change • 1970 to 2000



From 2000 to 2010, the Town of Osceola had the highest rate of population growth as a percentage of its population in Polk County at 36.9 percent. The following communities also had high population growth: Town of Eureka (23.2%), Village of Dresser (22.3%), and Town of Garfield (17.3%) A number of municipalities experienced population losses, including the towns of Georgetown, Lincoln, Lorain, and West Sweden, and the villages of Frederic and Luck.

Table 2 below provides population trends for 1970 to 2010 by municipality.

Table 2. Polk County Population Trends • 1970 to 2010

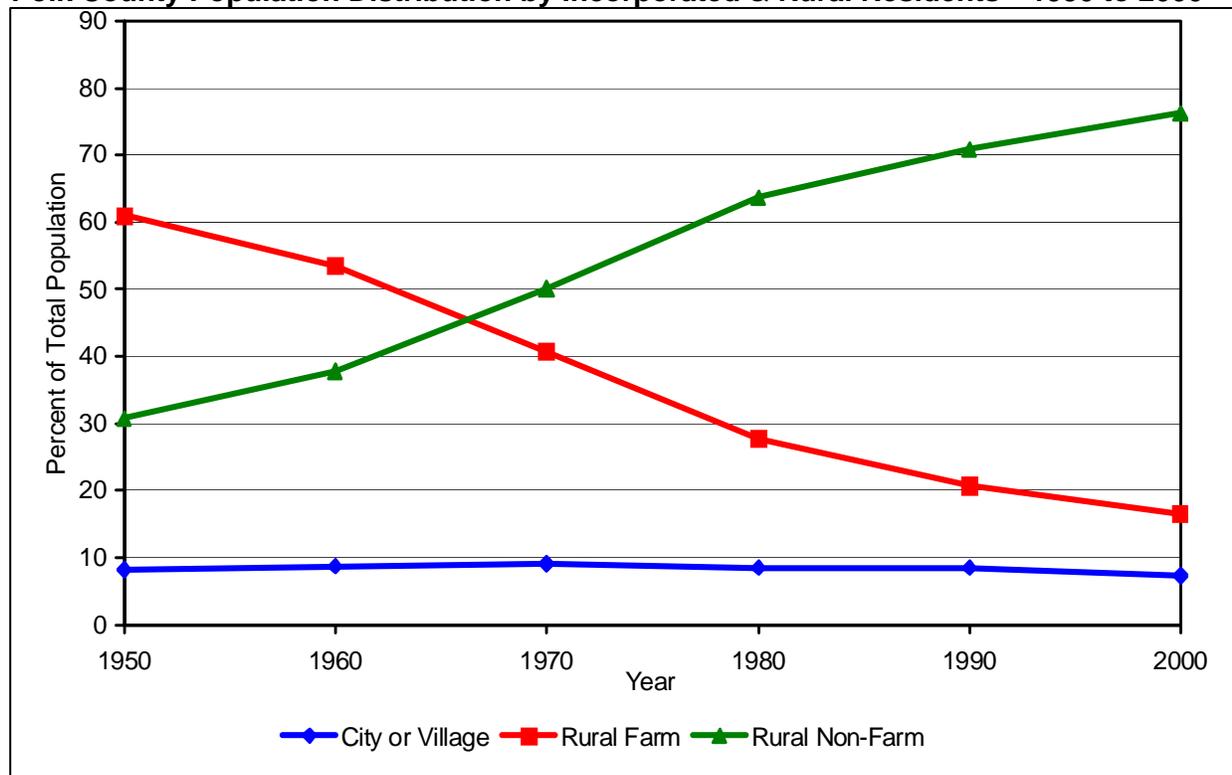
	Year					Percent Change			
	1970	1980	1990	2000	2010	'70-'80	'80-'90	'90-'00	'00-'10
Towns									
Alden	1,406	1,862	2,133	2,615	2,786	32.4%	14.6%	22.6%	6.5%
Apple River	544	819	815	1,067	1,146	50.6%	-0.5%	30.9%	7.4%
Balsam Lake	631	960	1,067	1,384	1,411	52.1%	11.1%	29.7%	2.0%
Beaver	641	755	663	753	835	17.8%	-12.2%	13.6%	10.9%
Black Brook	775	949	964	1,208	1,325	22.5%	1.6%	25.3%	9.7%
Bone Lake	416	466	503	710	717	12.0%	7.9%	41.2%	1.0%
Clam Falls	522	614	596	547	596	17.6%	-2.9%	-8.2%	9.0%
Clayton	713	789	780	912	975	10.7%	-1.1%	16.9%	6.9%
Clear Lake	793	777	744	800	899	-2.0%	-4.2%	7.5%	12.4%
Eureka	1,043	1,135	1,201	1,338	1,649	8.8%	5.8%	11.4%	23.2%
Farmington	1,156	1,195	1,267	1,625	1,836	3.4%	6.0%	28.3%	13.0%
Garfield	768	1,010	1,107	1,443	1,692	31.5%	9.6%	30.4%	17.3%
Georgetown	526	746	780	1,004	977	41.8%	4.6%	28.7%	-2.7%
Johnstown	328	401	410	520	534	22.3%	2.2%	26.8%	2.7%
Laketown	725	909	921	918	961	25.4%	1.3%	-0.3%	4.7%
Lincoln	1,198	1,683	1,835	2,304	2,208	40.5%	9.0%	25.6%	-4.2%
Lorain	275	280	299	328	284	1.8%	6.8%	9.7%	-13.4%
Luck	663	863	880	881	930	30.2%	2.0%	0.1%	5.6%
McKinley	297	337	327	328	347	13.5%	-3.0%	0.3%	5.8%
Milltown	691	943	949	1,146	1,226	36.5%	0.6%	20.8%	7.0%
Osceola	769	1,066	1,337	2,085	2,855	38.6%	25.4%	55.9%	36.9%
St Croix Falls	783	873	1,034	1,119	1,165	11.5%	18.4%	8.2%	4.1%
Sterling	379	497	591	724	790	31.1%	18.9%	22.5%	9.1%
West Sweden	691	718	682	731	699	3.9%	-5.0%	7.2%	-4.4%
sub-total	16,733	20,647	21,885	26,490	28,843	23.4%	6.0%	21.0%	8.9%
Villages									
Balsam Lake	648	749	792	950	1,009	15.6%	5.7%	19.9%	6.2%
Centuria	632	711	790	865	948	12.5%	11.1%	9.5%	9.6%
Clayton	306	425	450	507	571	38.9%	5.9%	12.7%	12.6%
Clear Lake	721	899	932	1,051	1,070	24.7%	3.7%	12.8%	1.8%
Dresser	533	670	614	732	895	25.7%	-8.4%	19.2%	22.3%
Frederic	908	1,039	1,124	1,262	1,137	14.4%	8.2%	12.3%	-9.9%
Luck	848	997	1,022	1,210	1,119	-	-	-	-7.5%
Milltown	634	732	786	888	917	15.5%	7.4%	13.0%	3.3%
Osceola	1,152	1,581	2,075	2,421	2,568	37.2%	31.2%	16.7%	6.1%
Turtle Lake*	0	0	6	65	93	0.0%	0.0%	983.3%	43.1%
sub-total	6,382	7,803	8,591	9,951	10,327	22.3%	10.1%	15.8%	3.8%
Cities									
Amery	2,126	2,404	2,657	2,845	2,902	13.1%	10.5%	7.1%	2.0%
St. Croix Falls	1,425	1,497	1,640	2,033	2,133	5.1%	9.6%	24.0%	4.9%
sub-total	3,551	3,901	4,297	4,878	5,035	9.9%	10.2%	13.5%	3.2%
Total	26,666	32,351	34,773	41,319	44,205	21.3%	7.5%	18.8%	7.0%

*Portion of Turtle Lake located in Polk County only.

source: U.S. Census Bureau

At approximately 45.6 persons per square mile on average, Polk County remains quite rural overall. The majority of residents continue to reside in the unincorporated towns and the percentage of the County's population in unincorporated areas continues to increase (see **Figure 8**). But since the mid-1960s, the majority of rural residents are no longer residing on working farms.

Figure 8.
Polk County Population Distribution by Incorporated & Rural Residents • 1950 to 2000



source: U.S. Census Bureau

The 1970s and 1990s are the only recent decades in which the population increase in Polk County has been more from the in-migration of new residents than natural increase³. The natural increase rate for the 1990s was at a 50-year low for the County.

The average age of Polk County residents increased 7.3 years from 1980 to 2000 to 38.7 years. By 2010, the average age was 42.5 years. Population increased in every age group except 0-4, 20-24, and 25-34 between 1980 and 2000. The middle-age groups (35-60) increased substantially during this timeframe, with a very large population increase of over 100 percent in the 35-44 and 45-54 age groups.

Overall, Polk County's population is relatively homogenous, with 96.8 percent of the population in the white, one-race racial group in 2010. During the previous decade, the population in all

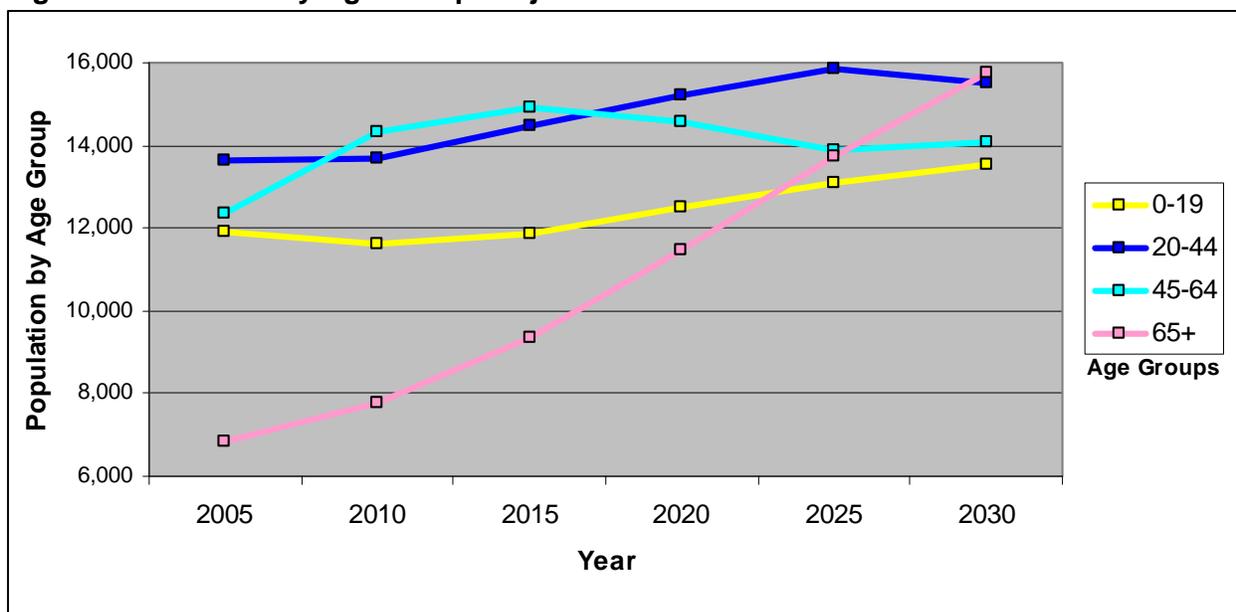
³ Does not include 2000 to date, though in-migration is expected to have continued to outpace natural increases. Confirmation will be available once the results of the 2010 Census become available.

racial groups increased, with the White Hispanic and American Indian races increasing most in Polk County. The American Indian population, largely members of the St. Croix Chippewa Indians of Wisconsin which has Tribal communities in the County, continues to be the County's largest minority population. Language and cultural barriers can pose challenges to education and outreach on weather awareness, available shelters, agricultural best practices, regulations, etc.

As shown in **Table 3** on the following page, the Wisconsin Department of Administration (WisDOA)⁴ projects a 42.5 percent increase (+17,547 residents) in the Polk County population between 2000 and 2030. Like recent trends, the percentage increases are projected to be highest in many of the towns. The largest rates of increase are expected in the Towns of Black Brook, Bone Lake, Eureka, Farmington, Garfield, and Osceola, and the Village of Dresser.

Figure 9 below shows Polk County's projected population by age group, reflecting that the baby boomer generation is dramatically becoming a larger proportion of the County's population. Between 2005 to 2030, the number of residents ages 65 and over is projected to more than double. This trend has serious future implications for services, housing, and the labor force.

Figure 9. Polk County Age Group Projections • 2005 to 2030



source: Wisconsin Department of Administration, August 2008

⁴ The WisDOA population projections are, by State Statute, the official population projections for Wisconsin.

Table 3. Polk County Population Projections • 2000 to 2030

Municipality	Census 2000	Estimate 2005	Proj. 2010	Proj. 2015	Proj. 2020	Proj. 2025	Proj. 2030	% Change 2000-2030
Towns								
Alden	2,615	2,876	3,089	3,335	3,579	3,803	3,991	52.6
Apple River	1,067	1,143	1,217	1,304	1,390	1,468	1,533	43.7
Balsam Lake	1,384	1,464	1,556	1,665	1,773	1,871	1,951	41.0
Beaver	753	839	883	936	989	1,035	1,073	42.5
Black Brook	1,208	1,387	1,511	1,650	1,790	1,919	2,030	68.0
Bone Lake	710	776	843	918	993	1,062	1,121	57.9
Clam Falls	547	566	562	563	564	562	555	1.5
Clayton	912	979	1,028	1,088	1,148	1,200	1,243	36.3
Clear Lake	800	859	890	930	970	1,003	1,029	28.6
Eureka	1,338	1,537	1,654	1,790	1,924	2,047	2,151	60.8
Farmington	1,625	1,831	1,990	2,168	2,347	2,510	2,652	63.2
Garfield	1,443	1,639	1,791	1,963	2,133	2,292	2,428	68.3
Georgetown	1,004	1,070	1,137	1,16	1,294	1,365	1,424	41.8
Johnstown	520	562	599	642	686	724	757	45.6
Laketown	918	925	922	929	935	935	928	1.1
Lincoln	2,304	2,446	2,592	2,765	2,938	3,092	3,219	39.7
Lorain	328	332	337	347	356	364	367	11.9
Luck	881	875	869	869	869	863	851	-3.4
McKinley	328	341	344	351	358	364	366	11.6
Milltown	1,146	1,237	1,310	1,396	1,481	1,557	1,619	41.3
Osceola	2,085	2,681	3,078	3,506	3,934	4,338	4,700	125.4
St Croix Falls	1,119	1,237	1,315	1,405	1,494	1,575	1,641	46.6
Sterling	724	758	799	849	898	942	977	34.9
West Sweden	731	763	779	803	827	846	858	17.4
Subtotal:	26,490	29,123	31,095	33,388	35,670	37,737	39,464	49.0
Villages								
Balsam Lake	950	1,035	1,100	1,178	1,254	1,324	1,382	45.5
Centuria	865	948	1,001	1,065	1,129	1,185	1,231	42.3
Clayton	507	556	589	627	666	699	727	43.4
Clear Lake	1,051	1,098	1,137	1,188	1,238	1,282	1,314	25.0
Dresser	732	833	896	969	1,041	1,107	1,162	58.7
Frederic	1,262	1,241	1,251	1,275	1,298	1,313	1,318	4.4
Luck	1,210	1,228	1,260	1,309	1,357	1,397	1,425	17.8
Milltown	888	915	944	981	1,020	1,051	1,074	20.9
Osceola	2,421	2,641	2,826	3,042	3,254	3,450	3,612	49.2
Turtle Lake*	65	80	92	105	118	129	141	116.9
Subtotal:	9,951	10,575	11,096	11,739	12,375	12,937	13,386	34.5
Cities								
Amery	2,845	2,919	2,989	3,080	3,177	3,253	3,302	16.1
St. Croix Falls	2,033	2,127	2,235	2,369	2,502	2,620	2,714	33.5
Subtotal:	4,878	5,046	5,224	5,449	5,679	5,873	6,016	23.3
Polk County	41,319	44,744	47,415	50,576	53,724	56,547	58,866	42.5

*Portion of Turtle Lake located in Polk County only.

source: U.S. Census Bureau & Wisconsin Department of Administration, Demographic Services Center, October 2008.
Projections are Pre-Release Version for Research and Analysis Only.

Implications of Polk County population trends for emergency services and hazard mitigation:

1. Increases in population (and related housing and other development), also increases the vulnerabilities to natural hazard risks.
2. Increases in population also results in increasing demand for emergency services, which is a special challenge during current governmental budget conditions.
3. With the largest percentages of growth occurring in rural areas, costs to provide services and emergency response times increase. In addition, communications and mitigating potential impacts are often more challenging (e.g., warning systems, public storm shelters, localized flood controls).
4. Some of the highest growth rates occurred in areas with significant natural amenities, such as shorelands and forests. New development in these areas can be more prone to certain natural hazards if not carefully planned (e.g., forest fire, flooding).
5. The in-migration of new residents from outside the County may have differing expectations of emergency service levels, may not be aware of local emergency procedures or contacts, and may not have knowledge of local hazard risks or event history.
6. The County's aging population poses unique challenges for emergency preparedness and response services, such as sheltering-in-place and evacuation strategies. Large numbers of seniors reside in rural areas which may need special attention during a hazard event (e.g., transportation for dialysis during a winter storm, access to medicine).
7. With a growing minority population, language and cultural barriers can pose challenges to education and outreach on weather awareness, available shelters, floodplain regulations, etc.

ii. Housing

As residential growth occurs in Polk County, so does the value of improvements which could potentially be vulnerable to natural hazard events. And the continued population growth in Polk County has created a corresponding demand for additional housing as shown in **Table 4** below. During the 1980s, the growth in housing units was nearly double the County's population growth, likely reflecting a sizable jump in seasonal homes during the time period. During the 1990s, the County's population grew by 18.8 percent, above the housing unit increase. During the past decade, the growth in the percentage of housing units more than doubled the growth in population during the same time period.

Table 4. Polk County Housing Unit Change • 1980 to 2000

Year	Number of Housing Units	Numerical Change	Percent Change
1980	16,228		
1990	18,562	+2,334	+14.4%
2000	21,129	+2,567	+13.8%
2010	24,248	+3,119	+14.8%

Source: 1980, 1990, 2000, & 2010 Census

Shown in **Table 5** are the housing unit projections for Polk County for the years 2000 through 2030 based on the previous population projections. However, local and national housing market changes during the last few years are not fully reflected in these projections.

Table 5. Polk County Housing Unit Forecast • 2000 to 2025

	2000 <i>Census</i>	2005 <i>Estimate</i>	2010 <i>Projection</i>	2015 <i>Projection</i>	2020 <i>Projection</i>	2025 <i>Projection</i>	2025 <i>Projection</i>
Population	41,319	44,744	47,415	50,576	53,724	56,547	58,886
Housing Units	21,129	23,214	25,374	27,660	29,851	31,735	33,738
Housing Unit Change		+10.0%	+9.3%	+9.0%	+7.9%	+6.3%	+6.3%

Source: U.S. Census, Wisconsin Department of Administration, 2008.

Approximately 20 percent of the County's total housing supply in 2010 (or 4,885 units) were seasonal, a slight increase in the number of seasonal units since 2000. Seasonal units are used or intended for use only in certain seasons (e.g., beach cottages and hunting cabins) or for weekend or occasional use throughout the year. Seasonal units may also include quarters used for seasonal workers such as loggers. During the twenty-year period from 1980 to 2000, the County experienced a 31 percent increase in seasonal units. Areas with the largest number of seasonal units in 2000 include the following:

Town of Georgetown	814
Town of Balsam Lake	463
Town of Milltown	345

Despite this growth in seasonal units, there is anecdotal evidence that the number of seasonal units is decreasing over much of the region as these structures are being converted to year-round homes, which has implications for local and emergency services.

Also of interest, nearly 80 percent of all housing units in Polk County in 2000 were owner-occupied (not rented), a large increase since 1990 and significantly above the State of Wisconsin average of 68.4 percent. Only ten percent of the County's housing units in 2000 were multi-unit structures (e.g., apartments), which is far below the State-wide average of 26.2 percent. A total of 2,068 housing units (10% of all units) in 2000 were mobile homes, more than double the State of Wisconsin average of 4.4 percent.

iii. Economic Overview

Economic characteristics and growth influence land use and may present unique hazard mitigation and emergency response challenges. The extent to which economic activities are vulnerable to natural hazard risks varies by the characteristics of the activity and the level of preparedness.

Polk County is predominantly rural in nature, with agriculture as the primary land use. In 2002, there were 192 more farms in Polk County than in 1987; however the County lost 77 farms between 2002 and 2007. The average farm size decreased from 215 acres in 1987 to 183 acres in 2007, as reflected in **Table 6** below.

From 1987 to 2002, the number of farms increased by 13.1 percent, yet average farm size decreased 18 percent. This data shows that Polk County had experienced a significant increase in smaller farms. But this trend may have stabilized or reversed more recently. The number of farms decreased five percent between 2002 and 2007 while average farm size increases three percent.

It needs to be noted that the U.S. Census Bureau defines "farm" as any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold during the census year. Of the 1,582 farms in Polk County, 604 (38 percent) had sales under \$1,000, and 1,046 (66 percent) had sales of under \$10,000.

Table 6. Polk County Acres in Farmland • 1987 to 2007

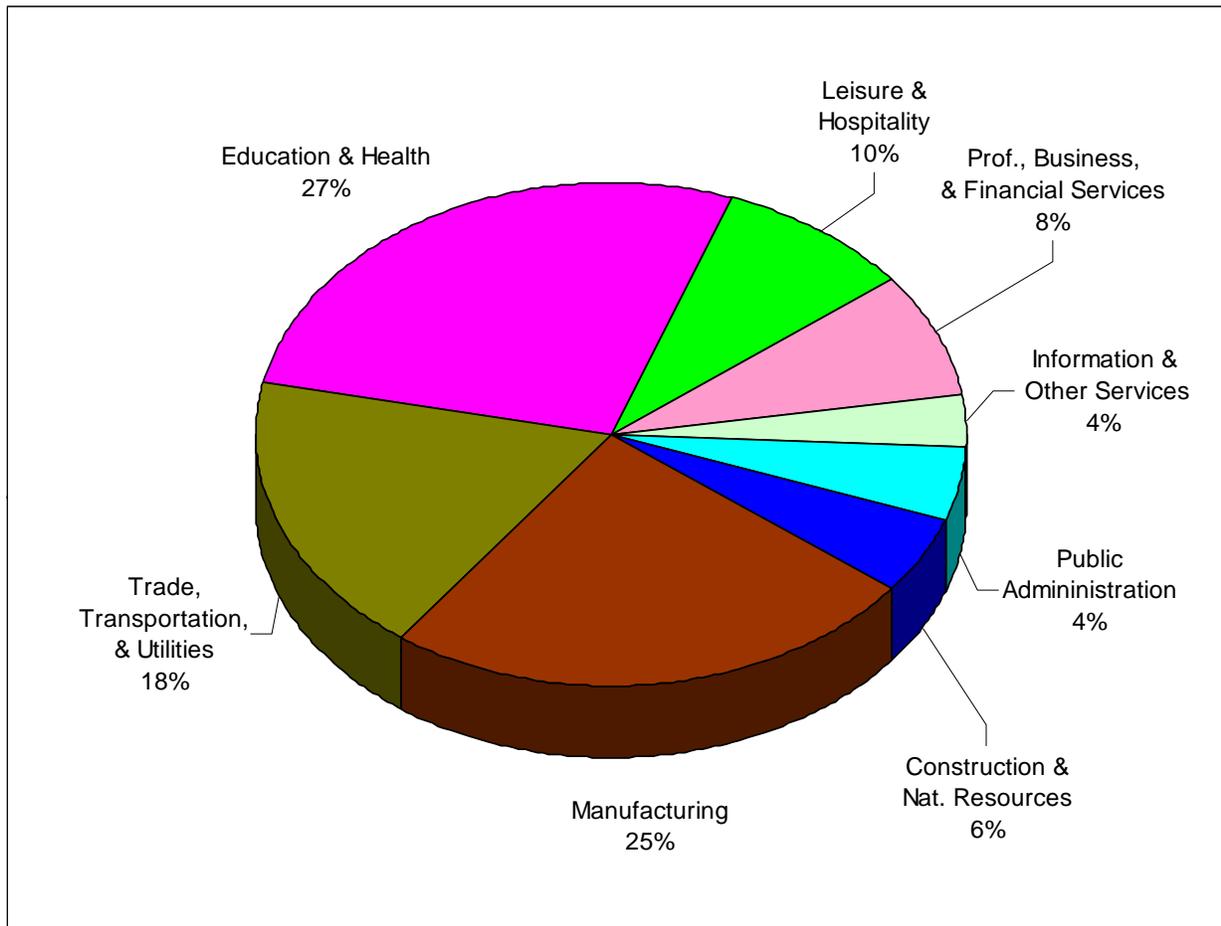
	1987	1992	1997	2002	2007
Acres	315,416	282,639	301,736	292,860	288,994
Percent of County Land Area	52.8%	47.4%	50.6%	49.1%	48.4%

Source: U.S. Department of Agriculture, National Agricultural Statistics Service

Like most of the region, and the nation, the economy of Polk County has been undergoing significant shifts. During the past three years, manufacturing has been overtaken by the education and health sector as the largest employer in the County. From 2001 to 2009, the number of manufacturing jobs has decreased 13.9 percent, while employment in the education and health sector increased 15.5 percent. The largest percent increase (60.8%) in jobs occurred in the professional and business services sector. The current economic downturn is reflected in these numbers, with a 4.5 percent decrease in employment in Polk County between 2005 to 2009.

Figure 10 shows the distribution of employment in Polk County as of 2009. It is important to note that this economic data covers only those employees reported for unemployment insurance coverage; self-employed individuals and farm operators are excluded. Retail trade employment constitutes the largest component of the trade, transportation, and utilities industry.

Figure 10. Employment by Industry in Polk County • 2009



source: Wisconsin Department of Workforce Development, WORKnet

In 2000, about 61.7 percent of the workers living in the County worked within Polk County. About 7.6 percent commuted to nearby St. Croix County. Almost 20 percent commuted to either Chisago, Washington, Ramsey, or Hennepin counties in Minnesota. In 1990, only 39.7 percent of employed residents commuted 20 minutes or longer, which increased to 50.8 percent by 2000. In short, Polk County residents are commuting longer distances to their place of employment, which partly reflects the in-migration of new residents during recent decades

The 2002 per capita personal income in the County of \$23,030 was 79% of the State average. The median household income in 1999 (the last full year of income data) in Polk County was \$41,182, also below the statewide average. 28% of Polk County households earned less than \$25,000 per year, 56% earned between \$25,000 and \$74,999, and 17% earned \$75,000 or more.

iv. Property Values

A disaster event can result in impacts to the natural environment, life and safety, the economy, structures, and personal property. This sub-section provides insight into the taxable improvements and personal property within Polk County.

According to the Wisconsin Department of Revenue, the aggregated assessed value for Polk County was almost 4.6 billion.⁵ **Table 7** at the right summarizes the 2009 Statement of Assessments for the County. This reflects the overall rural nature of Polk County with a relatively high proportion of the aggregate value in land and a much lower proportion in personal property when compared to urban areas.

From 2003 to 2009, the County's total assessed value of improvements grew by almost \$1 billion (over 51% increase or +8.5% per year). **Table 8** further breaks down the 2009 assessed values by primary land uses:

**Table 7. Polk County
2009 Assessed
Total Values
(not equalized)**

Land	\$ 1,592,304,600
Improvements	\$ 2,944,910,150
Real Estate	\$ 4,537,214,750
Personal Prty	\$ 57,261,892
Aggregate	\$ 4,594,476,642

Table 8. Polk County Assessed Value by Land Use • 2009

Use	Land Value	Improvements	Total
Residential	\$1,150,136,690	\$2,505,486,820	\$3,655,623,510
Commercial	70,100,120	245,613,630	315,713,750
Manufacturing	10,978,900	76,362,600	87,341,500
Agricultural	33,699,260	0	33,699,260
Undeveloped	43,207,070	0	43,207,070
Forest	51,625,100	0	51,625,100
Ag Forest	221,212,960	0	221,212,960
Other	11,344,500	117,477,100	128,791,600
Totals	\$1,592,304,600	\$2,944,910,150	\$4,537,214,750

source: Wisconsin Department of Revenue. 2009 Statement of Assessments.

Not included in the above values are tax-exempt properties. Polk County has over 44,000 acres of public resource lands, mostly forested, which are not included in the above figures. Governmental facilities and schools constitute the largest portion of those existing improvements not included in Tables 7 and 8, though other facilities on tax-exempt lands owned by non-profit institutions (e.g., churches) are also not included.

⁵ Wisconsin Department of Revenue, Bureau of Equalization. 2009 Statement of Assessments. Unequalized assessed values are used to best represent the actual value of improvements. Not all assessed values were available for all categories.

D. GENERAL DEVELOPMENT PATTERN

Polk County is located northeast of the Minneapolis-St. Paul metropolitan area, and is contiguous to the Minneapolis-St. Paul Metropolitan Statistical Area (MSA). The Census Bureau defines a Metropolitan Statistical Area (MSA) as a county or counties with a central city of at least 50,000 people, a total population over 100,000 people, and significant social and economic ties which exist between the central city and any outlying counties that are included. Based on that definition, St. Croix County became part of the Minneapolis-St. Paul MSA in 1980 and Pierce County in 1990. Consequently, even though Polk County is not currently a part of the MSA, it is apparent that the influence of the metro area is spreading, and that Polk County is becoming more economically and socially interconnected to the MSA.

Figure 11 on the following page shows the general land cover in Polk County based on 1998 satellite imagery. In 2009, the County had an overall population density of 47.75 persons per square mile, much lower than the 86.8 persons per square mile for the State of Wisconsin. Based on State official population projections, the County's density is projected to increase to 60.9 persons per square mile by 2030, compared to 99.9 persons per square mile statewide. This growth and development inherently increases the vulnerabilities to natural hazard events and can impact natural drainage systems, resulting in increased stormwater runoff and flooding if not appropriately planned for.

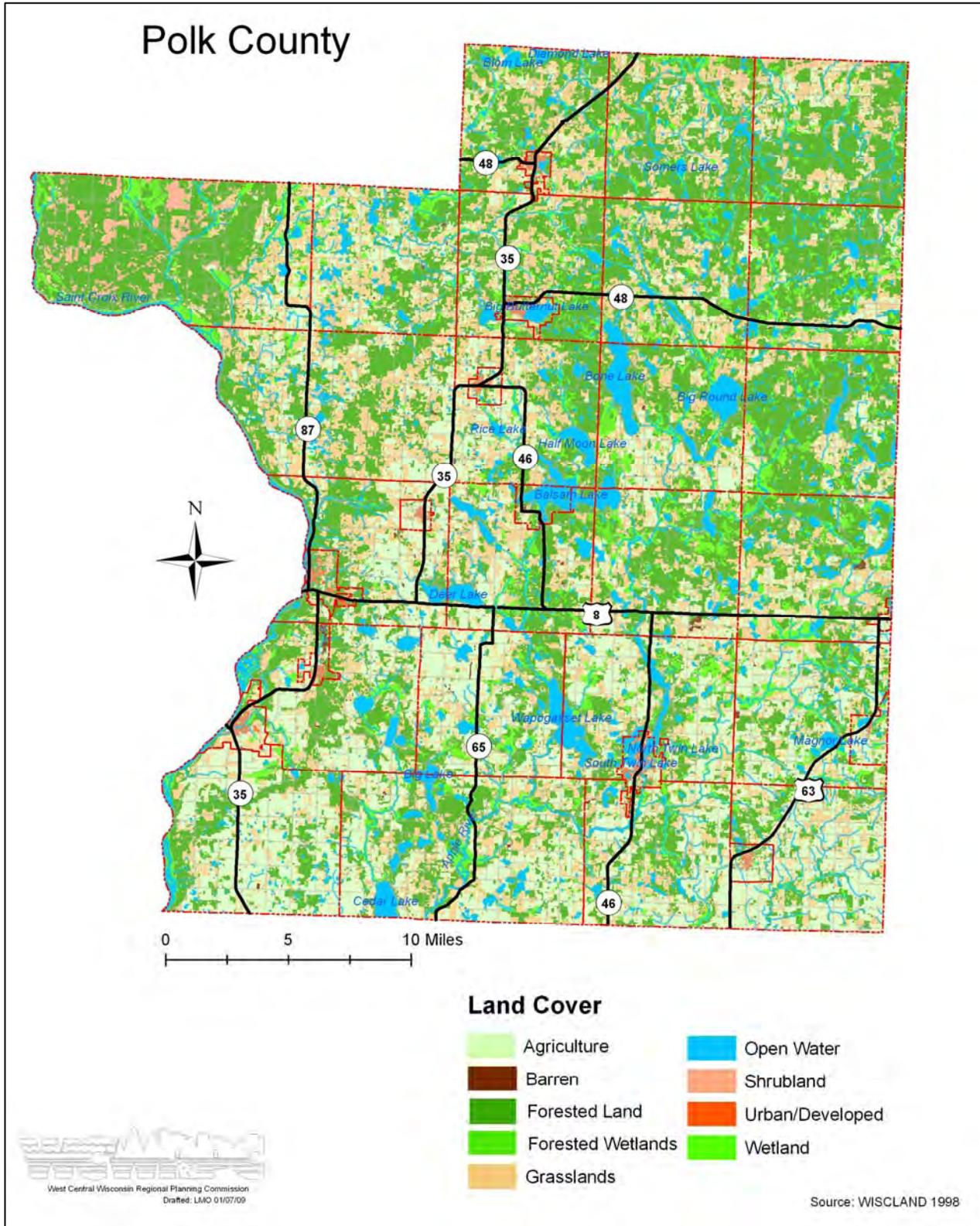
Residential Growth Trends

In 2007, the assessed residential acreage in the unincorporated areas of the County was 44,626, or 95.8 percent of the total assessed residential acreage in the County. This is down from 98.5 percent in 1987. However, the assessed residential acreage increase in unincorporated areas from 1987 to 2007 was 25,496 acres or a 133 percent increase. That is a 6.7 percent annual increase.

The Towns of Alden, Eureka, Farmington, Osceola, Lincoln, Milltown and St. Croix Falls had significant residential acreage (4,698, 3,716, 3,177, 2,746, 2,693, 2,673 and 2,505, respectively) in 2007. Six of these towns (Alden, Eureka, Farmington, Osceola, Milltown and St. Croix Falls) are generally in the western part of the County in proximity to Minnesota or St. Croix County and State Highways 35, 65 and 87, and account for nearly 42 percent of the assessed residential acreage in the County. When the Town of Lincoln is considered with those six towns they all account for 48 percent of the assessed residential acreage in the County. From 1987 to 2007, the Town of Alden (3,359) had the greatest absolute increase in assessed residential acres, followed by the Towns of Eureka (2,621), Farmington (2,342), Milltown (1,728) and Lincoln (1,525).

Regarding assessed residential acreage percentage increases between 1987 and 2007, the Town of Clear Lake (423 percent) had the greatest increase, followed by the Towns of Lorain (368 percent), Farmington (281 percent), Alden (251 percent), Eureka (239 percent) and Garfield (207 percent). These communities have grown in residential acreage at an average rate of at least 10 percent per year since 1987. Other towns that have at least doubled their residential acreage between 1987 and 2007 are Black Brook (197 percent), Milltown (183 percent), Laketown (174 percent), Luck (154 percent), Lincoln (131 percent), Clayton (129 percent), Clam Falls (123 percent), Balsam Lake (109 percent) and St. Croix Falls (106 percent).

Figure 11. Polk County Land Cover



The cities and villages in Polk County also saw dramatic growth in residential land. Since many communities had reporting discrepancies during the period and the assessment data are inconclusive for 1987, comparisons between 1998 and 2007 follow for incorporated areas. While the Village of Frederic saw a sevenfold increase in assessed residential acreage between 1998 and 2007, the Villages of Osceola (269 percent) and Balsam Lake (251 percent) at least tripled theirs and the Villages of Luck (159 percent), Dresser (126 percent) and Milltown (107 percent) at least doubled theirs. The other cities and villages experienced significant increases in residential land. This growth is expected to continue, noting that a substantial percentage of the County's housing units are seasonal or recreational use. Further, this development will continue to put pressure on the shores of lakes, rivers and streams, and their associated floodplains. And, as identified in the *2002 Polk County Land-Use Plan* and the WCWRPC's *2009 Polk County Conditions and Trends Report*, much of this residential growth is occurring in the southwestern areas of the County, closest to the Twin Cities metropolitan area.

Assessed undeveloped lands, often associated with very large lot or estate residential development, increased by 96.2 percent between 1997 and 2007, and totaled 14.6 percent of the assessed lands in the County in 2007. This is often due to a large lot being purchased for housing development, with only a portion being taxed as residential and the remainder being taxed as undeveloped.

Commercial and Industrial Properties

While unincorporated communities in Polk County have 64 percent of the assessed commercial land in the County, commercial assessed value per acre is over three times higher in villages and over six times higher in cities than in the towns. This indicates commercial activity in cities and villages is more intensive, concentrated, and includes commercial uses much larger in scale than in the towns. Commercial development in the towns is less concentrated and is often related to agricultural, tourism, or recreation. Polk County has experienced significant commercial growth between 1987 to 2007, increasing by 77 percent (or +1,424 acres). The majority of this growth occurred in the cities and villages.

Over 62 percent of the land assessed for manufacturing in Polk County is located in the incorporated cities and villages. Industrial activity in the County's unincorporated towns is significant only in a few areas, often near incorporated communities or associated with food production or non-metallic mining. Total assessed manufacturing acreage stayed about the same between 1987 to 2007 in the towns, but doubled (+553 acres) in the cities and villages.

Agricultural, Forestry, and Resource Lands

Though residential development has been increasing dramatically, agricultural uses in 2007 still constituted approximately 43 percent of all assessed acreage in the unincorporated areas of the County. Twenty of Polk County's twenty-four towns (83% of all towns) have more than a third of their assessed land assessed as agriculture. Five towns (20% of all towns) have at least half of their assessed land assessed as agriculture. It is clear that agriculture is a significant activity in Polk County. However, assessed agricultural land decreased by 26.2 percent between 1997 and 2007. Those towns that have lower agricultural acreage generally have at least one of the

following factors present; higher non-farm acres, higher forested acres, significant surface water acres, or other significant natural resource lands.

The loss of farmland has serious implications for those towns that are losing large amounts of acreage. However, not all the land converted from agriculture is going to non-farm uses. It is likely that some of it has been converted to forested land due to programs like the Conservation Reserve Program. Forest lands, with 31.4 percent of the County's assessed acreage, was the next predominant land use in Polk County and has been slowly increasing. Large areas of forest, grasslands, and barrens are found in Sterling Township to the northwest and the east-northeast portion of the County. Productive forested land will continue to be an important part of Polk County's landscape and economy, not only for forest and paper products but also for recreational opportunities.

There are significant publically owned natural resource and park lands in Polk County which are not assessed for tax purposes and included in the previous figures. Sixteen different towns have over 250 acres of public natural resource lands. The largest concentration is located in the Town of Sterling with over 19,000 acres.

E. CRITICAL FACILITIES & EMERGENCY SERVICES

For this hazard mitigation planning effort, a critical facility is defined as either:

- (1) a facility in either the public or private sector that provides essential products or services to the general public, is otherwise necessary to preserve the welfare and quality of life in Polk County, or fulfills important public safety, emergency response and/or disaster recovery functions; or,
- (2) a high potential loss facility (e.g., nuclear plant, military installation, extreme hazardous materials plant) with possible substantial secondary impacts resulting from a natural hazards event. No high potential loss facilities were identified in Polk County.

The primary critical facilities in Polk County include:

- government buildings & utilities
- hospitals and primary clinics
- law enforcement and emergency response facilities
- elderly homes (e.g., assisted living, nursing care)
- high voltage transmission lines, substations, and other regional utility lines
- Pre-K through 12 schools
- radio and cell towers

The Polk County Land Information Department has been proactive in its development of G.I.S. databases which identify eighty of these facilities as listed in **Appendix E**. The general location of each facility is shown in **Figure 12** on the following page, in addition to approximate locations of the major natural gas and electric transmission lines and substations. Not surprisingly, higher concentrations of facilities are located in the cities and villages.

Appendix E does not include all critical facilities at this time. Notably absent are the majority of emergency response facilities (e.g., fire halls) and radio/cell towers. WCWRPC amended Appendix E to include 25 additional facilities consisting of the locations of clinics and other types of licensed assisted living facilities, as well as 35 licensed child care centers, though these locations are not included in Figure 12. For reference, the boundaries for fire and ambulance services within Polk County are shown in **Figures 13** and **14**.

About 52 percent of Polk County is served by the Polk-Burnett Electric Cooperative, with two independent electric providers (Northwestern Wisconsin Electric Company and Xcel Energy) serving an additional 23 percent each. The remainder of the County is served by two electric cooperatives (St. Croix and Barron cooperatives) and the Centuria Municipal Electric Utility. Electric cooperatives and municipal utilities are eligible for FEMA hazard mitigation grant funding, but it is strongly recommended that they actively participate in the development of a hazard mitigation plan and include their projects within said plan.

The risk and vulnerability assessment (**Section III.B.**) further analyzes the critical facilities to determine potential impacts by a natural hazard event.

Figure 12. Polk County Critical Facilities

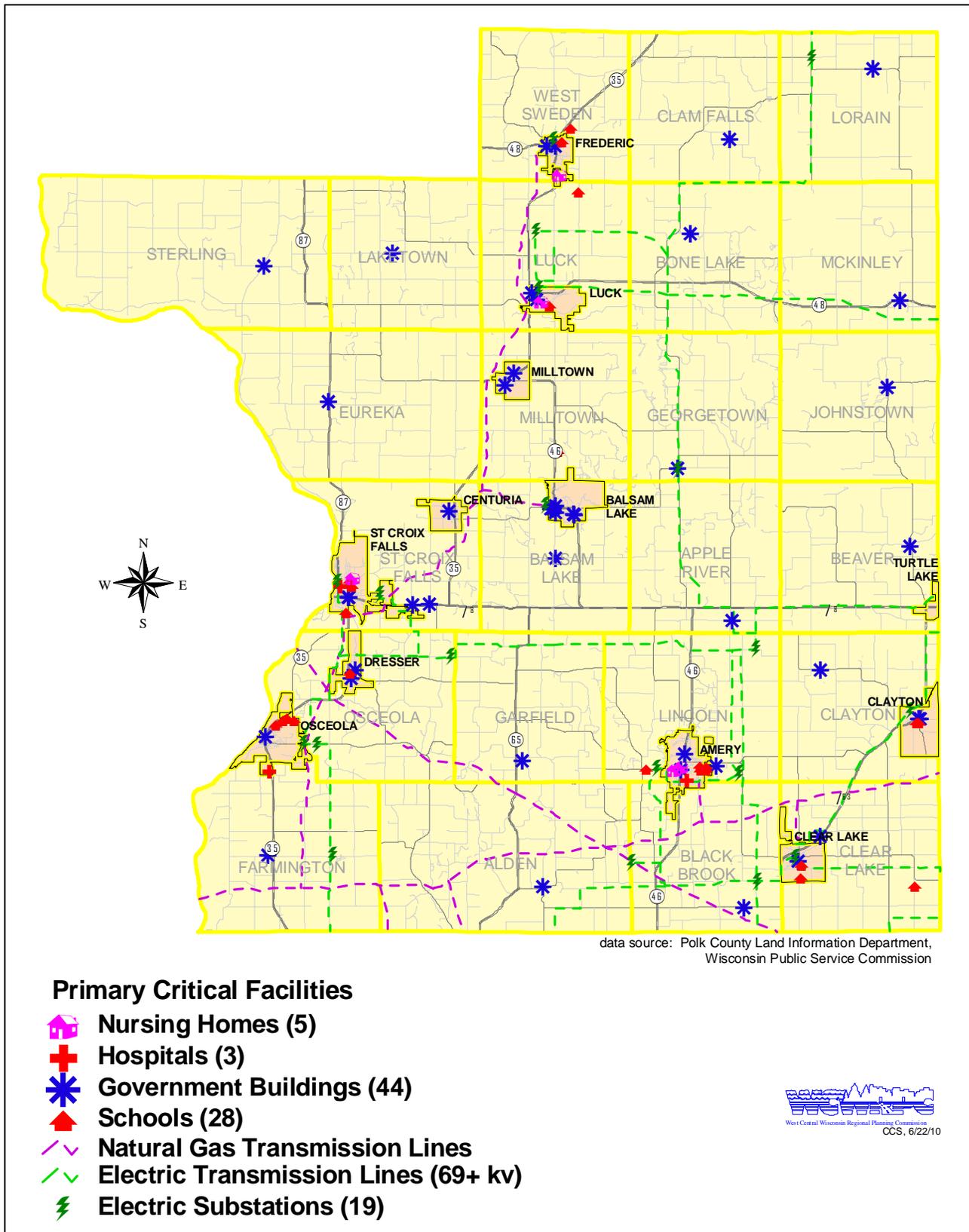


Figure 13.
Primary Fire Department
Service Areas
in Polk County

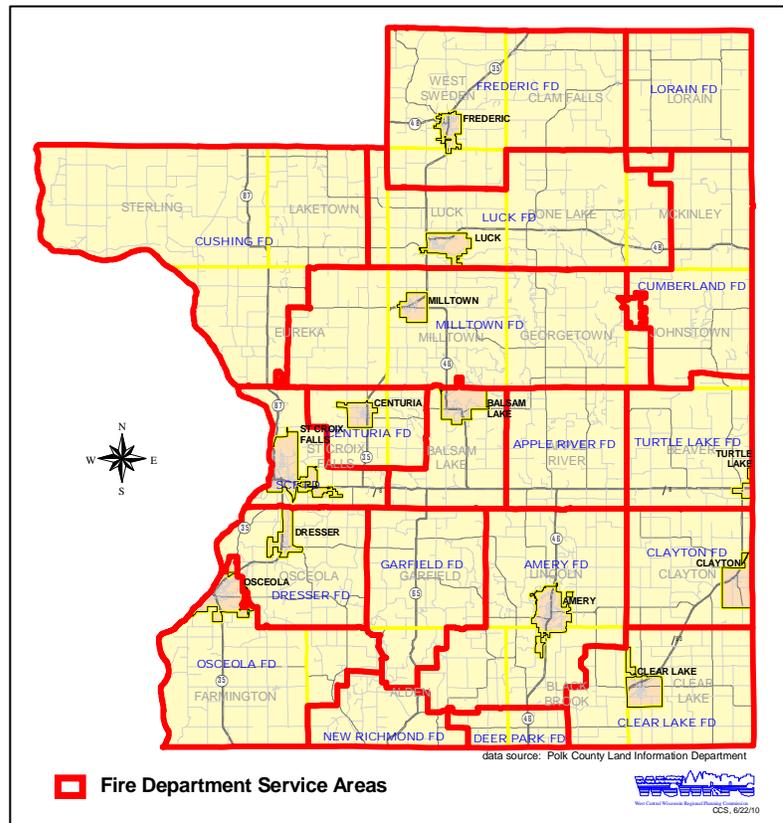
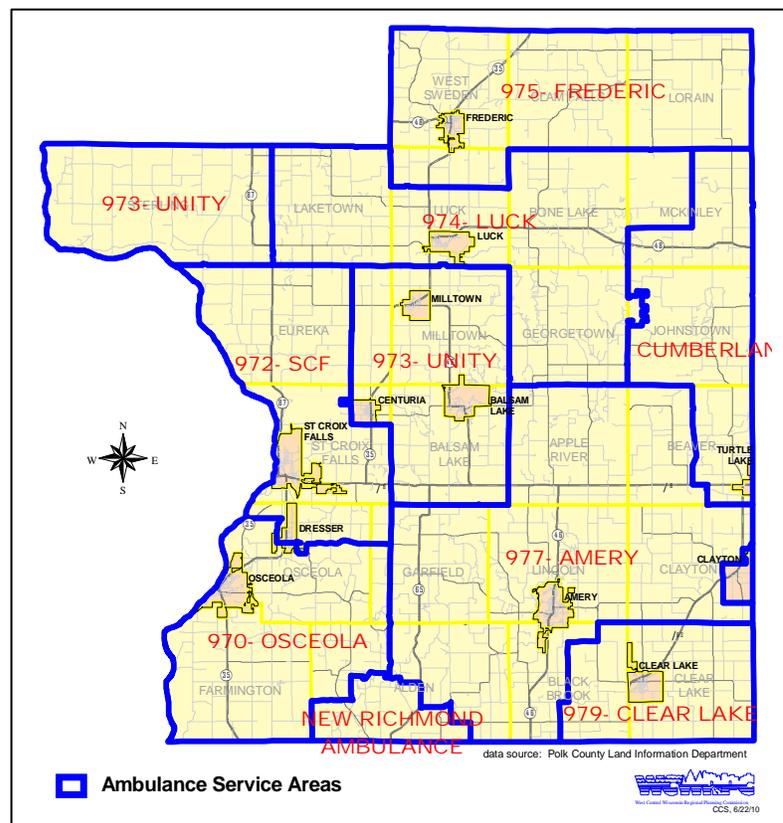


Figure 14.
Primary Ambulance
Service Areas
in Polk County



F. HAZARDOUS MATERIAL STORAGE AND USE

Hazardous materials can present special risks to humans and the environment at the time of disaster, as well as necessitate special precautions and resources for post-disaster clean-up. As of June 2010, there were 50 Tier Two Reporting facilities and 10 EHS Planning facilities located within Polk County. A Tier Two facility, by law (SARA Title III), is required to prepare or have available a Material Safety Data Sheet (MSDS) for a hazardous chemical present at the facility and must submit annual reports to Wisconsin Emergency Management (WEM), Polk County Local Emergency Planning Committee (LEPC), and the local fire department. EHS (Extremely Hazardous Substances) facilities store and/or use one of over 300 chemicals with extremely toxic properties, and must also maintain the MSDS and prepare annual reports. EHS Planning facilities have extremely hazardous substances in such quantity (thresholds vary by chemical type) that an emergency plan must be prepared by the owner/operator to WEM and the LEPC.

The majority of these facilities are located within incorporated areas, with a number of cities and villages having between four and six such facilities. For security reasons, the names, addresses, and types of chemicals at each of these facilities are not included within this report, but are on file at the Polk County Emergency Management Office for reference as needed.

During steering committee meetings and the key informant interview process, no unique natural hazard vulnerabilities were identified for any of the Tier Two or EHS facilities. A G.I.S. database with the locations for most of these facilities is maintained by Polk County and was used to compare to these locations to the official flood insurance rate maps; none of these facilities were identified as being sited within a 100-year floodplain.

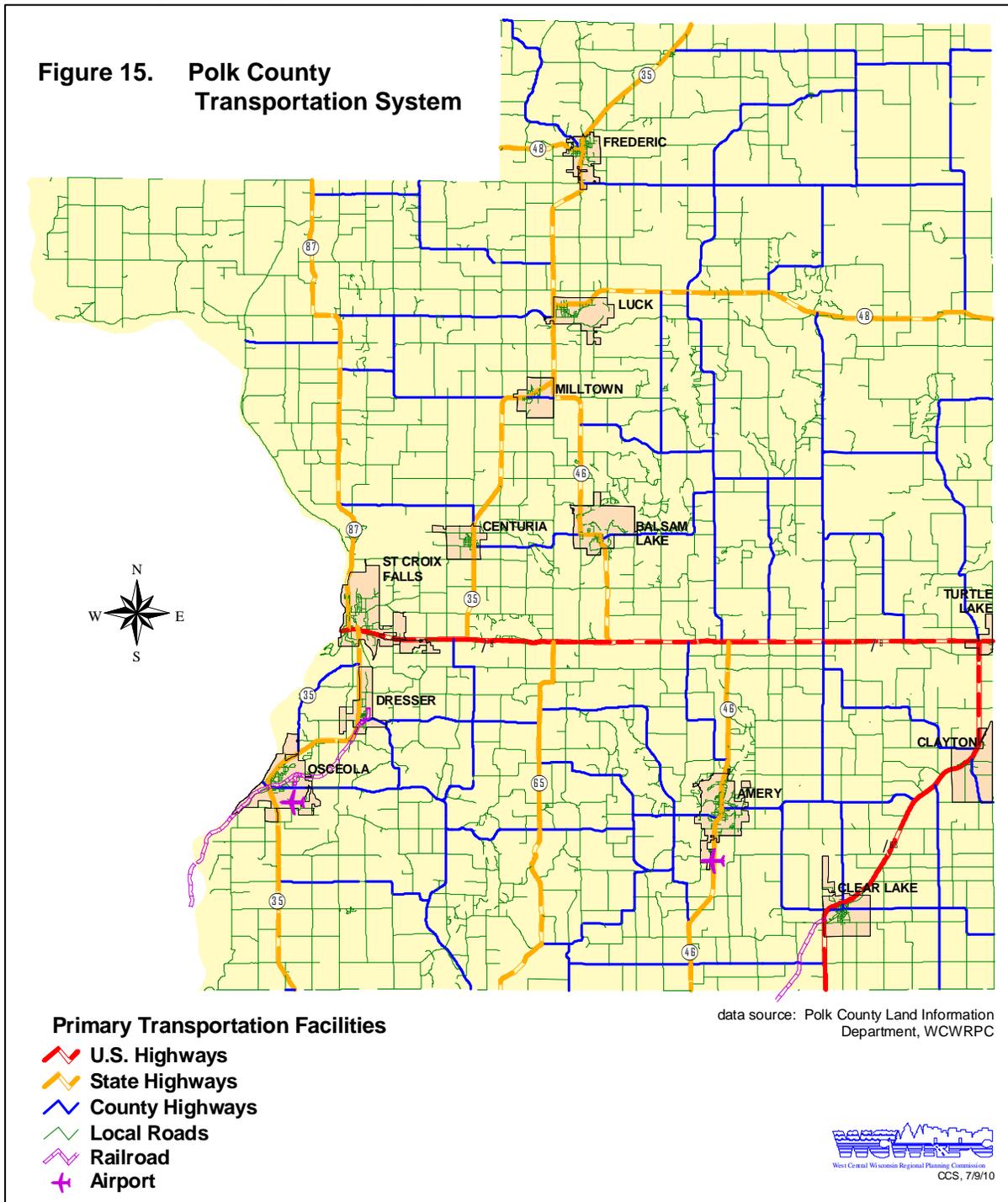
G. TRANSPORTATION SYSTEMS

Providing an uninterrupted transportation network is critical to Polk County given that residents often travel significant distances for services, critical facilities, and employment. The highway system serving Polk County links residents and businesses to the employment centers and services in the Twin Cities area, as well as in St. Croix and Barron counties. Increasing commuter traffic to the metropolitan area to the southwest has resulted in high traffic volume growth rates above previous forecasts. In 2000, over 38 percent of employed residents commuted to places of employment outside Polk County. Increasing commuter traffic is expected to continue to rise and significantly influence growth and development in the County.

The County's size and road miles can be a challenge for road crews and emergency personnel during and after a natural hazard event (e.g., snow removal, downed trees, culvert washouts). Polk County maintains over 331 miles of county trunk highway (see **Figure 15**), reflecting the largely rural nature of much of the County. Only 159.2 miles of highways with State jurisdiction exist in the County. The County also has 72 bridges, of which 21 are owned by the County and 13 owned by the State of Wisconsin.

Rail service in the County has diminished over the past century with current service limited to Osceola and Dresser through a Canadian National line. The two public airports in Amery and

Osceola have no scheduled passenger service, with the Minneapolis-St. Paul International Airport expected to continue to provide the primary commercial air service for Polk County residents and businesses. While rail service has decreased, recreational transportation systems have increased. Polk County boasts over 370 miles of snowmobile trails, 27.8 miles of ATV/trail bike trails, almost 70 miles of cross country ski trails, a 30-mile horseback trail, and over 131 miles of hiking and walking trails, not including snowmobile club trails, bicycle paths/routes, city and village trails, and private trails.



H. HISTORIC PROPERTIES AND DISTRICTS

Historic structures, sites, and districts are sometimes targeted for hazard mitigation strategies due to their unique, often irreplaceable, social value. According to the National Register of Historic Places⁶, Polk County has a total of twelve historic properties and one historic district, which have received Federal historic landmark designation. This is an increase of four structures since the County's 2006 mitigation plan, reflecting a growing interest in preserving local heritage.

#	Historic Site	Address	City	Listed
1	Polk County Courthouse	Main Street	Balsam Lake	1982
2	Frederic Depot	210 Oak Street W.	Frederic	2003
3	Seven Pines Lodge	SE of Lewis	Lewis	1978
4	First Baptist Church	201 3 rd Avenue	Osceola	2008
5	Geiger Building (old courthouse)	201 Cascade Street	Osceola	1985
6	Heald, Alan A. House	202 Sixth Avenue	Osceola	1985
7	Minneapolis, St. Paul, & Sault Saint Marie Railway Depot	114 Depot Road	Osceola	2000
8	Osceola Commercial Historic District	downtown Osceola	Osceola	2000
9	Cushing Land Agency Building	106 S. Washington St.	St. Croix Falls	2005
10	Dalles Bluff Site	restricted ⁷	St. Croix Falls	1981
11	Lamar Community Center	NE of St. Croix Falls	St. Croix Falls	1982
12	St. Croix Falls Auditorium	201 N. Washington St.	St. Croix Falls	2007
13	Thompson, Thomas Henry House	205 South Adams St.	St. Croix Falls	1984

There have been no known natural hazards events which have substantially impacted any of the above historic properties. Most of these historic buildings are very well constructed, and they continue to serve as an important vestige of Polk County's past.

The above list is not inclusive of all sites of historic and cultural significance, however. Additional structures undoubtedly qualify as National Register candidates. The Wisconsin Architecture & History Inventory (AHI) identifies 138 buildings, structures, or objects in Polk County which illustrate Wisconsin's unique history. Such sites are quite varied and include churches, cemeteries, homes, and barns, as well as archeological sites. A detailed assessment of the vulnerability of each of these sites to natural hazard events is not currently available.

⁶ National Park Service. National Register of Historic Places database. <<http://www.nps.gov/nr/research/index.htm>>. July 9, 2010.

⁷ Restricted to protect this unique site of archeological significance.

SECTION III.

ASSESSMENT OF HAZARD CONDITIONS

In order to more effectively evaluate potential hazard mitigation alternatives and develop feasible strategies to address the risks associated with the identified hazards, the County must:

- identify the hazards which are thought to pose the greatest risk to the residents of the County;
- profile the extent and severity of past hazard events that have affected the County; and
- assess the vulnerability of the community to the risk of future hazard events.

A. HAZARD IDENTIFICATION

Although Polk County could potentially be at risk from a number of different natural hazards, this plan will attempt to narrow the scope of the hazards that will be addressed to those natural hazards that pose the most substantial risks.

i. Hazard Events Historical Summary

Since 1953, there have been four Presidential Declarations for a Major Disaster which included Polk County:

April 1965 – Tornadoes, severe storms, and flooding in Wisconsin (specifics for Polk County not available)

July 2000 – Flash flooding resulted in roughly \$600,000 in estimate damage in Polk County

April 2001 – Flooding due to heavy snow melt with over \$1.6 million in estimated damage, including damages at Kennedy’s Mill Dam and Woodley’s County Dam

September 2002 – Flash flooding with roughly \$575,000 in damages with the Village of Osceola hardest hit due to a dam failure

While the above four catastrophic events were of sufficient severity to warrant major Federal assistance, there have also been two Presidential Emergency Declarations for events encompassing Polk County. Emergencies were declared for the 1976 drought and for high winds, hail, and heavy rain in the fall of 1977. During an emergency declaration, Federal assistance will supplement State and local efforts.

To assist in determining what hazards should be evaluated in the plan, National Climatic Data Center (NCDC) information from the National Weather Service (NWS) was used. This data describes past, reported weather events and the resulting deaths, injuries, and damages associated with each of these events. Data for a wide variety of events has been maintained, while some older data is only available for tornado and thunderstorm-related events.



During the period from January 1, 1993, through June 2010, Polk County has experienced 195 weather hazard events reported to the National Climatic Data Center, shown in **Table 9**.

None of the events in Table 8 included any deaths reported to have occurred within Polk County. Table 8 shows thunderstorms and winter storms are the most frequently occurring natural hazard events. The most damaging events since 1993, in terms of property, have been flooding and flood damage, especially to roads and infrastructure. However, looking farther back into history, tornadoes appear to have been the most devastating in terms damage and deaths since 1950.

It should be noted that some event types in Table 8 are often related, such as a thunderstorm event could include high winds, hail, and flooding. Further, a single storm event can trigger multiple event reports for different communities within the County. Other times, an event may be regional in nature, so the damages may be reported for multiple counties.

**Table 9. Natural Hazard Events • Jan 1993 to Sept 2010
Polk County (NCDC data only)**

Event	Number of Occurrences	Reports/Year	Deaths	Injuries	Property Damage	Crop Damage
Extreme Heat	10	0.6	0	0	\$0	\$0
Drought	<i>no NOAA-NCDC reports; discussed later in this section</i>					
Flooding	7	0.4	0	0	\$12,453,338	\$0
Tornado/Funnel Cloud	8/5	0.5/0.3	0	1	\$100,000	\$0
Thunderstorm/Hail	93/57	8.8	0	0	\$6,591,310	\$196,445
Wildfire/Forest Fire	<i>no NOAA-NCDC reports; discussed later in this section</i>					
Winter Storm/Extreme Cold	49/8	3.4	0	0	\$0	\$0
TOTAL	237	13.9	0	1	\$19,144,648	\$196,445

Sources: National Climatic Data Center (NCDC) <<http://www4.ncdc.noaa.gov/cgi-win/>>;

Reports and data may be regional in scope for some events; some events/storms may have multiple reports.

Damage estimates adjusted to 2009 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

The actual number of events and their impacts are likely significantly higher for many of the above hazards. For instance, a lightning event may not be reported unless there is related damage. And damages and expenses related to a natural hazard event often go unreported or are under-reported, in particular for smaller events where a disaster declaration has not occurred and crop damage which is fully covered by insurance. This data and its limitations are discussed in more detail for each hazard later in this document.

ii. Hazard Risk & Vulnerability Assessment Survey

Identification of the hazards for inclusion in the survey was based on the hazards identified in the *Resource Guide to All Hazards Mitigation Planning in Wisconsin* prepared by Wisconsin Emergency Management. This list was further modified and shortened based on NOAA historical data for Polk County.

As part of the 2006 planning effort, members of the Natural Hazards Mitigation Plan Steering Committee completed a *Natural Hazard Identification and Risk Assessment Matrix*⁸. Each person was asked to assign a risk rating (1-low, 2-moderate, or 3-high) to the various risk assessment criterion for that hazard. For each risk assessment worksheet, an average risk rating was then calculated for each of the identified hazards. A composite overall average risk rating for each hazard was then calculated by totaling the average risk rating from each respondent and dividing by the total number of respondents.

Shown in **Table 10** is the summary of overall average risk ratings for each hazard that was rated. None of the hazards exceeded a moderate (2.00) rating overall. For reference, the rating breakdown by risk assessment criterion (e.g., frequency, probability, business disruption, etc.) for each hazard can be found in the 2006 plan.

Table 10. Overall Average Risk Ratings

Hazard	Overall Avg. Risk Rating
Tornado/High Winds	2.00
Heavy Snow Storm	1.85
Blizzard	1.85
Ice Storm	1.78
Extreme Cold	1.70
Lightening Storms	1.63
Thunderstorms	1.58
Flash Flooding	1.58
Stormwater Flooding	1.48
Extreme Heat	1.45
Drought	1.45
Hail Storms	1.38
Fog	1.35
Dam Failure Flooding	1.33
Agricultural	1.30
Riverine Flooding	1.15
Forest Fires	1.10
Wildland Fires	1.10
Landslide	1.03
Lake Flooding	1.00
Coastal Hazards	1.00
Earthquake	1.00
Subsidence/Sinkholes	1.00

As a follow-up to Table 10, a survey was distributed to every Town Board as part of the 2006 planning effort to obtain additional input on the natural hazards impacting their respective communities. The results (**Table 11**) were consistent with those of Table 10.

Tornadoes, winter storms, and thunderstorms all ranked relatively high in both surveys, in large part due to their past frequency and probability of occurrence in the future. Flooding, especially river and spring flooding, ranked relatively low.

⁸ matrix taken from: Wisconsin Emergency Management. *Resource Guide to All Hazards Mitigation Planning in Wisconsin*. April 2003. p.10.

Table 11. Town Ratings of Natural Hazard Risks in Polk County

Hazard	Frequency of Occurrences in Past	Probability of Occurring in Future	Degree of Damage/Injury in the Past	Amount of Population or Property at Risk
Tornado/High Winds	1.67	2.13	1.43	1.2
Thunderstorms/Lightning	2.33	2.63	1.71	1.5
Winter Storms/Ice/Cold	2	2.63	1.57	1.3
River/Spring Flooding	1.33	1.38	1.14	1
Flash/Stormwater Flooding	1.5	1.63	1.29	1.17
Extreme Heat/Drought	1.57	1.86	1.33	1.2

iii. Polk County Natural Hazards Prioritization

The purpose of reviewing past frequency and severity data (Table 9) and rating the potential risks associated with each hazard (Tables 10 & 11) is to identify those hazards posing the greatest threat to residents and property. In discussing the hazards included in the 2006 plan, the steering committee determined extreme heat should be removed from the plan's scope, since past impacts of such events in the County have not been severe. It was also noted that the 2006 plan included no strategy recommendations which focused on extreme heat and it was felt that the options to mitigate extreme heat impacts in a largely rural county were limited. The steering committee and different stakeholders also suggested that the updated plan should place more emphasis on wildfire risks given development levels in wooded areas.

After a review of available data and consideration of the relationships between many of these hazards, the following natural hazards were identified by the steering committee to be the focus of the plan assessment, goals, and strategies:

- winter storms & extreme cold (includes heavy snow/blizzards, and ice storms)
- tornadoes
- thunderstorms (includes high winds, lightning, and hail)
- flooding (includes riverine, stormwater, and dam failure flooding)
- drought
- wildfire

Of the above hazards, only flooding and wildfire have geographic areas or locations of higher risk, as will be identified later in this section. It was also decided to include a special analysis on long-term power outages since this is a critical vulnerability which could be related to a number of natural hazard events (e.g., ice storm, tornado, heavy winds).

iv. Other Natural Hazards of No Significant Risk

Although there are other natural hazards that could potentially impact the County, there are very few or no records of the following events occurring in Polk County in the NOAA database. In order to meet the comprehensive requirements for developing an all hazards mitigation plan, these other natural hazards are identified and described below. It is important to note that these hazard events may still pose some threat to the community, but they were considered by the steering committee to either have a minimal chance of occurring, pose a minimal widespread risk to the safety of residents or property, or offer only very limited mitigation options.

Landslides & Land Subsidence

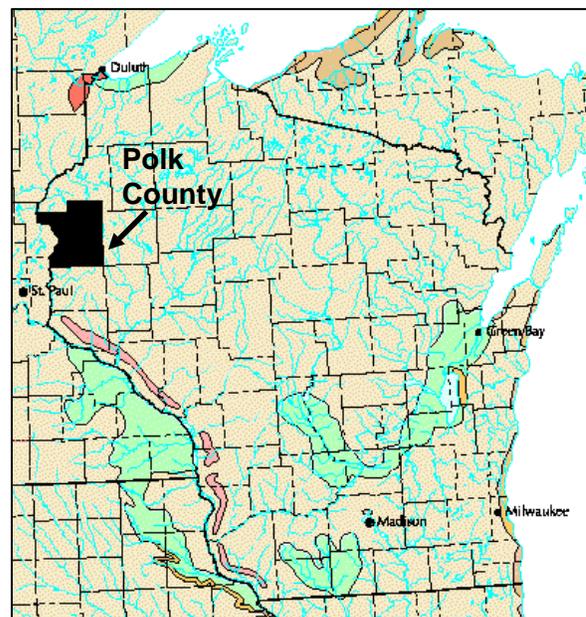
The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on a steep slope is the primary reason for a landslide, there can be other contributing factors. Erosion by surface waters or excess weight from rain, snow or man-made structures may stress weak slopes to failure. Slope material that becomes saturated with water may develop a debris flow or mudflow.

The USGS *Landslide Overview Map of the Conterminous United States*⁹ (excerpt for Wisconsin in **Figure 16**) identifies no large-scale landslide risks for the Polk County area.

According to the USGS topographic maps and U.S. Natural Resources Conservation Service soil maps for Polk County, there are 95,661 acres that potentially have a slope of 13 percent or greater representing 16.3% of the total Polk County land base. Of this, 31,105 acres (5.3% of Polk County) have slopes of 21 percent or greater. The majority of these steep slopes are located in the far western and far northern and far southern portions of the County. Additional localized and site-specific variations in topography and slope may exist. Past glacial activity has created some topography in Polk County that is scenic, but may also be very sensitive to development.

While there are steeper areas, the area's soils pose more of a gradual erosion risk, rather than the sudden, large-scale movement of ground associated with landslide hazards. Stormwater runoff has created serious riverbank erosion and washouts concerns for some locations, such as along the east banks of the St. Croix River of the Osceola area, which will be discussed in the flooding assessment.

FIGURE 16. Landslide Hazards in Wisconsin



source: U.S. Geologic Service. *Landslide Overview Map of the Conterminous United States*. <http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html>

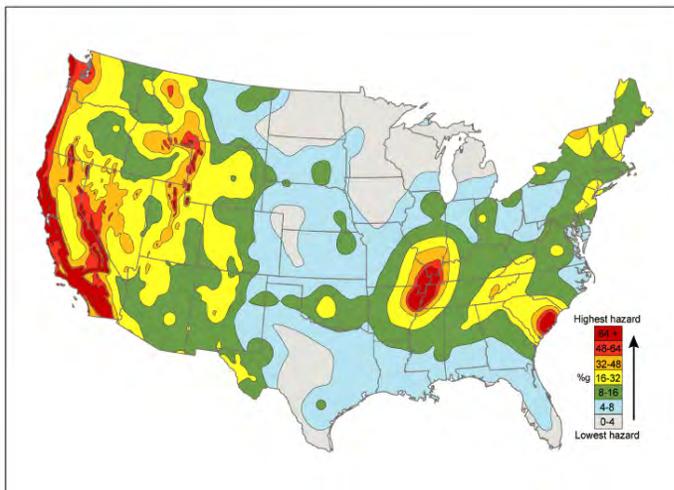
⁹ U.S. Geological Survey. *Landslide Overview Map of the Conterminous United States*. <http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html>

Land subsidence is an event in which a portion of the land surface collapses or settles. Common locations of subsidence are in areas having karst topography or in areas in which large quantities of groundwater have been withdrawn. Polk County is not an area of significant karst topography which could contribute to land subsidence. There are no records of substantial damage or injury from large landslides or land subsidence within Polk County.

Earthquakes

According to the U.S. Geological Survey, there have been 19 earthquake events in Wisconsin, with none noted for west-central Wisconsin. Where readings are available, these events were relatively small, most being 3.0-3.8 on the Richter Scale in size and the largest being an intensity of 5, which may be strong enough to crack some plaster, but not cause serious damage. Due to the lack of recent events, some geologists question whether many of these events were true earthquakes, but rather quarry collapses, blasts, etc.

Figure 17. U.S. Geological Survey Earthquake Hazard-Shaking Map



source: U.S. Geological Survey. *Earthquake Hazard in the Heart of the Homeland*. <<http://pubs.usgs.gov/fs/fs-131-02/CUSshazard.html>>.

The nearest active earthquake fault outside of Wisconsin is the New Madrid Fault which has a seismic zone that stretches from northeast Arkansas to southern Illinois. As **Figure 17** shows, the Polk County area falls within the lowest earthquake hazard-shaking area, with the different colors representing the levels of horizontal shaking that have a 1-in-50 chance of being exceeded in a 50-year period. Similarly, Polk County falls within a 0%g peak ground acceleration (PGA) zone as shown on the USGS PGA values map for the United States with a 10 percent chance of being exceeded over 50 years; Polk County is a non-affected area.¹⁰ The earthquake threat to Polk County is considered very low.

Fog

Fog is low-level moisture that can reduce visibility. It can occur in isolated low-lying areas or be a widespread event that can cover several counties. In general, fog is often hazardous when the visibility is reduced to 1/4 mile or less. Thick fog reduces visibility, creating a hazard to motorists as well as to air traffic. Airports may close because of heavy fog. The intensity and duration of fog varies with the location and type of fog. Generally, strong winds tend to prevent fog formation. In Polk County, fog occurs infrequently and is typically a short-term weather

¹⁰ U.S. Geologic Service. *Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years*. map. <<http://geohazards.cr.usgs.gov/eq/pubmaps/US.pga.050.map.gif>> November 1996.

event lasting only for portions of a day. The NCDC database only includes one dense fog record from November 19-20, 2007, which included Polk County.

Coastal Hazards (Hurricanes, Tsunamis, Tidalwaves, Waterspouts, etc)

Coastal hazards can cause increases in tidal elevations (storm surges), high winds, and erosion caused by tropical cyclones (such as hurricanes) or the sudden displacement of water (such as tsunamis from earthquakes). Polk County is located in the upper Midwest, approximately 1,000 miles from the Atlantic Ocean, 1,200 miles from the Gulf of Mexico, and 2,000 miles from the Pacific Ocean. Polk County also has no large inland lakes within its boundaries. Such coastal hazards have no direct impact on Polk County, and only occasionally indirectly impact the County in the form of thunderstorms which are discussed separately.

Extreme Heat

In contrast to other natural hazard events, the occurrence and impacts of extreme heat are often more difficult to recognize. Excessive or extreme heat is a slowly evolving phenomenon that can catch many people by surprise. Unlike tornadoes or thunderstorms that normally develop and occur more quickly and with more observable characteristics, a heat wave typically builds slowly over time. Because of this creeping effect, it is important for forecasters and officials to be constantly aware of heat and humidity conditions in order to properly warn and protect citizens.



Heat waves usually consist of high temperatures and high relative humidity. This combination makes it difficult for the human body to dissipate heat through the skin and sweat glands. Sweating will not cool the human body unless the water is removed by evaporation. High relative humidity retards evaporation and, thus, inhibits the cooling process. The National Weather Service (NWS) uses the heat index as a measure of the combined effects of high temperatures and high relative humidity, shown in **Table 12**.

**Table 12. Heat Index Table
(Heat Index Values in Degrees Fahrenheit)**

Temperature (°F)	Relative Humidity (PERCENT)								
	10	20	30	40	50	60	70	80	90
70	65	66	67	68	69	70	70	71	71
75	70	72	73	74	75	76	77	78	79
80	75	77	78	79	81	82	85	86	88
85	80	82	84	86	88	90	93	97	102
90	85	87	90	93	96	100	106	113	122
95	90	93	96	101	107	114	124	136	
100	95	99	104	110	120	132	144		
105	100	105	113	123	135	149			
110	105	112	123	137	150				
115	111	120	135	151					

Source: National Weather Service

Heat is the number one weather-related killer in the United States and Wisconsin. From 1979 to 1999, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined.

Although Wisconsin may not be thought of as a high risk area for deadly heat waves, every year the State of Wisconsin experiences a period or series of periods in which the temperature and humidity produce a heat index which could be harmful to human health. From 1986 to 2003, there were 197 deaths directly or indirectly attributed to heat in Wisconsin. The following are examples of recent heat wave events affecting Wisconsin:

- During the summer of 1995, two heat waves affected most of Wisconsin. Together, they resulted in 154 heat-related deaths and an estimated 300 to 400 heat-related illnesses. This makes the combined 1995 summer heat waves the biggest weather-related killers in Wisconsin for the past 50 years, far exceeding tornado deaths.
- In 1999, heat waves occurred on July 23rd-25th and 29th-31st. Collectively, these heat waves were directly and indirectly responsible for 20 deaths.
- Several heat waves from mid-July through early August 2001 claimed fifteen lives across Wisconsin. Additionally, it is estimated that 300 or more were treated at hospitals for heat-related conditions.

From 1993 to 2010, Polk County has experienced ten extreme heat weather events according to the NCDC database. While this averages to one event every 0.6 years, it is not uncommon to have multiple events reported in a single year (e.g., 1999, 2001). In addition, extreme heat events commonly last multiple days. All of the Polk County events were reported in the months of June, July, or August, except for one record warmth event on October 12, 1995.

To date, the NCDC database identifies no deaths or serious injuries within Polk County related to extreme heat, though deaths and injuries often go unreported to the database. However, temperatures in excess of 90°F pose a risk of heat-related illness and death, especially when humidity levels exceed 35 percent. The risk is highest for individuals who are suffering from chronic illnesses and for those who are not acclimated to these conditions. Most health-related illnesses involve the elderly, especially those residing in urban areas for which temperatures can be further elevated due to the urban heat island effect. However, people on certain medications, isolated individuals who live alone and seldom leave their home, infants and young children, persons with chronic heart or lung problems, overweight people, persons with disabilities, and people who work outside are also at greater risk during extreme heat events. Research findings strongly suggest that heat index values of 90 to 105 make sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity. Heat index values of 105 to 130 degrees make sunstroke, heat cramps, and heat exhaustion likely with prolonged exposure and/or physical activity. Shown in **Table 13** are the potential dangers associated with heat index temperatures.

**Table 13. Apparent Temperature Heat Stress Index
(Dangers Associated with Heat Index Temperatures)**

Category	Apparent Temperature (Heat Index - °F)	Associated Dangers
Caution	80-90°F	Exercise more fatiguing than usual.
Extreme Caution	90-105°F	Heat cramps, exhaustion possible.
Danger	105-130°F	Heat exhaustion likely.
Extreme Danger	Greater than 130°F	Heat stroke imminent.

Source: National Weather Service

Any time the temperature and humidity combine to produce a heat index that could cause health concerns for humans, the National Weather Service will issue various statements on heat conditions. For example, the NWS issues “Heat Advisories” when it expects the daytime heat index to equal or exceed 105° for 3 hours or more and the nighttime heat index equals or exceeds 80° for any 24-hour period. The NWS issues “Excessive Heat Warnings” when it expects the daytime heat index to equal or exceed 115° for 3 hours or more and the nighttime heat index equals or exceeds 80° for any 24-hour period. The NWS may issue an “Excessive Heat Watch” 24 to 8 hours in advance of anticipated heat wave conditions.

Currently, Polk County Emergency Management distributes educational information via local media on steps to minimize the impacts of extreme heat. In addition, the Polk County Aging Office also distributes similar educational information through its newsletter to the County’s elderly; and its meal delivery personnel help maintain watch over elderly clients who might be more at-risk of succumbing to the impacts of extreme heat.

Summer 2011 was accompanied by periods of extreme heat in Polk County and cooling shelters were designated in some communities. Demands for power were high as air conditioners worked overtime. And to the west in Minnesota, severe storms resulted in power loss for some areas. As such, this hazard was re-evaluated by the steering committee during the planning process for potential inclusion in the Risk and Vulnerability Assessment section.

While extreme heat is a concern for the residents of Polk County, widespread serious injuries or fatalities were deemed to be unlikely in the County. The steering committee recognized the risks and vulnerabilities of extreme heat to local residents, but believed current mitigation efforts were adequate to address these concerns and the risks were not significant enough to warrant a full analysis at this time. However, if changes to Wisconsin’s climate continue as discussed in the next sub-section, extreme heat risks and vulnerabilities may warrant more attention during the next or future plan updates.

v. Possible Hazard Impacts of Climate Change

When analyzing hazard risks, it should be remembered that the assessment is largely based on past weather events and existing development trends. Projecting future risks and vulnerabilities is also subject to the influence of possible large-scale, longer-term climatic changes.

There is ongoing debate over the existence, causes, severity, and impacts of global climatic changes, such as global warming. According to the U.S. Environmental Protection Agency:

“According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities.... Rising global temperatures are expected to raise sea level, and change precipitation and other local climate conditions. Changing regional climate could alter forests, crop yields, and water supplies. It could also affect human health, animals, and many types of ecosystems.... Most of the United States is expected to warm, although sulfates may limit warming in some areas. Scientists currently are unable to determine which parts of the United States will become wetter or drier, but there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils.”¹¹

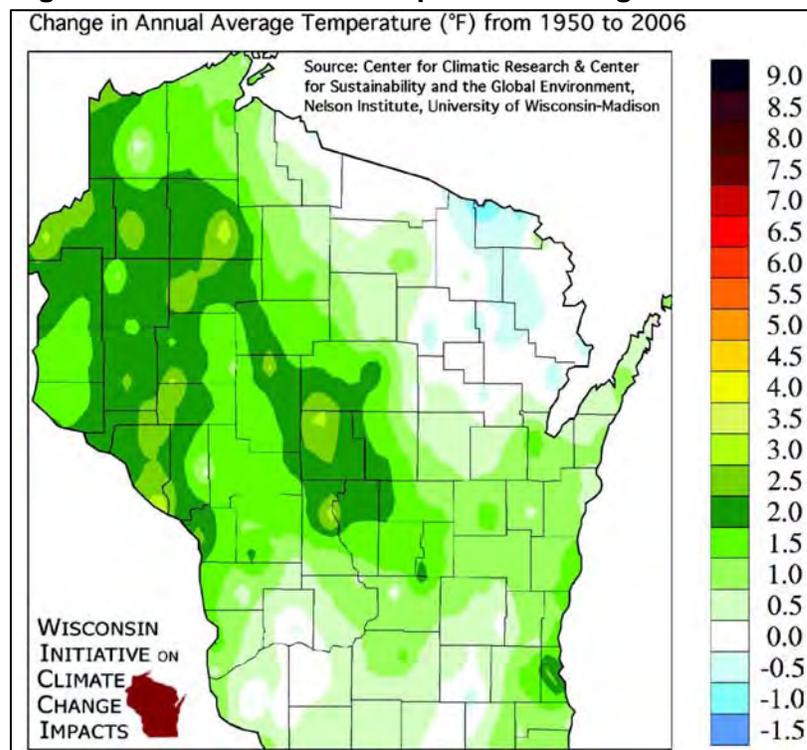
Regardless of the debate over the causes of climate change, there is clear evidence that Wisconsin's climate is indeed changing. The 2003 report entitled *Confronting Climate Change in the Great Lakes Region* published by the Union of Concerned Scientists and the Ecological Society of America projected that by 2030, summers in Wisconsin may resemble those in Illinois overall, in terms of temperature and rainfall. By 2100, the summer climate will generally resemble that of current-day Arkansas, and the winter will feel much like current-day Iowa.

To further document these climate changes and explore their impacts on our State, the Wisconsin Initiative on Climate Change Impacts (WICCI) was formed as a collaborative effort of the University of Wisconsin and the Wisconsin Department of Natural Resources.

The following are some of the key climatic trends being experienced in Polk County and Wisconsin according to the WICCI analysis (www.wicci.wisc.edu):

- Polk County's average temperatures are rising and are projected to continue to rise. **Figure 18** shows that the annual average temperature in Polk County

Figure 18. Wisconsin Temperature Change



¹¹ U.S. Environmental Protection Agency. <http://yosemite.epa.gov/oar/globalwarming.nsf/content/impacts.html>

has increased between 1.5° F and 2.5° F between 1950 and 2006. Between 1980 and 2055, annual average temperatures are projected to increase by about 6.5° F in the County.

- Polk County is experiencing more annual precipitation, and is expected to get wetter in the future, but there is significant seasonal and geographic variation to the precipitation. **Figure 19** shows that the annual average precipitation has increased in Polk County over the past fifty years overall, while **Figure 20** shows that summer precipitation has been remained unchanged or has been decreasing as one moves north. Overall, WICCI projects Polk County's annual average precipitation to increase by about 2.0 inches per year between 1980 and 2055.
- Heavy precipitation events are expected to increase in Polk County. Currently, northern Wisconsin experiences heavy precipitation events of two or more inches about seven times in a decade (once every 17 months). **Figure 21** shows that Polk County is projected to experience about 2.5 more heavy precipitation events per decade by 2055, which is a 36 percent increase for one event every 12.6 months.

These climatic changes, should they continue, have significant natural hazard implications. Most of our existing best practices and infrastructure are based on historic events and do not fully accommodate these climatic trends.

Increased temperatures would result in more frequent heat waves and evaporation of surface waters. Increased precipitation and heavy precipitation events would potentially result in more flooding. And keep in mind the seasonality of these changes. More precipitation during the winter months increases the potential for heavy snows and ice storms. And higher temperatures during the summer months could result in more frequent agricultural droughts and increasing demand for irrigation.

Such changes in climate could have some positive natural hazard impacts. For instance, the winter season would be shorter overall with fewer days of extreme cold. But other problems may also be exacerbated, such as plant and animal diseases and infestations, Lyme's disease, air quality changes, and decreasing water quantity.

Given the ongoing debate in the scientific community, it is not appropriate to debate the causes of climate change within this document. Regardless of the cause, it is important that Polk County officials and residents remain aware that the hazard trends presented in this report may change in the future; and, in some cases, the frequency and magnitudes of disaster events may intensify. Communities and residents should keep informed on climate change research and use their best judgment as to the most appropriate action and response. The WICCI webpage www.wicci.wisc.edu includes suggestions on how communities may prepare for and adapt to such changes.

Figure 19. Wisconsin Precipitation Change

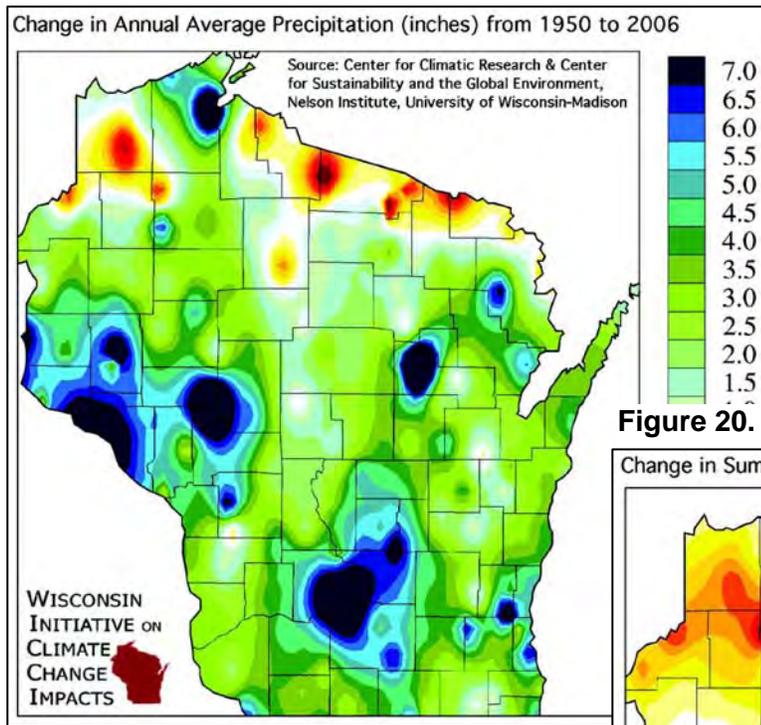


Figure 20. Wisc. Summer Precipitation Change

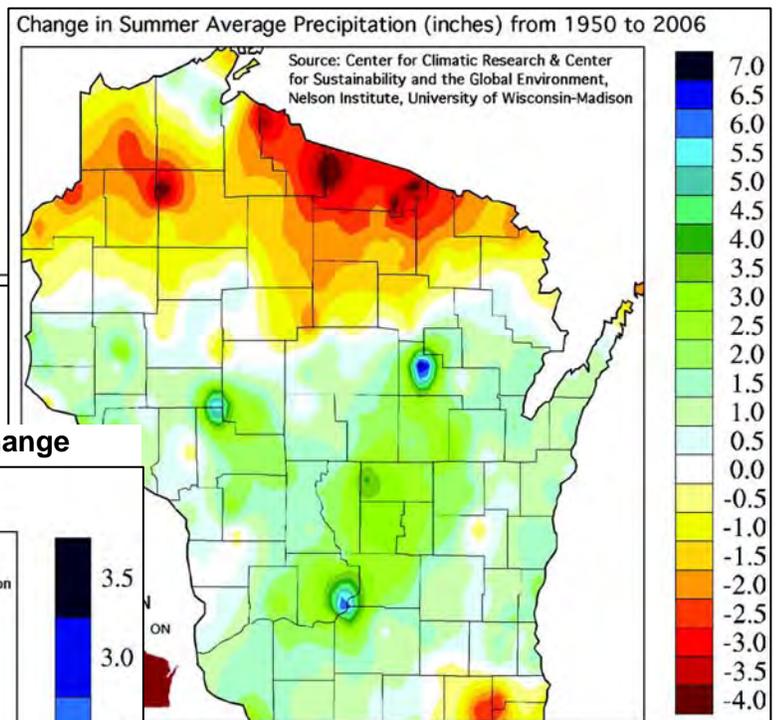
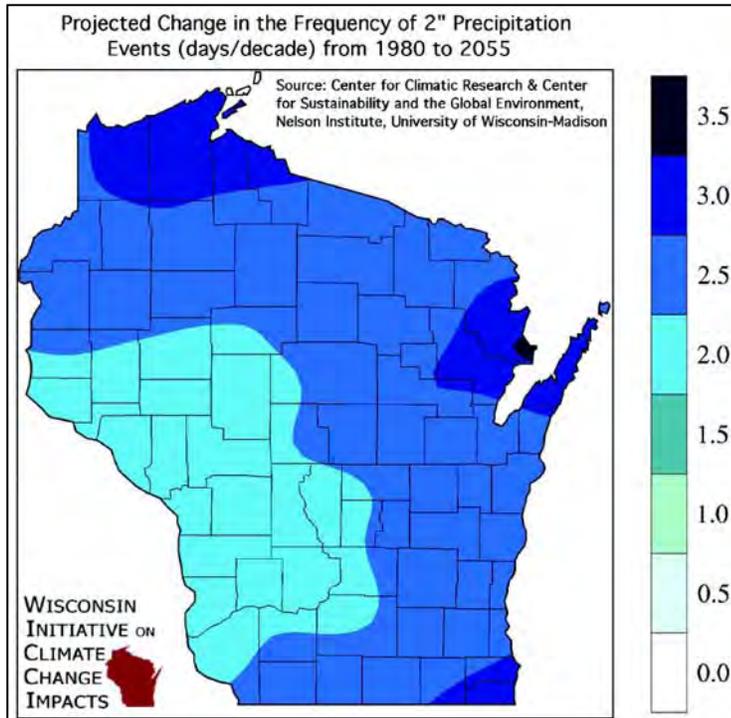


Figure 21. Wisc. Heavy Precipitation Change



B. RISK AND VULNERABILITY ASSESSMENT

This section is organized by the six natural hazards identified previously as having the highest overall disaster threat to Polk County. For the purposes of this plan, some hazards have been grouped into related hazard topics in order to better organize and describe the extent of the potential risk and vulnerability. For instance, the winter storms assessment includes extreme cold and ice storms.

The assessment for each of the six hazards generally includes the following sub-sections:

- **Summary** of risks, vulnerabilities, and issues.
- **Risk Assessment** defines the hazard, identifies past events, and discusses the probability of reoccurrence.
- **Vulnerability Assessment** assesses potential impacts to people, property, and critical facilities. The vulnerability assessment for critical facilities is expanded upon in **Appendix F**.
- **Unique Jurisdictional Risks and Vulnerabilities** analyzes the related hazard risks and vulnerabilities for participating cities and villages which are further expanded upon by the table and maps in **Appendix G**.

With the exceptions of flooding and, to some extent, wildfire, the natural hazard threats facing Polk County typically do not have defined hazard areas. Most events facing County residents often affect large areas, or are even county-wide, such as a drought or an ice storm.

Comments on the Special Threat Analysis – Long-Term Power Loss

Since multiple types of natural hazards could potentially result in long-term power loss in Polk County, the following seven pages provide a special, topical analysis. This approach allows additional attention to this critical threat, while avoiding undue repetition within the individual natural hazard assessments sub-sections (i.e., winter storms, tornadoes).

Keeping with the scope of this plan, only power outages related to natural hazard events are explored, though many of the same vulnerabilities would be shared regardless of the cause.

Special Threat Analysis – Long-Term Power Loss

Many of the highest-rated natural hazard events facing Polk County in Table 9 have the potential to cause an extended and widespread loss of electrical power. More specifically, above-ground power lines and transmission towers can be damaged by ice storms, heavy snows, tornadoes, and high straight-line winds. Elevated power lines in wooded areas have the greatest vulnerability. Such infrastructure can also be damaged by wildfire, lightning, and flooding, though the impacts are typically much more localized.

Risk Assessment – Long-Term Power Loss

Three natural hazard threats pose the biggest power loss threat within Polk County: a large ice storm, possibly in conjunction with heavy/wet snow; the high winds associated with unstable summertime weather patterns; or high winds during a blizzard. However, it is large ice storms which often pose the greatest threats due to the potential to affect entire regions during times of year when the vulnerabilities due to the loss of power are at their highest.

From 1993 through September 2010, there have only been two ice storm events reported for Polk County—one occurring in January 1994 and one in January 1996. Neither of these events resulted in large-scale, long-term power outages.

However, the risk of a long-term event is very real. For example, the March 1976 ice storm was one of the worst natural disasters to hit Wisconsin; Polk County was not one of the 22 counties which were part of this disaster declaration. Ice accumulations of up to five inches were reported, and high winds of 60 mph made the situation worse. Up to 100,000 people were without power at the height of this storm. Serious winter or ice storms in central Wisconsin also occurred in December 1904, February 1922, February 1936, and November 1943, though data on the impacts are limited.



In January 1998, an ice storm hit the Montreal area and left over four million residents without power. Some areas were without power for over three weeks. The January 2009 ice storm which hit Kentucky resulted in \$616 million

in damages, 36 fatalities, and 700,000 customers without power at its peak; 50,000 customers were still without power after two weeks, and it took 38 days for full restoration.

While the focus of power loss is often on ice storms due to their widespread nature, other natural events can also result in a sizable loss of power. In fact, high winds appear to be a more frequent cause of widespread loss of power due to a natural hazard event. In July 1991, a particularly violent and widespread straight-line wind (or derecho) lasted 17 hours and stretched from South Dakota to western Pennsylvania, including parts of Wisconsin. This event caused over \$100 million in damage and resulted in power loss to nearly one million customers. A similar event in May 1998 which blew through central Wisconsin resulted in at least \$500 million damage; and over two million people were without electrical power, some for over 10 days. Other wind events have resulted in localized power losses in Polk County, though the long-term loss of power exceeding 48 hours is quite rare and has been limited to a very small number of customers in recent history.

There are three primary electrical providers in Polk County:

- Polk-Burnett Electric Cooperative (serves approximately 53% of the County area)
- Xcel Energy (serves approximately 23% of the County area)
- Northwestern Wisconsin Electric Co. (serves approximately 23% of the County area).

The remainder of the County area is served by three additional cooperatives (Barron Electric, St. Croix Electric, and Dunn Electric) and the Centuria Municipal Utility.

While Polk County has not recently experienced a long-term power outage event, a look at the recent causes of power outages for Polk-Burnett Electric provides further insight into the potential risk. The numbers in **Table 14** are for the full Polk-Burnett Electric Cooperative which includes significant coverage in adjacent counties, especially within Burnett County to the north.

Table 14. Polk-Burnett Electric Cooperative Power Outages • 2007-2009

Outage Cause	# of outages				# customers affected	# outage hours
	2007	2008	2009	Total		
Tree	193	199	79	471	17,579	40,856
Weather	67	69	20	156	1,825	3,534
All Other	1,574	1,329	1,264	4,167	106,377	86,720
Total	1,834	1,597	1,363	4,794	125,781	131,110

source: Polk-Burnett Electric Cooperative, 01/28/11

The above table shows that a very small percentage of outages—less than five percent—were directly caused by weather, such as ice damage and lightning strikes. An additional eleven percent were tree-related (non-human) such as tree limbs falling upon power lines. Many of these tree-related outages may also be related to weather, such as high winds, heavy snow, or ice. Within the “All Other” category in Table 14, some of the causes were unknown or not available; it is possible that a small number of these may also be weather-related.

Perhaps more notable is that the tree- and weather-related outages typically affected more customers for more time than the combined “all other” causes. While an average of 26 customers were affected by an “all other” outage, 31 customers lost power for the average tree/weather outage. And the average tree/weather outage had more than triple the lost customer hours than that of an “all other” outage—70.8 total customer hours without power per outage compared to 20.8 hours, respectively.

In summary, a widespread, long-term power outage event covering most or all of Polk County would be rare, but the potential does exist. Based on discussions with personnel from area electric providers, it is estimated that only about five or six long-term power outage events have likely impacted the region during the past century, but these have not approached the scale of the 1976 Wisconsin, 1998 Montreal, or 2009 Kentucky outages.

Vulnerability Assessment – Long-Term Power Loss

While rare, the impacts and costs of a long-term power outage event can be tremendous. Extended power loss in Polk County due to a natural storm event would likely involve many downed trees and power lines. Downed lines present safety hazards for residents, travelers, and emergency responders. Response can be further hampered by blocked roads from power lines and debris.

Replacement costs for power lines vary based on physical site conditions, but are approximated as follows:

Single Phase – Overhead (Rural):	\$42,000/mile
Single Phase – Underground (Rural):	\$35,000/mile
Single Phase – Underground (Lake):	\$60,000/mile
Three Phase – Overhead (Rural):	\$82,000/mile
Three Phase – Underground (Rural):	\$100,000/mile

Estimated mileage of the elevated power lines in Polk County are not available. There is over 3,300 miles of line in the entire Polk-Burnett system with approximately 1,871 miles (56%) of overhead line. Given the above replacement costs, the potential

damages to overhead power lines from a severe storm event in Polk County could easily be in the millions.

With forest the predominate land cover over approximately one-third of Polk County (*see Section II.D.*), a significant portion of these overhead lines are most at risk of damage due to falling trees or limbs. Polk-Burnett Electric Cooperative identified the lakes region within the towns of Bone Lake, Milltown, Balsam Lake, Johnstown, and Georgetown as being the most susceptible to power loss during high winds due to development density and the number of trees as shown in **Figure 22**.

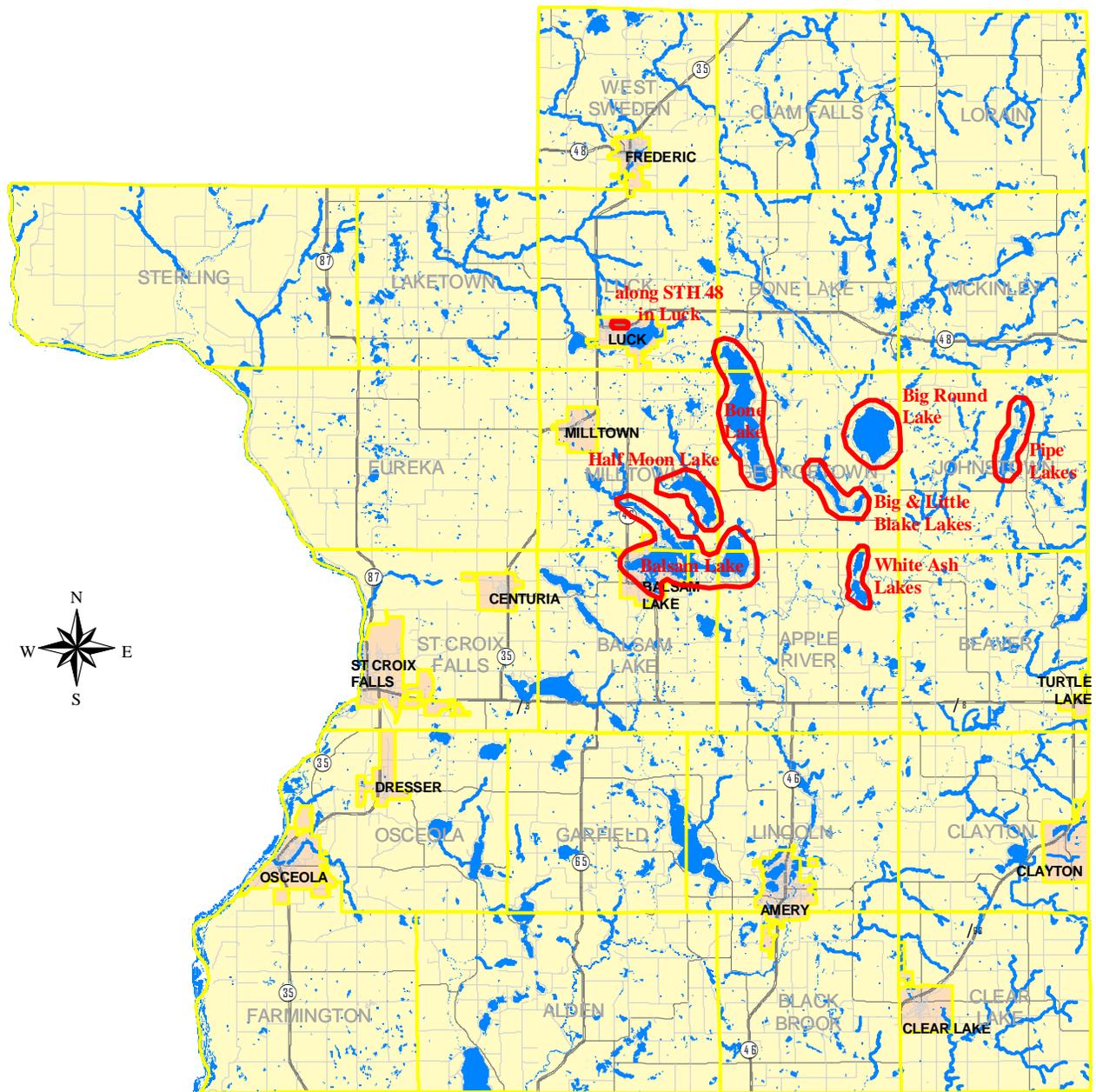
Residential neighborhoods with older trees or built within wooded areas of cities and villages can also be vulnerable to outages. During the planning process, the Village of Luck was the only city or village which identified a specific neighborhood or “hotspot” that was particularly prone to repetitive power outages. The Village of Milltown did express a need for an electric hook-up for a generator at the community center and a generator for the community club. The villages of Balsam Lake and Centuria also identified a need for an emergency generator.

Electrical providers in the County have buried some electric lines in the most at-risk areas. And some local electric providers have a policy of moving toward all below-ground power lines through attrition and as part of annual work plans. Polk-Burnett Cooperative has been actively converting overhead facilities to underground since 2004, in particular around the lakes within their system.

The loss of power due to falling limbs has been further significantly mitigated through proactive, aggressive tree-trimming programs by the electric providers serving Polk County. But even with such efforts, many wooded and lakeshore areas are still prone to power outages.



Figure 22. Areas Prone to Power Loss Due to Storm Events



"Hotspot"

The above identified areas (or "hotspots") were identified by communities, Polk-Burnett Electric Cooperative, and other stakeholders as being particularly prone or vulnerable to a power loss due to a storm event.

Given recent experiences elsewhere, it is not unrealistic to imagine a significant portion of the County's population and facilities could be without power for one to three weeks should a 50- or 100-year event occur. Following the 2009 Kentucky storm, 37 percent of affected customers were still without power after one week and seven percent were without power after two weeks. During the Kentucky event, carbon monoxide from improper generator use was the largest cause of death. But it must be remembered that the potential impacts for Polk County could be much more severe—Kentucky's temperature warmed well above freezing following their ice storm. In comparison, Amery's daily mean January temperature of 9.3°F¹² could prove quite deadly should power be lost and transportation systems hindered for an extended time. This is discussed more in the winter storms assessment.

Long-term power outage (LTPO) planning has been receiving increased attention in Wisconsin during the past three years. Realizing the seriousness of this threat, Polk County Emergency Management and other local stakeholders participated in a series of regional-level workshops and tabletop exercises in 2010 on this topic. Based on these workshops and exercises, the following groups and critical facilities were identified as being especially vulnerable or important during a long-term power outage event:

- Independent Special Needs Populations
- Assisted Living Facilities and Hospitals
- Municipal Utilities and Emergency Fuel
- Emergency Response Providers, Communications, & Operations Centers
- Emergency Shelters and Food Distribution Sites (i.e., schools)

Overall, Polk County is a relatively rural county posing challenges to public communication, response, and recovery, including the provision of services to independent populations who may have special needs during a LTPO event (e.g., dialysis, oxygen/ventilator, medicines).

Seniors living alone in rural areas are of special concern. In 2005, Polk County had an estimated 6,860 residents ages 65 and over. This number is expected to more than double by 2030. In July 2010, the Polk County Aging Office provided “meals-on-wheels” services to 110 different clients on an average day, many of whom reside alone. In total, the Aging Office provides 35,000 meals per year, of which 70-75 percent are home delivered. Many seniors also take advantage of the meals and

¹² National Climatic Data Center. Amery Station Climatology, 1971-2000.
http://cdo.ncdc.noaa.gov/climate_normals/clim20/wi/470175.pdf

services provided at one of the five County meal sites or from adult day care services, and may not be prepared for the loss of these services during an event.

Polk County Aging, Public Health, and Emergency Management have cooperatively developed a registry to identify and reach out to independent special needs populations for times of emergency. Participants are self-registered by themselves, a family member, or friend. Continued efforts are underway to increase the visibility of this program.

As of December 2010, Polk County also had five nursing homes and twenty other long-term care facilities (i.e., assisted living, adult family homes, CBRFs), most of which are believed to be without emergency power generation. During a LTPO event, most of these facilities would initially shelter-in-place, though medicine, equipment, and municipal water and sewer would become very serious concerns after the first 24-48 hours if power is not restored. The recent LTPO exercises have increased attention to these concerns. During the planning effort, the County Aging Department noted that some of these long-term care facilities have begun to develop more detailed emergency plans. Yet some are also approaching County offices looking for model LTPO plans for their facilities (which are not currently available through the County) and with expectations of County emergency and evacuation support (which may not be available during an event).

The availability of emergency power generators for utilities, communications, shelters, emergency operations, fuel sources, and critical facilities is crucial to mitigating the potential impacts of a LTPO event. Further, demands may be high on limited fuel sources for response vehicles, electric crews, and power generators.

In short, a long-term, widespread power outage is one of the greatest natural hazard vulnerabilities facing Polk County. As the Kentucky experience shows, total costs in response and damages can be in the tens of millions or greater. And significant threats to life and safety exist due to downed lines, fire, improper generator use, loss of access to medical treatments, extreme cold, and loss of food and other utilities.

The lessons learned from the recent LTPO workshops and exercises have been integrated into a state-level report which is available at the Wisconsin Emergency Management website. The recommendations of the State report were considered during this hazard mitigation planning effort and, when appropriate, have been integrated into the mitigation strategies found later in this document.

i. Tornadoes

Tornadoes are typically linked with severe thunderstorm events. It is sometimes difficult to determine the difference between the impacts of a tornado versus very high winds. As such, the discussion in this subsection includes significant overlap with the thunderstorm assessment.



Summary—Tornadoes

Risk – Relative to other parts of the State, Polk County has a moderately high frequency of reported tornado events. Since 1950, there have been 21 tornado reports for Polk County, resulting in four deaths, 18 injuries, and over \$54 million in property damage. All four of the deaths and the far majority of the injuries and damages are the result of two tornado events in 1952 and 1953. It is expected that a tornado will continue to be reported for Polk County once every two to three years.

Vulnerabilities – Tornadoes and high winds can have similar impacts, though tornadoes have the potential to be more devastating and violent for a smaller area. All structures and critical facilities are vulnerable, but especially large span buildings, unanchored trailer homes, campgrounds, structures with substantial numbers of people (e.g., schools, hospitals), and residents without access to a storm shelter or safe room. Above-ground utilities are also vulnerable. Based on trends since 1950, average annual property, injury, and death losses for Polk County were estimated at \$1,138,010 due to tornado events and approximately \$92,441 for thunderstorm-related high winds.

1. Overall, the risks and vulnerabilities related to tornadoes and high winds for Polk County are not unique and not site-specific. Measures to mitigate will largely focus on emergency preparedness, storm shelters, notification systems, and related education.
2. In 2000, Polk County had 2,068 trailer homes (10% of all housing units). Few regulations exist which require the designation of storm shelters or emergency planning for mobile homes parks or rental apartment buildings.
3. All but three incorporated municipalities currently have a public storm shelter, though four other communities may need alternative or additional sites in the future. Most current shelters are located on property not owned by the municipality with no formal shelter agreement or policies.
4. No formal plans, emergency siren, or designated storm shelter are in place at the Apple River County Park campground for severe weather. There may be municipal campgrounds with similar needs. Overall demand for shelters at campgrounds and resorts was low during the planning process.

5. Many other areas of the County have significant resort development and seasonal housing. Many of these resorts do have a designated storm shelter, though many seasonal homes lack basements or access to a shelter.
6. Overhead power lines in wooded areas are especially vulnerable to high winds. Related risks and vulnerabilities were previously discussed in the *Special Threat Analysis—Long-Term Power Loss* section.
7. The majority of the existing warning sirens do not have battery back-up. A number of cities and villages are in need of additional sirens or to replace aging equipment. Sirens were also identified as a need for a number of unincorporated areas where a concentration of residential development exists.

Risk Assessment—Tornadoes

The Hazard

Tornadoes are relatively short-lived local storms composed of an intense rotating column of air, extending from a thunderstorm cloud system. It is nearly always visible as a funnel, although its lower end does not necessarily touch the ground. Average winds in a tornado, although never accurately measured, are between 100 and 200 miles per hour; however, some tornadoes may have winds exceeding 300 miles per hour.

For reference, the following are the National Weather Service definitions of a tornado and funnel cloud:

Tornado - A violently rotating column of air that is touching the ground.

Funnel Cloud - A rapidly rotating column of air that does not touch the ground.

A tornado path averages four miles, but may reach up to 100 miles in length. Widths average 300 to 400 yards, but tornadoes have cut swaths a mile or more in width. Severe tornadoes, or groups of two or three funnel clouds, can also travel together. On the average, tornadoes move between 25 and 45 miles per hour, but speeds over land of up to 70 mph have been reported. Tornadoes rarely last more than a couple of minutes over a single spot or more than 15 to 20 minutes in a ten-mile area, but their short periods of existence do not limit their potential devastation. Though similar in potential impact, high-wind events, straight-line winds, derechos, and downbursts are defined within the thunderstorms sub-section.

Shown in **Table 15** is the Enhanced Fujita (EF) Scale, recognized as the accepted tornado magnitude measurement rating and is based on damage estimates for a 3-second wind gust.

Table 15. Tornado Magnitude Measurement Enhanced Fujita (EF) Scale

Operational EF-Scale	Wind Speed (miles per hour)	Character of Damage	Relative Frequency (percent)
EF0 (GALE)	65-85	Minor or No Damage	53.5
EF1 (WEAK)	86-110	Moderate Damage	31.6
EF2 (STRONG)	111-135	Considerable Damage	10.7
EF3 (SEVERE)	136-165	Severe Damage	3.4
EF4 (DEVASTATING)	166-200	Devastating damage	0.7
EF5 (INCREDIBLE)	Over 200	Extreme damage	<0.1

Source: National Oceanic Atmospheric Administration (NOAA)

The EF scale replaced the original Fujita scale in 2006 and takes into account 28 different damage indicators for a more accurate indication of tornado strength. The new EF scale does have higher wind speed thresholds, and a larger percentage of reported tornadoes will likely fall within the EF0 category. A lower percentage will fall in each of the higher categories. None of the tornadoes recorded on or before January 31, 2007, will be re-categorized.

The following types of damage could be expected for each EF-Scale tornado:

- F0** Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees.
- F1** Peels surface off roofs; mobile homes badly damaged or overturned; moving autos pushed off roads; attached garages may be destroyed.
- F2** Roofs torn off well-constructed homes; mobile homes demolished; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
- F3** Entire stories of well-constructed homes destroyed; trains overturned; trees debarked.
- F4** Well-constructed houses leveled; cars thrown and large missiles generated.
- F5** Strong frame houses lifted off foundations and carried considerable distances; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

The destructive power of the tornado results primarily from its high wind velocities and sudden changes in pressure. Wind and pressure differentials probably account for 90 percent of tornado-caused damage. Tornadoes are generally associated with severe storm systems which are often accompanied by hail, torrential rain, flooding, and intense lightning.

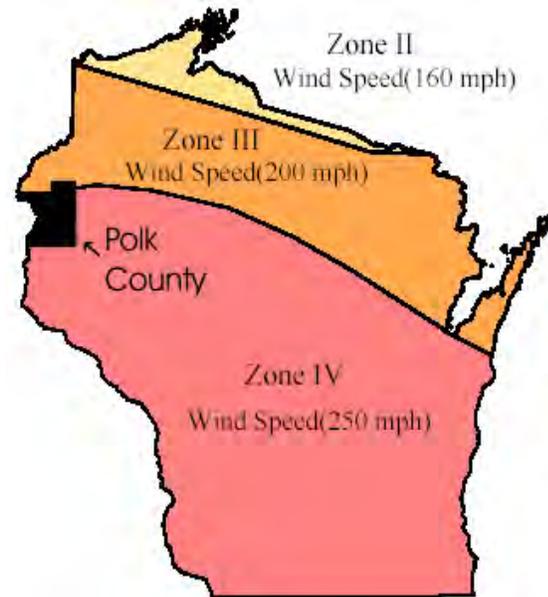
Regional Trends

On the basis of 40 years of tornado history and more than 100 years of hurricane history, the United States has been divided into four zones that geographically reflect the number and strength of extreme windstorms.

Zone IV has experienced the most and the strongest tornado activity with wind speeds of up to 250 mph, and includes nearly all of Polk County (see **Figure 23**).

Wisconsin lies along the northern edge of the nation's maximum frequency belt for tornadoes (known as "tornado alley") which extends northeastward from Oklahoma into Iowa and then across to Michigan and Ohio. Generally, the frequency and severity of tornado events decreases as one travels north.

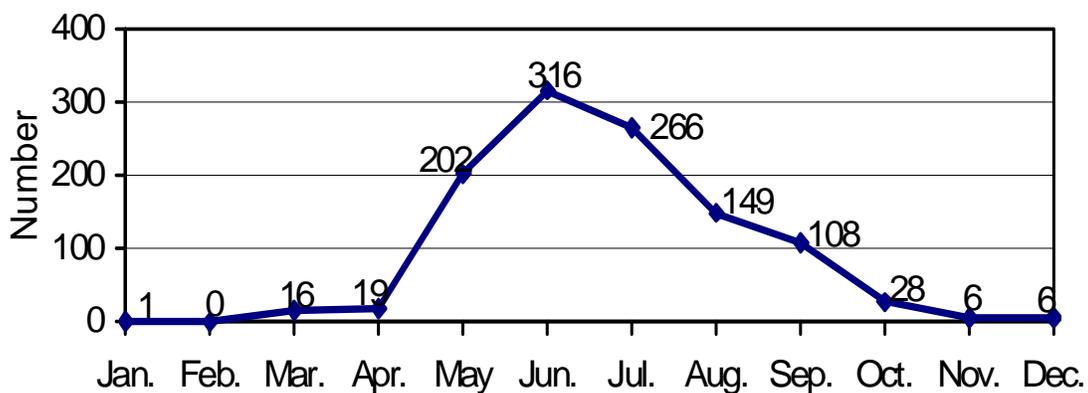
FIGURE 23. Design Wind Speed Map of Wisconsin



adapted from "Design Wind Speed" map from FEMA's "Taking Shelter from the Storms: Building a Saferoom in Your House"

Tornadoes have occurred in Wisconsin in every month except February, as shown in **Figure 24** below:

Figure 24. Wisconsin Tornado Events by Month • 1844 to 2001

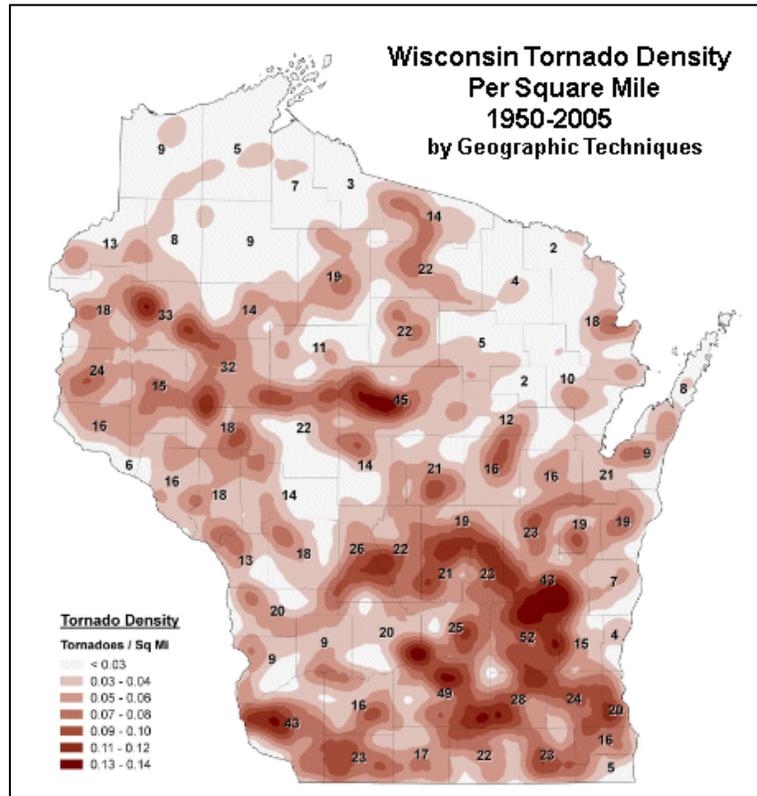


Wisconsin's tornado season runs from the beginning of April through September. The most severe tornadoes typically occur during April, May, and June. Many tornadoes strike in late afternoon or early evening. However, tornadoes have occurred during other times of the day. Personal property damage, deaths, and injuries have and will continue to occur in Wisconsin.

Figure 25 to the right shows that the Polk County area has a moderate tornado density, with only eighteen reported tornadoes between 1950 and 2005.

The potential destructiveness of tornadoes remains fairly fresh in the minds of many Polk County residents due to two recent and substantial tornado events in the region. On June 18, 2001, an F3 tornado with a 27-mile path hit the Village of Siren approximately five miles to the north, resulting in three deaths, 16 injuries, 167 destroyed homes, and 280 damaged homes. More recently, about 50 miles east of Polk County, an F3 tornado hit the City of Ladysmith on September 2, 2002, injuring 37 and resulting in over \$20 million in damage. Many long-time residents of the region also recall the devastating Colfax Tornado of 1958 which had a 32-mile path, caused at least 19 deaths, and resulted in severe damage. However, such events were mentioned much less frequently during the update of this plan compared to similar planning efforts in the region two to three years ago, demonstrating that past events can quickly fade from memory.

Figure 25. Wisconsin Tornado Density • 1950 to 2005



Local Events

According to Wisconsin Emergency Management, there have been 34 tornadoes reported for Polk County between 1844 to 2007. Only seven other Wisconsin counties reported more tornadoes during this timeframe, including Barron County immediately to the east with forty reports.

From 1950 through September 2010, there have been 21 tornado events reported for Polk County as shown in **Table 16**. However, some events have likely gone unreported if not confirmed or the impacts were not significant, in particular for the funnel cloud events for which data was not been kept until 1993.

Since January 1993, there have been eight tornado and five funnel cloud event reports for Polk County. This averages to one tornado event report approximately every 2.1 years, though one storm system can spawn multiple tornadoes or there can be multiple reports for a single tornado. Funnel cloud reports are less frequent, with about one such report every 3.4 years.

**Table 16. Tornado Events • 1950 to Sept 2010
Polk County**

Location	Date	Time	Mag	Deaths	Injuries	Property Damage	Crop Damage
Tornado Events							
Polk Co. (not specified)	6/23/1952	2130	F3	2	6	20,018,208	0
Polk Co. (not specified)	5/10/1953	1910	F2	2	9	19,868,258	0
Polk Co. (not specified)	7/10/1966	1900	F2	0	2	1,637,292	0
Polk Co. (not specified)	6/12/1967	845	F2	0	0	158,827	0
Polk Co. (not specified)	7/30/1968	2100	F1	0	0	1,524,375	0
Polk Co. (not specified)	7/26/1969	2000	F1	0	0	144,546	0
Polk Co. (not specified)	8/8/1973	1700	F1	0	0	1,194,780	0
Polk Co. (not specified)	10/9/1973	100	F1	0	0	119,478	0
Polk Co. (not specified)	7/30/1977	1728	F3	0	0	8,753,837	0
Polk Co. (not specified)	5/9/1980	1330	F0	0	0	7,725	0
Polk Co. (not specified)	8/3/1981	1430	F0	0	0	58,359	0
Polk Co. (not specified)	8/3/1981	1435	F0	0	0	58,359	0
Polk Co. (not specified)	4/26/1984	2125	F1	0	0	510,570	0
Centuria	7/9/1999	11:41 AM	F0	0	0	0	0
Balsam Lake	7/9/1999	11:52 AM	F0	0	0	0	0
Clam Falls	7/8/2000	5:40 PM	F0	0	0	0	0
Luck	8/14/2000	7:35 PM	F0	0	0	0	0
Clear Lake	6/11/2005	1:40 PM	F0	0	0	0	0
Milltown	5/26/2007	15:44 PM	F0	0	0	0	0
East Farmington	5/25/2008	16:17 PM	F0	0	0	0	0
Luck	8/7/2010	22:37 PM	F0	0	1	100,000	0
Funnel Cloud Reports							
Range	6/7/2005	3:24 PM	N/A	0	0	0	0
Clayton	6/7/2005	3:53 PM	N/A	0	0	0	0
Amery	6/7/2005	4:26 PM	N/A	0	0	0	0
Clam Falls	5/26/2007	16:13 PM	N/A	0	0	0	0
Range	7/20/2010	17:15 PM	N/A	0	0	0	0
26 reports				4	18	\$54,154,614	none reported

source: National Climatic Data Center (NCDC)

Damage estimates in 2009 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

The tornado events reported in Table 16 have resulted in four deaths, eighteen injuries, and over \$54 million of estimated property damage in current dollars. No associated crop damage was reported. All but two the tornadoes occurred during the months of May through August. The far majority of the events occurred between the hours of 2:00 PM and 10:00 PM.

The frequency of tornado events does not necessarily equate to more deaths, injuries, and property damage. Barron County has had 38 tornado events reports compared to Polk County's 21 for the same timeframe, but Barron County had no deaths, fewer injuries, and about half as much reported damage.

Also notable is that all of the deaths, almost all of the injuries, and over 70 percent of the damages in Table 16 are associated with two events in 1952 and 1953. In June 1952, a tornado left an eight-mile path of destruction from Centuria to Half-Moon Lake near Half-Moon Lake north of Balsam Lake. A dozen homes in the Village of Centuria were destroyed and two resorts were struck. In May 1953, high winds and tornadoes struck the western part of the State. A farmer in the Amery area and a young girl near Frederic were killed due to barn collapses. Temporary power and communication outages in the surrounding areas accompanied both of these events.

These facts demonstrate that the total impacts in Table 16 can change dramatically depending where a tornado should strike.

Relative Level of Risk

In the 2006 plan, the Polk County steering committee rated tornadoes as the highest natural hazard concern. This is likely due to the potential destructiveness of such events, the possibility of a tornado touchdown anywhere in the County, and the recent history of tornado events in the region (e.g., 2001 Siren tornado). **It is probable that a tornado will continue to touch down and be reported for Polk County once every two to three years. Funnel clouds will continue to be reported at a similar rate, though they are likely more frequent in occurrence.**

Although the improvement of technology has enabled meteorologists to better identify and predict the conditions that are favorable for tornado development, there is no precise way to predict the formation, location, and magnitude of a tornado. And, there is no predictable pattern that can be used to accurately predict future tornado events.

Vulnerability Assessment—Tornadoes & High Winds

Due to the potential impacts similar to those of tornadoes, high wind vulnerabilities are discussed within this section, though their risk assessment (e.g. history, frequency) is discussed with thunderstorms.

from The Rhinelander Daily News,
June 24, 1952

Dozen Homes Demolished in Village of Centuria

By The Associated Press

A tornado slashed across Wisconsin's Indianhead county last night in the wake of violent electrical storms, killing at least two persons in Polk County when it smashed at the village of Centuria.

The dead

Irvin Koshatka, 36, killed in the basement of his father's home when the tornado lifted the house from its foundation and drove it against a tree.

Martin Walker, 62, killed while sitting in his living room when the tornado blasted his house to fragments.

At least three other persons were injured critically. They were 2-months-old Marjorie Kashatka, a niece of Irvin's, visiting with her family from Cass Lake, Minn.; Mrs. Martin Walker and Frank Sonderlik, 80, who was struck by a falling tree.

A dozen homes in the village were demolished by the tornado, which struck at 9:30 last night and left giant foot steps of destruction across an eight mile path from Centuria to Half-Moon Lake near Milltown. Two resorts were struck at the lake, and at least one vacationing family was left out in the storm when a cabin was destroyed.

Reports of the loss in life and property damage were slow to come in because telephone and utility lines were down all over the area. Centuria was without water overnight until an emergency pump was rigged today.

O. W. Peterson, president of the Centuria State Bank, said the tornado cut a 75-foot swath across the village.

The electrical storms both preceded and followed the tornado elsewhere in the area. At Superior,

Did you know?

The eighth deadliest tornado in U.S. history occurred in the City of New Richmond in June 1899 with 117 confirmed deaths and more than 200 injured.

Potential Impacts

Tornadoes and high winds have no defined hazard area within Polk County. Due to the unpredictable nature of tornadoes and lack of specific hazard areas, the assessment of potential community impacts as a result of a tornado is difficult to quantify.

Tornadoes and high winds are capable of killing or injuring residents and damaging or destroying homes, businesses, public buildings, and infrastructure. This destruction can occur as a result of high winds or by airborne debris that can be carried by the tornado. Tornadoes can uproot trees and topple power lines, impacting the supply of electrical service to local homes and businesses. Roadways can also be blocked by debris, and debris can accumulate in rivers or stormwater systems and contribute to washouts or flooding.

All above-ground structures are vulnerable to a tornado or strong high winds. As discussed previously, Polk County has about \$3 billion in assessed improvements and personal property, most of which would be vulnerable during such events. This total does not include structures located on tax-exempt properties such as municipal buildings, churches, and certain utilities.

Further, damaged buildings may pose additional safety concerns due to structural instability, damage to electrical systems, or gas leaks. Specific data on the structural condition of buildings in Polk County is not available. In 2000, only about 21 percent of the County's housing stock was built in 1939 or earlier, but this does reflect condition and older structures are often more likely to have basements compared to new construction in some areas.

In addition to direct impacts to buildings, economic losses can be experienced when a business sustains direct damage from the event or when supporting infrastructure (e.g., utilities, services) are not available for extended periods. Such a business closure may be temporary, but could have large impacts on the local economy and related services, while some smaller or struggling business may fail.

Based on a review of the community and past tornado impacts, it was determined that the following general types of properties are especially vulnerable to tornado and high wind events:

- Mobile homes, especially those which are unanchored
- Homes with crawlspaces (elevated and more susceptible to lift)
- Buildings with large spans (e.g., airport hangars, pole barns, gyms, factories)
- Residents in slab-on-grade structures without access to a safe-room or storm shelter
- Campgrounds, trailers, and resort properties without storm shelters
- Above-ground power lines, especially in wooded areas
- Critical facilities and historic sites, due to their high value to the community

Mobile homes, in particular, are vulnerable to tornado and high wind events. According to the National Weather Service, between 1995 and 2002, there were 415 tornado fatalities in the

United States. Forty-one percent (41%) of these fatalities occurred in mobile homes, which constitute just 7.5 percent of the nation's housing supply.

As discussed previously, Polk County had 2,068 mobile homes in 2000 constituting ten percent of the total housing supply, more than double the State average. **Figure 22** on the following page shows the locations of eighteen mobile home parks in Polk County. According to the Wisconsin Department of Commerce, there are 27 licensed manufacturing housing communities in Polk County. The difference between the numbers is primarily due to numerous resorts being licensed, but discrepancies between the data sources do exist. Nearly all of the parks in Figure 22 are located within cities or villages. And to the knowledge of local officials, nearly all of the mobile home parks in Polk County do not offer an on-site storm shelter. All incorporated municipalities, except Centuria, Dresser, and St. Croix Falls, have a storm shelter available for the public.

Throughout most areas of the region, new mobile home development is minimal. In fact, the number of mobile homes may be decreasing in some areas. Other types of manufactured or pre-fabricated homes have become a preferred option of affordable housing. These units are typically well-secured to a permanent foundation, but usually lack a basement or safe room for a storm shelter. Data on homes with crawlspaces or without basements is currently not collected as part of the Federal census and is not available. During the planning process, it was stated that new residential development in Polk County has typically included a basement or crawlspace. This is contrary to many surrounding counties which have experienced a high percentage of slab-on-grade construction during the past decade.

Did you know?

25% of businesses do not re-open following a major disaster.

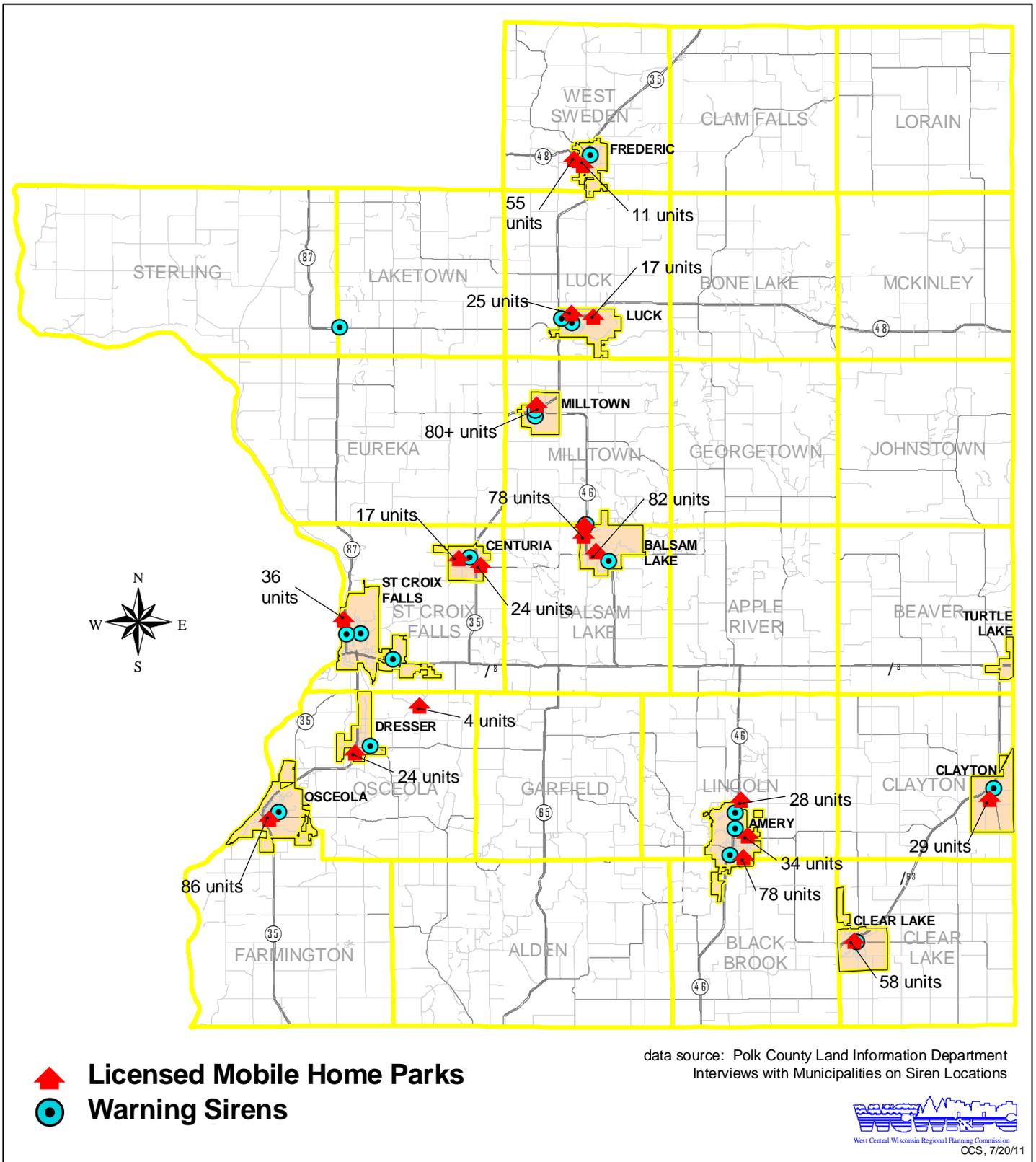
– *The Institute for Business & Home Safety*

Tents and trailers at campgrounds are particularly vulnerable to tornado and high wind events as was experienced nearby in the City of Cumberland (Barron County) during a Summer 2010 wind storm. The 2009 *Polk County Outdoor Recreation Plan* stated that there were 23 licensed public, private, and group campgrounds in the County, the majority of which are private. Polk County owns and operates one campground with approximately ten sites at Apple River Park north of Amery. The campground has a small restroom, but no designated storm shelter.

Wisconsin's Interstate State Park managed by WDNR has 85 family campsites and a primitive group camp that accommodates 60 people. Information is posted for all guests on actions in case of severe weather and a weather radio is available at the ranger station. Nearby warning sirens in St. Croix Falls and Taylor Falls can be heard from most, if not all, of the park. The concrete park office is used as a weather shelter and is open to the public. Park staff, supplemented by the St. Croix Falls Fire Department, drive through the campground and alert guests of approaching severe weather when warnings occur.

The need for severe weather shelters at other campgrounds and resorts in Polk County was not identified as a significant priority during the planning process. Some need undoubtedly exists, though it is believed that most private resorts have designated a shelter should it be required.

Figure 22. Storm Sirens and Licensed Mobile Home Parks in Polk County



The *State of Wisconsin Hazard Mitigation Plan* provides projected average annual county loss estimates for tornado events based on past event history. The first tornado loss estimates in **Table 17** for Polk County were taken from the *State Hazard Mitigation Plan*. WCWRPC produced a revised loss tornado loss estimate based on the events and damages reported in Table 16, which reflect significantly higher losses. Loss estimates for high winds were developed by WCWRPC using a similar approach and the data provided in Table 20 in the thunderstorms assessment.

Table 17. Polk County Tornado & Straight-Line Wind Loss Estimates for Residential Units

Tornado Loss Estimates (Wisconsin Emergency Management)			
Avg. Damage per Tornado (1950-5/31/08)	Annual Probability	Estimated Future Annual Loss (property)	Estimated Future Annual Loss (injury, death, & property)
\$431,400 (20 events)	.3484	\$150,314	\$385,747
Tornado Loss Estimates (WCWRPC)			
Avg. Damage per Tornado (1950-9/10)	Annual Probability	Estimated Future Annual Loss (property)	Estimated Future Annual Loss (injury, death, & property)
\$2,578,791 (21 events)	.3500	\$902,577	\$1,138,010
Thunderstorm High Wind Loss Estimates (WCWRPC)			
Avg. Damage per T-Storm Wind (1950-9/10)	Annual Probability	Estimated Future Annual Loss (property)	Estimated Future Annual Loss (injury, death, & property)
\$41,704 (133 events)	2.2166	\$92,441	\$92,441 (no injuries or deaths reported)

Source: Wisconsin Emergency Management. State of Wisconsin Hazard Mitigation Plan. December 2008; National Climatic Data Center (NCDC); and, West Central Wisconsin Regional Planning Commission (WCWRPC).

The methodology used to develop the first tornado loss estimate is described in the *State of Wisconsin Hazard Mitigation Plan*. It incorporates the average damage per tornado, an annual probability of a tornado event, and average injuries and deaths per event based on historic data for 1950 through June 31, 2008, from the National Climatic Data Center (NCDC). On average, each injury was given a monetary value of \$10,553 per injury, while deaths were given a monetary value of \$3,332,658 per death based on FEMA guidance for benefit-cost calculations.

The WCWRPC estimation used a very similar approach based on the NCDC data provided in Tables 16 and 20, which were adjusted to 2009 dollars. The Wisconsin Emergency Management estimates for injuries and death were then added. Since the bulk of the property damage occurred in 1952 and 1953, the average damage per tornado was much higher when the past damages were adjusted to current dollars.

According to Wisconsin Emergency Management, Polk County ranked 19th overall among Wisconsin's 72 counties for annual tornado damage risk based upon the above loss estimates. This reflects its relatively high annual probability but rural character. Average total losses from tornado events in Polk County can be estimated between \$400,000 to \$1.2 million annually, with the understanding that damages may not be incurred every year. Average annual straight-line wind losses were significantly lower at under \$100,000 per year. But it must be kept in mind that the estimates in Table 17 are based on those events reported to the NCDC since 1950. No recent events have struck a high-density developed area and some damages and injuries likely have gone unreported, in particular for the high wind events. Crop and forest damage are also not included in the above numbers.



Siren, WI - June 2001 Tornado

While few, if any, buildings can withstand the direct impact of a large-magnitude tornado, large-span structures can be particularly vulnerable to high wind damage. Data on the number of large-span structures in Polk County is not available, though some, such as school gymnasiums, are addressed in the critical facilities vulnerability assessment. Most of these large-span buildings tend to be large storage buildings, garages, or barns which are common throughout the County. Many of these are relatively inexpensive to construct and are used for storage or livestock. Of greater vulnerability, due to contents

and risk of injury or death, are industries or big-box commercial buildings which have large-span structures. Most of these are located near or within the incorporated areas.

Agricultural-related damages include structures (e.g., barns), livestock, and crops. No tornado-related crop damage was reported since 1950 and only \$123,000 in high-wind crop damage was reported. Based on the NCDC records, it is not certain if crop damage reports were tracked prior to 1993, or they may have been combined with other property damage. But as the two deaths associated with collapsing barns in May 1953 demonstrated, livestock barns and structures are quite vulnerable to high winds and tornadoes. There were no natural areas or environmental characteristics within Polk County which were identified as being uniquely vulnerable to tornadoes or high winds.

Continuing changes in land-use and development patterns will influence the County's potential for future exposure to tornadoes. As discussed previously, Polk County is continuing to grow and develop. This creates an increasing exposure to the number of residents and properties that are at risk from future tornado events.

Vulnerable Critical Facilities

All critical facilities are susceptible to being hit by a tornado. A more robust assessment of community assets (critical facilities) and their susceptibility to tornadoes and other hazard events is located in **Appendix F**. Above-ground electrical infrastructure is particularly vulnerable to tornadoes and high winds and was discussed previously in the *Special Threat Analysis—Long-Term Power Loss* section. Above-ground communications infrastructure is also vulnerable and high winds in August 2010 twisted one of the County’s radio communications towers.

Though no critical facilities have been impacted by tornadoes in recent years, the vulnerability assessment did yield that tornadoes and high winds represent the highest vulnerability and risk to the critical facilities of Polk County. Schools were of special concern due to:

- large numbers of individuals present, including school-age children or when being used as a storm shelter in some communities
- most having large span areas, such as gyms and theaters, which are especially vulnerable to tornadoes and high winds

The inventory of critical facilities identifies up to 28 school facilities in Polk County which likely meet the above criteria, not including any Amish and Mennonite schools. Long-term care and assisted-living facilities are also vulnerable due to the age and/or health of residents. Most of these facilities are also single-story structures for reasons of mobility and have a designated storm shelter area, instead of a basement. As of January 2011, Polk County had 58 long-term care and assisted living facilities (i.e., nursing homes, adult family homes, CBRFs),

Hospitals were also identified as being of significant concern due to their potentially vulnerable population, emergency response functions, and importance to the community. Polk County has four hospitals located in Amery (2), Osceola, and St. Croix Falls. Two communities—Amery and Osceola—have municipal airports with hangars, structures, and aircraft which can be particularly vulnerable to tornadoes and high winds. Since the 2006 plan, the Village of Osceola now requires all aircraft to be properly tied-down.

Unique Jurisdictional Risks or Vulnerabilities—Tornadoes & High Winds

During the planning process, each incorporated area was analyzed to provide insight into the extent of its vulnerabilities to tornadoes and high wind events. The extent of the vulnerabilities identified by the communities was largely limited to recent events, mobile home parks, slab-on-grade construction, and public storm shelters as summarized in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**. **Appendix H** summarizes current mitigation efforts for each incorporated community.

Tornadoes pose no risks or vulnerabilities unique to individual incorporated jurisdictions (villages and cities). The Village of Centuria has the most significant tornado history when the June 1952 tornado destroyed a dozen homes and caused serious damage throughout much of the community. The May 1953 tornado also caused significant damage within the City of Amery.

More recently, a July 2010 tornado resulted in significant damage in the Village of Balsam Lake, including downed trees, roof damage, and severe damage to one home and a garage. Other communities noted that there have been tornado touchdowns in close proximity, but the events have missed most incorporated areas. The cities and villages reported that high straight-line winds are much more common. Downed trees, roof damage, and scattered debris are the most commonly noted types of wind damage. Power loss due to downed trees is also fairly common in some of the older neighborhoods. The City of Amery noted that a 2005 downburst caused severe damage to airport hangars, a feed mill, and one home on the City's south side.

Overall, community vulnerability increases with development density, population density, type of development, and value of improvements. And as more growth and development occurs, this vulnerability also increases. As such, cities and villages are the highest vulnerability areas, as well as those areas with higher populations, larger numbers of housing units, and higher assessed value per square mile described previously in **Section II. Community Profile**.

According to the 2000 Census, the cities and villages of Polk County had 683 mobile homes, which is about one-third of all the mobile homes in the County. Many communities do not require mobile homes to be anchored or tied down, unless the mobile homes are newer and fall under more recent State installation codes. Whether older mobile homes are anchored is not known in most cases. The majority of communities also do not specifically require mobile home parks to have designated storm shelters or an emergency operating plan, though these could potentially be required as part of a conditional use permit. While new mobile home park development is limited, a number of communities recognized the potential need for increased emergency requirements as part of their ordinances.

A number of communities identified other facilities and concerns which may be particularly vulnerable to tornadoes or high winds:

- Village of Centuria identified a 24-unit subsidized housing complex without a basement.
- Village of Clayton identified a local business with hazardous materials on-site.
- Village of Dresser identified the mobile home park and public housing given the lack of a storm shelter, along with Trollhaugen during large events.
- Village of Frederic identified three retirement homes and two mobile home parks.
- City of Amery identified four senior housing and three low-income housing complexes, plus Catholic charities structure.
- City of St. Croix Falls identified the County Fairgrounds.

As mentioned previously, all incorporated municipalities except Centuria, Dresser, and St. Croix Falls have a designated storm shelter. Centuria and St. Croix Falls have no plans to designate a shelter, but Centuria has sent letters to residents on storm safety. Dresser is working on designating a shelter. For those communities with shelters, Frederic, Milltown, Osceola, and Balsam Lake may need additional or alternative sites in the future. All current shelters, except in Clear Lake, are not owned by the municipality and lack a formal agreement with the owners for shelter use.

Weather Warning Sirens

The public relies heavily on emergency or storm sirens for notification of potentially approaching storms or tornadoes. The existing sirens are all located in incorporated areas as shown previously in Figure 26.

A brief inventory of storm siren needs was conducted as part of this planning effort. Many existing sirens lack battery back-up. New sirens are also needed in some communities to have full geographic coverage due to growth, topography, etc. There are also unincorporated and seasonal use areas with significant population concentrations which would also benefit from siren coverage.

The following warning siren needs were identified during the planning process based on interviews with the cities and villages, town surveys, and other stakeholder interviews:

Replace Existing Older Sirens	Amery(1), Clear Lake(1), Milltown(1)
Lack of Battery Back-up	Centuria(1), Clayton(1), Luck(1), Frederic(1), Milltown(1)
Additional Sirens May Be Needed for Full Coverage	Dresser, Osceola, Luck
Unincorporated Areas Potentially in Need of a Siren	Round Lake, Lake Wapogasset, Round Lake/Town of Garfield, Atlas, Eureka

All sirens are triggered locally, though some communities during interviews did express an interest in having County Dispatch trigger sirens. Other municipalities, such as Milltown, identified a need to be able to trigger the sirens remotely from vehicles or through radios. Also during the planning process, the Village of Dresser identified a potential need for the adoption of a formal policy on siren use and testing.

ii. Winter Storms and Extreme Cold (including blizzards and ice storms)



Summary—Winter Storms

Risk – Since 1993, Polk County has experienced approximately three winter storm and/or extreme cold events per year on average. True blizzards are quite rare. Should the climate change as predicted, the winters could become shorter with fewer extreme cold events, but would also be wetter with more potential for heavy snow or ice storm events.

Vulnerabilities – Most vulnerable are travelers, above-ground utilities (especially in wooded areas), crops (especially alfalfa), and persons exposed to extreme cold.

1. The potential for a large-scale ice storm resulting in a long-term power outage, especially during very cold temperatures, is likely the most significant winter storm threat facing Polk County. Overhead power lines in wooded areas and older neighborhoods with trees are especially vulnerable to high winds, heavy snow, and ice storms. Some critical facilities and some local emergency operations centers do not have emergency generators. Additional emergency response planning and exercises may be needed on this topic. This topic was discussed previously in greater detail.
2. Though there are scattered areas prone to drifting of snow on roadways, many of these concerns have been largely mitigated through snow fencing and improved equipment (wing plows). Some areas particularly prone to drifting problems were identified, but feasible options to further mitigate these concerns are limited in most cases. A hill cut on STH 35 west of Milltown may be warranted to address serious drifting and visibility concerns.
3. The U.S. Highway 8 hill in St. Croix Falls is especially dangerous under slippery conditions. When the highway is icy, east-bound truck traffic has jack-knifed as they attempt to ascend the hill.
4. Winter kill of crops, especially alfalfa, can be significant during extended periods of cold when there is little or no snow cover which requires farmers to purchase supplemental feed. Though more rare, early frost events (e.g., September 1974) can nearly wipeout an entire corn and soybean crop.
5. No cities or villages identified a “hotspot” especially vulnerable to frequent water main breaks, winter-related accidents, or similar types of problems. The Village of Luck identified some lakeshore erosion concerns along the west shore of Big Butternut Lake for which ice action is a contributing factor.

Risk Assessment—Winter Storms

The Hazard

Winter storms can vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death.

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

<i>Heavy Snowfall:</i>	The accumulation of six or more inches of snow in a 12-hour period, or eight or more inches in a 24-hour period.
<i>Winter Storm:</i>	The occurrence of heavy snowfall accompanied by significant blowing snow, low wind chills, sleet, or freezing rain.
<i>Blizzard:</i>	The occurrence of sustained wind speeds in excess of 35 miles per hour accompanied by heavy snowfall or large amounts of blowing or drifting snow.
<i>Ice Storm:</i>	An occurrence where rain falls from a warm and moist upper layer(s) of the atmosphere to colder and dryer layer(s) at or near the ground, freezes upon contact with the ground, and accumulates on exposed surfaces.
<i>Freezing Drizzle/Rain:</i>	The effect of drizzle or rain freezing upon impact on objects that have a temperature of 32° Fahrenheit or below.

Dangerously cold conditions can be the result of extremely cold temperatures or the combination of cold temperatures and high winds. The combination of cold temperature and wind creates a perceived temperature known as “wind chill.”

Wind chill is the apparent temperature that describes the combined effect of wind and air temperatures on exposed skin. When wind blows across the skin, it removes the insulating layer of warm air adjacent to the skin. When all factors are the same, heat loss is greater with increased wind speed, thereby resulting in a colder feeling. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and, eventually, the internal body temperature. Shown in **Table 18** are the calculated wind chill temperatures as a result of specified air temperatures and wind speed.

**Table 18. Wind Chill Table
(Wind Chill Values in Degrees Fahrenheit)**

Temperature (°F)	Wind Speed (MPH)								
	5	10	15	20	25	30	35	40	45
30	25	21	19	17	16	15	14	13	12
25	19	15	13	11	9	8	7	6	5
20	13	9	6	4	3	1	0	-1	-2
15	7	3	0	-2	-4	-5	-7	-8	-9
10	1	-4	-7	-9	-11	-12	-14	-15	-16
5	-5	-10	-13	-15	-17	-19	-21	-22	-23
0	-11	-16	-19	-22	-24	-26	-27	-29	-30
-5	-16	-22	-26	-29	-31	-33	-34	-36	-37
-10	-22	-28	-32	-35	-37	-39	-41	-43	-44
-15	-28	-35	-39	-42	-44	-46	-48	-50	-51
-20	-34	-41	-45	-48	-51	-53	-55	-57	-58

Source: National Weather Service

Regional Trends

Most winter storm events are typically regional in nature and are not limited to a localized area or county. However, levels of snowfall or ice accumulations can vary significantly over relatively short distances.

Much of the snowfall in Wisconsin occurs in small amounts of between one and three inches per occurrence. Heavy snowfalls that produce at least eight to ten inches of accumulation occur on average only five times per season. True blizzards are rare in Wisconsin. They are more likely to occur in northwestern Wisconsin than in southern portions of the State, even though heavy snowfalls are more frequent in the southeast. However, blizzard-like conditions can exist during heavy snowstorms when gusty winds cause the severe blowing and drifting of snow.

Both ice and sleet storms can occur at any time throughout the winter season from October into April. Early- and late-season ice and sleet storms are generally restricted to northern Wisconsin. Otherwise, the majority of these storms during the winter months occur in southern Wisconsin. In a typical winter season, there are 3 to 5 freezing rain events; and a major ice storm occurs on a frequency of about once every other year. If a half-inch of rain freezes on trees and utility wires, extensive damage can occur, especially if accompanied by high winds that compound the effects of the added weight of the ice. There are also between three to five instances of glazing (less than 1/4 inch of ice) throughout the State during a normal winter.

Local Events

From 1971 to 2000, the mean annual snowfall for Polk County has been 40 to 60 inches. According to the National Weather Service, the worst snow storms in the State of Wisconsin from 1881 to present which potentially included Polk County are:

- **March 2-4, 1881** - Southern / Central - Blizzard - 2 to 4 feet of snow. Drifts to 20 feet. Milwaukee reported 28.5 inches.
- **January 15, 1887** - Southern / Central - Snowstorm - 2 feet of snow. Huge drifts.
- **January 30-February 1, 1915** - Southern / Central - Heavy snow / ice – severe glazing. 10 inches of snow in Milwaukee.
- **February 12-14, 1923** - Statewide - Blizzard - Heavy snow - severe drifting.
- **February 8-10, 1936** - Statewide - Blizzard - severe drifting.
- **November 6-8, 1943** - Statewide - Heavy snow / ice - 10 to 18 inches of snow. Roads blocked for several days.
- **January 28-30, 1947** - Southern / Central - Blizzard - 10 to 27 inches. Drifts to 15 feet. Roads blocked.
- **November 9-10, 1975** – Northern – Major snowstorm – 10 to 14 inches. Edmund Fitzgerald sinks in Lake Superior.
- **January 22-23, 1982** - North half - Blizzard - 10 to 20 inches. Superior had 19 inches.
- **November 30 - December 2, 1985** - Statewide (except southeast corner) - Widespread snows of 10 to 18 inches. Madison had about 10 inches.
- **October 31 - November 2, 1991** - Northwest / West Central - Blizzard - "Halloween Storm" - 15 to 30 inches, 6 to 10 foot drifts. 30 inches in Burnett, Douglas, Polk and St. Croix counties.
- **January 26-27, 1996** - Statewide - Heavy snow - 6 to 18 inches. Localized amounts of 16 to 18 inches fell along a line from La Crosse to Green Bay.
- **March 13-14, 1997** - West Central / Northeast - Snowstorm - 12 to 28 inches. 28 inches at Wautoma in Waushara County.
- **January 21-22, 2005** - Statewide - Blizzard (gusts to 50 mph) - 6 to 15 inches. Although winds gusted up to 50 mph in some areas and visibilities were reduced to less than 1/4 mile due to falling or blowing snow, many areas didn't experience these conditions for 3 hours or more to classify as a full blizzard. Nonetheless, heavy snow and very windy conditions created near white-out conditions especially in the south and east. The heaviest totals occurred near Lake Michigan due to additional lake effect, where some areas ended up near 15 inches.
- **March 18-19, 2005** – West-central – Winter Storm – 18 to 23 inches in a swath from southern Buffalo County to western Jackson County, with 12 to 15.6 inches in La Crosse County. The maximum of 23 inches occurred in northwestern Jackson County.
- **March 13-14, 2006** – West-central to North-central– Winter Storm – 17 to 32 inch swath from St. Croix County northeast to Iron County. Thundersnow enhanced the accumulations. Very poor visibility resulted from gusty winds around 30 mph and drifting resulted in hundreds of accidents. Locals said it was the worst storm since the 1980s.

- February 23-26, 2007** – West-central (through southern and eastern Wisconsin) – Blizzard - Two-round storm, with one overnight the 23rd to 24th, and the second round overnight the 24th into the 25th. Leftover snow accumulations continued overnight the 25th into the 26th. In counties surrounding La Crosse, 8 to 15.6 inches (Galesville) fell in round one, while round two produced 6 to 12.5 inches (Sullivan NWS office) over the southern three-fourths of the State. The leftover snow added another 1 to 4 inches, except for 6 to 14 inches from New London into Door County. Many locations totaled 20 to 25 inches for this long-duration two-punch episode from around La Crosse to Port Washington and a small part of Door County. Gusty winds generated snow drifts up to 5 to 7 feet in height.

Shown in **Table 19** is a listing of winter storm events, including winter storms, heavy snowfall, freezing rain/ice, blizzards, and periods of extreme cold, that have been recorded by the National Climatic Data Center for Polk County since 1993. Prior to 1993, winter storm data for Polk County was not available through the National Climatic Data Center.

**Table 19. Winter Storm Events • January 1993 – September 30, 2010
Polk County**

Location	Date	Time	Type	Deaths	Injuries	Property Damage
Statewide	1/13/1993	12:00 AM	Heavy Snow	0	0	0
Regional	2/20/1993	10:00 PM	Heavy Snow	0	0	0
Regional	4/15/1993	4:00 AM	Heavy Snow	0	0	0
Regional	11/25/1993	1:00 AM	Heavy Snow	0	0	0
Statewide	1/13/1994	6:00 AM	Cold	0	0	0
Regional	1/26/1994	8:00 PM	Heavy Snow/ice Storm	0	0	0
Regional	4/29/1994	12:00 PM	Heavy Snow	0	0	0
Regional	11/27/1994	9:00 AM	Heavy Snow	0	0	0
Northern	2/10/1995	9:00 PM	Cold	0	0	0
Regional	3/4/1995	6:00 PM	Heavy Snow	0	0	0
Regional	3/27/1995	3:00 AM	Heavy Snow	0	0	0
Regional	12/13/1995	6:00 AM	Heavy Snow	0	0	0
Regional	1/17/1996	9:00 PM	Ice Storm	0	0	0
Regional	1/18/1996	5:00 AM	Heavy Snow	0	0	0
Regional	1/31/1996	5:00 AM	Extreme Cold	0	0	0
Regional	2/1/1996	12:00 AM	Extreme Cold	1	0	0
Regional	2/8/1996	12:00 AM	Freezing Rain	0	0	0
Regional	3/24/1996	1:00 AM	Heavy Snow	0	0	0
Regional	11/23/1996	12:00 AM	Heavy Snow	0	0	0
Regional	12/14/1996	4:00 PM	Heavy Snow	0	0	0
Regional	12/23/1996	9:00 AM	Heavy Snow	0	0	0
Regional	1/4/1997	5:00 AM	Heavy Snow	0	0	0
Regional	1/15/1997	5:00 PM	Extreme Windchill	0	0	0
Regional	3/13/1997	1:00 AM	Winter Storm	0	0	0
Regional	1/11/1998	10:00 AM	Winter Storm	0	0	0
Regional	3/8/1999	8:00 AM	Winter Storm	0	0	0
Regional	12/28/2000	2:00 AM	Winter Storm	0	0	0

Regional	1/29/2001	7:00 PM	Winter Storm	0	0	0
Regional	3/12/2001	12:00 AM	Heavy Snow	0	0	0
Regional	11/26/2001	1:00 PM	Winter Storm	0	0	0
Regional	3/8/2002	6:00 PM	Winter Storm	0	0	0
Regional	3/14/2002	8:00 AM	Winter Storm	0	0	0
Regional	2/2/2003	8:00 PM	Winter Storm	0	0	0
Regional	11/22/2003	6:00 PM	Winter Storm	0	0	0
Regional	12/9/2003	3:00 AM	Winter Storm	0	0	0
Regional	2/1/2004	2:00 AM	Winter Storm	0	0	0
Regional	3/5/2004	12:00 AM	Winter Storm	0	0	0
Regional	8/21/2004	2:00 AM	Frost/freeze	0	0	0
Regional	1/1/2005	2:00 PM	Winter Storm	0	0	0
Regional	1/21/2005	2:00 PM	Winter Storm	0	0	0
Regional	3/12/2006	8:00 PM	Winter Storm	0	0	0
Regional	2/24/2007	7:30 AM	Winter Storm	0	0	0
Regional	3/1/2007	12:00 AM	Winter Storm	0	0	0
Regional	12/1/2007	9:30 AM	Winter Storm	0	0	0
Regional	12/22/2007	6:15 AM	Winter Storm	0	0	0
Regional	2/10/2008	2:00 AM	Cold/wind Chill	0	0	0
Regional	2/19/2008	18:00 PM	Cold/wind Chill	0	0	0
Regional	3/17/2008	6:55 AM	Heavy Snow	0	0	0
Regional	3/31/2008	10:00 AM	Heavy Snow	0	0	0
Regional	4/1/2008	12:00 AM	Heavy Snow	0	0	0
Regional	4/10/2008	15:00 PM	Winter Storm	0	0	0
Regional	12/30/2008	7:15 AM	Winter Storm	0	0	0
Regional	1/15/2009	12:00 AM	Cold/wind Chill	0	0	0
Regional	2/26/2009	12:00 PM	Winter Storm	0	0	0
Regional	10/12/2009	6:00 AM	Winter Weather	0	0	0
Regional	12/8/2009	13:00 PM	Winter Storm	0	0	0
Regional	12/23/2009	20:00 PM	Winter Storm	0	0	0
			57 events	1	0	none reported

source: National Climatic Data Center (NCDC)

Damage estimates in 2009 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

Since 1993, Polk County has experienced three winter storm events per year, with a total of 57 reported events over the seventeen-year period. These events were further characterized by 19 heavy snowfall events, 26 winter storms (*mix of snow, ice, wind*), two ice storms, eight extreme windchill or cold, and two freezing rain or frost events. Noticeably absent are any blizzards. One event, an August 2004 early freeze, is notably out-of-season. The list also includes four April and one October winter events.

All events reported were regional or statewide in nature, also affecting areas outside Polk County. The single death associated with the above storms occurred within Eau Claire County when a woman locked herself in the garage and died due to exposure to extreme cold. Additional deaths and injuries as a result of traffic accidents, frost bite, etc., associated with these events likely occurred, but were not reported to the National Weather Service.

Drifting of snow on many of the roads of Polk County is common during winters when snow and high winds are present, though this has been less of a problem in recent years due to weather patterns, improved equipment, furrowing, and snow fencing. The following snow drifting “hotspots” were identified during the planning process:

- CTH “W” in the Town of West Sweden where limited right-of-way hinders snow removal.
- STH 35 west and southwest of Milltown. A hillside adjacent to STH 35 just west of Milltown contributes to drifting and visibility problems.
- CTH “V” and USH 8 east of Range to the county line.
- CTH “F” in the Ubet Flats. The road level in this area is the same as the surrounding landscape which contributes substantial drifting.
- Osceola to Farmington along STH 35.
- The Town of Alden noted that while winters in recent years (prior to 2010) have not been severe, there could be many areas which may pose a challenge for local snow removal crews to keep clear.
- The Town of Eureka identified 193rd Avenue at the point it turns north and the intersection of 210th Avenue and 220th Street as being locations especially prone to severe snow drifting.

Relative Level of Risk

During the risk assessment survey in the 2006 plan, the steering committee ranked winter storms and extreme cold as the second highest natural hazard facing Polk County. This high ranking was primarily due to their frequency in the past and probability of reoccurrence, and the related health and safety vulnerabilities. Recent long-term power outage planning efforts within the region, as discussed previously in this plan, further validated these concerns.

The probability of reoccurrence of winter storm events for Polk County is expected to be consistent with recent trends, with three to four winter storm events, on average, occurring each year. Should Wisconsin’s climate change as discussed previously, Polk County could experience warmer, shorter, and wetter winters overall, which could mean fewer extreme cold events, but increased potential for heavy snow and ice storms.

Vulnerability Assessment—Winter Storms

Winter storms have no defined hazard area within Polk County, and as the data previously showed, most of these storms are regional in nature. Due to the irregular nature of these events and lack of specific hazard areas, the assessment of community impacts as a result of winter storms is difficult to quantify.

Winter storms pose a serious health and safety threat to area residents and can result in significant damage to property and infrastructure. Heavy snow or accumulated ice can: cause the structural collapse of buildings; down power lines, severely affecting electrical power distribution; cause accidents (e.g., traffic crashes, slipping/falling); or restrict mobility of emergency assistance or access to services. Most structures in Polk County were built to standards that considered snowloads and needed insulation, so this aspect was deemed a relatively low concern.

In addition to the health risks directly related to exposure to cold temperatures, residents are also susceptible to other risks associated with extremely cold temperatures. For example, many homes could become too cold either due to a power failure or because the heating system isn't adequate for the weather. Water lines can break. When people begin to use space heaters, wood stoves, and fireplaces to stay warm, the risk of household fires increases as well as the risk of carbon monoxide poisoning. There can be economic impacts from the closure of businesses due to lack of mobility or power loss, but these are almost always very short-term impacts.

Accidents and Exposure

According to the National Weather Service, approximately 70 percent of serious injuries resulting from winter storms are vehicle accidents, with prolonged exposure to the cold constituting another 25 percent. And it does not require a disaster event to incur traffic-related or exposure injuries during the winter months.

Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. When exposed to cold temperatures or low wind chills, one's body begins to lose heat faster than it can be produced. The result is hypothermia or abnormally low body temperature. A body temperature that is too low can affect the brain, making the victim unable to think clearly or move well. This makes hypothermia particularly dangerous because a person may not know it is happening and won't be able to do anything about it. Hypothermia occurs most commonly at very cold temperatures, but can occur even at cool temperatures (above 40°F) if a person becomes chilled from rain, sweat, or submersion in cold water. Victims of hypothermia are most often elderly people with inadequate food, clothing, or heating; babies sleeping in cold bedrooms; children left unattended; adults under the influence of alcohol; mentally ill individuals; and people who remain outdoors for long periods such as the homeless, hikers, hunters, etc.

Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Frostbite can permanently damage the body, and severe cases can lead to amputation.

Long-Term Power Loss

Of greater concern is the long-term loss of power due to ice storms, winds, and/or heavy snows, especially during extremely cold temperatures. Long-term power loss poses one of the greatest (if not THE greatest) natural hazard vulnerabilities facing Polk County. This threat was discussed previously within the special analysis on long-term power loss.

Winter Kill and Frost Impacts on Agricultural Crops

Winter crops are vulnerable to winter kill during periods of extreme cold without sufficient snow on the ground to help act as an insulator. Four inches of snow cover will allow up to a 20°F difference in temperature between the soil and air, and will prevent the premature breaking of dormancy during temporary warm spells. Some amount of winter kill is fairly frequent and can be expected almost annually; more substantial winter kill events can be expected to occur one or two seasons each decade on average (about a 10% to 20% chance per year) based on recent trends.

Alfalfa is especially vulnerable to winter kill, compared to other forage types. In 2002-2003, it was estimated that about 61 percent of the Polk County alfalfa acreage was impacted to varying degrees resulting in a 48 percent reduction in the County's alfalfa yields or about \$5 million in lost value overall. Winter kill was also high in the winter of 2008-2009. To provide an

understanding of the potential vulnerability, between 2000 and 2008, Polk County farmers produced an average of 134,500 tons of alfalfa hay and haylage per year on 45,300 acres planted.

The loss of feed for cattle due to winter kill can be a significant hardship on a producer. At about \$1,500 of additional feed per mature cow for a year and with 46,100 head of cattle in the County, feed replacement costs can accumulate quickly. And since alfalfa is a relatively low-value crop, it is typically uninsured.

These additional costs can result in less of revenue to the individual producer and can be added costs to manufacturers (e.g., dairies, grocery stores, food processing) and consumers. Late fall alfalfa or hay

from Wisconsin State Journal, Sept. 10, 1974

Frosted Farmers Seek Federal Aid

By ROBERT C. BJORKLUND
State Journal Farm Editor

Farmers by the hundreds were turning to government disaster programs Monday for help after a costly frost emergency in western and northern Wisconsin.

The state's weekly crop summary was dominated by the tragic reports from nearly half of the state's counties that substantiate earlier farm loss estimates of corn and soybeans of more than \$100 million.

THE WISCONSIN Farmers Home Administration (FHA) office at Stevens Point has started receiving applications for special aid programs and Henry Zeeh, farmer program specialist, said that the drought, followed by the unusually early frost, "will be a tremendous economic loss to Wisconsin."

Wayne Danielson, Cadott, a dairyman and also a member of the State Board of Agriculture, said that agricultural officials in Chippewa County now estimate that only 10 per cent of the thousands of acres of corn planted for grain will yield mature corn.

In the words of a Jackson County farmer, "the roof fell in on us as hard frost took care of

both corn and soybeans and most everything else."

THE POLK County estimate is that more than 80 per cent of the corn and soybean crops were ruined.

Richard Webb, executive director of the Chippewa County Agricultural Stabilization and Conservation (ASC) office, said that as many as 1,600 of the county's 1,900 farms with a corn allocation will seek aid under the government's new "disaster payments" program.

The county boards in most of the frost-stricken counties are expected to have their counties designated as eligible for the emergency loan program, and thus eligible for 5 per cent interest loans.

TO BECOME eligible, the farmer must establish that he had a 10 per cent loss of his corn crop.

Webb said that up to 150 farmers a day are applying for disaster eligibility in Chippewa County.

"We're in rough shape up here and we've applied for the 5 per cent disaster loans and the emergency livestock feeding program," he said.

A Clark County farmer said

that in his area there were five straight nights of frost.

To the south and east of the frost line, the corn looks good, but Marvin Heiser, crop reporting specialist, said that it needs about three weeks of favorable weather to mature for grain.

"**ONLY 20** per cent of the corn intended for grain in Wisconsin has begun to dent, compared with 55 per cent last year and 50 per cent in the past 10 years," Heiser said.

Soil moisture is 50 per cent short in the state and 50 per cent adequate. The west and north central areas are the driest and the southwest, with the best corn in the United States, is in the best shape for moisture.

Bernard Chapman, of the Bloomington area in Grant County, said that much of his corn is dented and a frost won't hurt too much. However, the ears are not all filled out on the ends, indicating some pollination problems.

The big worry for many southwest Wisconsin farmers is root damage. There is a row or two in the fields where the corn is down either because the heavy rains after planting leached out the chemical protection or it was lost by erosion.

cuttings can further contribute to winter kill since time is not allowed for adequate re-growth of ground cover which provides an additional insulating blanket. And periods of freezing and thawing in the spring can contribute to frost heaving within certain types of soils, leading to additional crop damage.

While less frequent, early frosts can also severely impact agricultural crops. The most significant early frost in recent history transpired in September 1974. This severe frost event occurred on multiple nights, included much of northern and western Wisconsin, and stretched as far south as Kansas. It was reported that more than 80 percent of the soybean and corn crops in Polk County were ruined during this event. Combined with the impacts of a summer drought, the soybean and corn losses were near 100 percent in nearby Dunn, Chippewa, and Eau Claire counties. In today's dollars, the total statewide crop losses as a result of the September frost were estimated at more than \$470 million.

Overall, Polk County farmers are aware of the winter-related agricultural risks and most use best management practices to mitigate these risks.

Summary of Potential Vulnerabilities

Based on interviews, town surveys, and consideration of the previous analysis, it was determined that the following general types of facilities and community assets are most vulnerable to winter storm events:

- Residents and travelers
- Vulnerable populations, such as elderly (especially during extreme cold events)
- Above-ground power lines, especially in wooded areas
- Agricultural crop losses, especially alfalfa

Although the improvement of technology has enabled meteorologists to better forecast and track winter storms, there is no precise way to predict the location and severity of their associated risks. As shown in Table 19, there is no predictable pattern of occurrence, associated risk characteristics, and resulting damage that can be identified and used to make detailed projections on future winter storm events.

Overall, there is a very low vulnerability to structures in Polk County due to winter storms. Some occasional roof damage due to ice damming or bursting of inadequately buried water lines can be expected, but such damage is almost always isolated, not officially reported, and/or remedied by the homeowner with an insurance claim. It is unfeasible to maintain a database accurately detailing the structural condition of all \$3 billion in assessed improvements in Polk County to determine which structures may be more vulnerable to the impacts of future winter storm events.

The continuing changes in land-use and development patterns can influence the County's potential for future exposure to winter storms. As discussed previously, Polk County is continuing to grow and develop. This creates an increasing exposure to the number of residents and properties that could be at risk from future winter storm or extreme cold events.

Vulnerable Critical Facilities

A more robust assessment of the County's assets (critical facilities) and their susceptibility to winter storms is located in **Appendix F**. The greatest winter storm-related vulnerability for Polk County's critical facilities is the widespread loss of electric power. The risks and vulnerabilities related to this threat were discussed previously (see *Special Threat Analysis – Long-Term Power Loss*).

While there are few long-term physical impacts on roads from a hazard mitigation perspective, travel upon sidewalks, roads, and bridges is often hazardous under icy or heavy snow conditions as discussed previously. Such road conditions can also impair the function of critical facilities (e.g., staffing at hospitals or schools) and increase emergency response time. Roads in shaded, wooded areas can be especially icy and hazardous.

Unique Jurisdictional Risks or Vulnerabilities—Winter Storms

Winter storms pose no risks or vulnerabilities unique to individual jurisdictions. Winter storms and extreme cold events are typically large-area or regional events, occurring countywide. The level of vulnerability increases in areas of higher population, development density, and supportive infrastructure as described previously in **Section II. Community Profile**. Any notable differences between municipalities regarding the vulnerability of winter storm and extreme cold events are further discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**.

Some of the incorporated communities reported occasional and scattered water line freeze-ups or breaks. Water-dripping programs are often used to mitigate potential damage. As budgets allow, older water lines potentially more prone to breaks are typically replaced and buried deeper as part of street projects. Some mobile homes can be more vulnerable to the water pipe breakage since the lines are often less insulated than standard home construction.

No communities noted a serious problem with the loss of power due to the damage to overhead power lines. The Village of Luck noted that ice build-up and the freeze-thaw cycle is a contributing cause to shoreland erosion problems along the west shore of Big Butternut Lake. Ice damming on the St. Croix River occurs north of the dam in St. Croix Falls about once every 10-12 years and resulting in damage to a park pier and outside stairs at a home, but no serious damages to date.

Most of the participating cities and villages did not identify specific streets that were uniquely prone to ice accumulation or drifting. The exception is the City of St. Croix Falls. Louisiana and Kentucky Streets in the City are sometimes closed due icy conditions on their steep hills. Of greater concern is east-bound traffic on U.S. Highway 8 within the City. As east-bound traffic crosses the St. Croix River, it must ascend a steep, long hill. At times, ice or snow conditions are such that travelling up the hill is dangerous, if not impossible, for some vehicles. Such circumstances have led to traffic accidents and the “jack knifing” of semi-trucks in the past.

iii. Thunderstorms and High Winds



Thunderstorms encompass lightning, heavy rains, high winds, and hail and are intricately linked with some of the other hazards, such as tornadoes and flooding. Due to the similarities in impacts, the vulnerabilities associated with high winds are largely discussed as part of the previous tornado sub-section (III.B.i.) and are not repeated here. Flooding as a result of heavy rains is analyzed as part of the next sub-section (III.B.iv.).

Summary—Thunderstorms

Risk – Thunderstorms are the most frequent natural hazard event reported for Polk County, with high winds and hail the most common attributes. Severe thunderstorms should be expected on an average of five days each year based on official reports, with about half of all reported events accompanied by high winds and one-third accompanied by hail.

Vulnerabilities – Most events pass with only minor debris clean-up, but associated high winds, hail, lightning, and heavy rains can all cause significant damage, injury, or death. As in tornado events, all structures are vulnerable, but especially large span buildings, unanchored trailer homes, aircraft, and structures with substantial numbers of people (e.g., schools, hospitals). Above-ground utilities are also vulnerable to high winds and lightning strikes, especially in forested areas. And past hail and high wind events have caused significant crop damage and damage to barns.

1. The actual damages and expenses related to thunderstorm events are likely significantly much greater than shown in the official reports, though most storms pass with minimal damage. If adequately covered by insurance, options to mitigate thunderstorm risks in Polk County are very limited.
2. High winds are the most destructive component of thunderstorms in Polk County. It is often difficult to distinguish between the impacts of a tornado and those of a very high wind storm. Refer to the tornado sub-section for the discussion of vulnerabilities and issues related to high winds (Section III.B.i.).
3. Refer to the Flooding sub-section for the discussion of risks, vulnerabilities, and issues related to flooding (Section III.B.iv.).
4. No specific problem areas or priorities regarding thunderstorms were identified during the planning process, with the exception of tornadoes and high winds discussed in the previous sub-section and flooding discussed later in this report.

Risk Assessment—Thunderstorms

The Hazard

Thunderstorms are severe and violent forms of convection produced when warm, moist air is overrun by dry, cool air. As the warm air rises, thunderheads (cumuli-nimbus clouds) form which cause the strong winds, lightning, thunder, hail and rain associated with these storms. The National Weather Service definition of a severe thunderstorm is a thunderstorm event that produces any of the following: winds of 58 miles per hour or greater (often with gusts of 74 miles per hour or greater), hail 3/4 inch in diameter or greater, or a tornado.

The thunderheads formed may be a towering mass six miles or more across and 40,000 to 50,000 feet high. They may contain as much as 1.5 million tons of water and enormous amounts of energy that often are released in the form of high winds, excessive rains, and three violently destructive natural elements: lightning, hail, and tornadoes.¹³

A thunderstorm often lasts no more than 30 minutes, as an individual thunderstorm cell frequently moves between 30 to 50 miles per hour. Strong frontal systems, though, may spawn more than one squall line composed of many individual thunderstorm cells. These fronts can often be tracked from west to east. Because thunderstorms may occur singly, in clusters, or as a portion of large storm lines, it is possible that several thunderstorms may affect a single area in the course of a few hours.

Lightning can strike anywhere. Lightning is formed from the build-up of an electrical charge in a cloud. When this charge is big enough, the air ionizes and a discharge occurs with another cloud, the ground, or the best conducting object. The resulting electric charge reaches temperatures higher than 50,000°F. This rapid heating and subsequent cooling causes the air to expand and contract, which results in thunder.

Hail is the accumulation of ice crystals due to warm, moist air rising rapidly into the freezing temperatures of the upper atmosphere. When frozen droplets accumulate enough weight, they fall as precipitation. Hail or sleet occurs when these frozen ice balls do not fully melt upon descent, and they can reach the size of softballs.

High winds are those winds of 58 miles per hour or greater. High winds can affect much larger areas than a tornado and occur for a longer period of time. More intense types of high winds are downbursts or straight-line winds.

Straight-line winds are often responsible for most of the wind damage associated with a thunderstorm. These winds are often confused with tornadoes because of similar damage and wind speeds. However, the strong and gusty winds associated with straight-line winds blow roughly in a straight line unlike the rotating winds of a tornado.

Downbursts (straight-line winds) are unrelated to tornadoes, but can have similar impacts and destructive power. A downburst is a strong, violent downdraft, initiated by rapidly descending

¹³ Tornadoes and high wind vulnerabilities (potential impacts) are discussed separately in Section III.B.ii.

rain and/or rain-cooled air beneath a thunderstorm. The result is an outburst of straight-line winds on or near the ground in a single direction. They may last anywhere from a few minutes in a small scale micro-burst to periods of up to 20 minutes or longer, known as a macro-burst. Wind speeds in downbursts can reach 150 mph, which is similar to that of a strong tornado.

Downburst damage is often highly localized, typically covering 2.5 miles or less in width, and resembles that of tornadoes. A long-lived, widespread, and quickly travelling thunderstorm event producing numerous downbursts along its path is known as a **derecho**. The last major derecho event impacting Wisconsin in July 1995 included parts of nine states and one Canadian province. Damages in Minnesota alone from this event were estimated at over 5 million downed trees and exceeded \$30 million in 1995 dollars.¹⁴ There are significant interactions between tornadoes and downbursts, and a tornado's path can also be affected by downbursts. Because of this, the path of a tornado can be very unpredictable.

High-wind risks and past events are discussed here due to their relationship to thunderstorms and the method of data collection by the National Climatic Data Center, though the destructive impacts and vulnerabilities related to thunderstorms with high, straight-line winds are at times difficult to distinguish from the concentrated cyclical winds of a tornado. Some local debate continues on whether the damage from one recent event in the region was the result of high, straight-line winds (as officially recorded) or a tornado. Further, tornado and thunderstorm/high wind events are very often related and part of the same storm cell, making it a challenge to distinguish the impacts. High wind impacts were discussed previously as part of the tornado vulnerability assessment.

Local Events

Thunderstorms are the most common natural hazard event for Polk County. Shown in **Table 20** below is a listing of severe thunderstorms that have been reported to the National Climatic Data Center for Polk County since 1957. Data prior to 1980 is limited; more complete data is available since 1994.

Since January 1994, Polk County has experienced 150 severe thunderstorm, hail, and high-wind events of varying magnitude, for an average of approximately nine to ten severe thunderstorms reported each year. Table 20 also shows that thunderstorms can occur throughout the year, with the highest frequency during the months of May through August.

Many of the events reported in Table 20 are for the same storm cells recorded for different parts of the County; multiple reports within a single day for large storm cells are not uncommon. The 150 reported thunderstorms since January 1994 occurred on 80 unique dates for an average of five severe thunderstorm days per year. Prior to 1993, specific locations for storm events were not provided in the database.

¹⁴ National Oceanic and Atmospheric Administration. *Derecho Series in July of 1995* webpage. <http://www.spc.noaa.gov/misc/AbtDerechos/casepages/jul1995derechopage.htm#2nd1995>.

Although the storms listed in Table 20 are classified as thunderstorms, each of these storms had its own unique characteristics and associated risks to residents and property in Polk County, such as high winds and hail. Other risks associated with thunderstorms that have been documented with these storms include the potential for excessive rains, leading to flash flooding and the potential to spawn tornadoes which is discussed in other sections.

**Table 20. Severe Thunderstorm Events (and associated hazards) • 1957 to Sept 2010
Polk County**

Location	Date	Time	Type	Mag	Property Damage	Crop Damage
Polk Co. (not specified)	6/30/1956	2200	Hail	1.50 in.	0	0
Polk Co. (not specified)	6/9/1961	1800	Hail	2.00 in.	0	0
Polk Co. (not specified)	4/1/1963	1620	Hail	1.50 in.	0	0
Polk Co. (not specified)	7/12/1966	30	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/7/1970	1830	Hail	2.00 in.	0	0
Polk Co. (not specified)	8/13/1971	1500	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	8/8/1973	1700	Hail	1.75 in.	0	0
Polk Co. (not specified)	6/16/1979	1215	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/15/1980	2130	T-storm Wind	52 kts.	0	0
Polk Co. (not specified)	6/13/1981	1030	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	6/13/1981	1050	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	6/14/1981	515	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	6/14/1981	1600	T-storm Wind	60 kts.	0	0
Polk Co. (not specified)	8/3/1981	1358	Hail	2.75 in.	0	0
Polk Co. (not specified)	3/12/1982	1710	T-storm Wind	52 kts.	0	0
Polk Co. (not specified)	7/6/1982	55	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/6/1982	115	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/6/1982	115	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/6/1982	125	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/6/1982	135	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	9/5/1982	805	Hail	1.75 in.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/3/1983	1250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1515	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1515	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1515	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1515	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1530	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1540	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1983	1545	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	4/26/1984	2130	Hail	1.75 in.	0	0
Polk Co. (not specified)	10/16/1984	2000	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	4/12/1985	1615	Hail	1.75 in.	0	0

Polk Co. (not specified)	4/21/1985	2250	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	5/14/1985	1900	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	5/30/1985	2200	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/4/1986	258	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/4/1986	1800	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/18/1986	1840	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/19/1986	120	T-storm Wind	61 kts.	0	0
Polk Co. (not specified)	7/19/1986	130	T-storm Wind	61 kts.	0	0
Polk Co. (not specified)	7/24/1986	1410	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	7/11/1987	730	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	8/3/1988	2140	T-storm Wind	56 kts.	0	0
Polk Co. (not specified)	8/3/1988	2210	T-storm Wind	56 kts.	0	0
Polk Co. (not specified)	8/7/1988	1800	T-storm Wind	0 kts.	0	0
Polk Co. (not specified)	6/7/1989	1220	Hail	1.75 in.	0	0
Polk Co. (not specified)	6/2/1990	1315	T-storm Wind	52 kts.	0	0
Polk Co. (not specified)	5/28/1991	2110	Hail	0.75 in.	0	0
Milltown	5/8/1993	2030	Lightning	N/A	743,232	73,423
Osceola	4/26/1994	1135	Hail	0.75 in.	0	0
Arbor Vitae	4/26/1994	1430	Hail	1.00 in.	0	0
St. Croix Falls	5/30/1994	1600	T-storm Winds	0 kts.	71,590	1,432
East Farmington	6/25/1994	1600	T-storm Winds	0 kts.	0	71,590
St. Croix Falls	7/19/1994	1700	Heavy Rain	N/A	71,590	0
Deer Park	6/25/1995	1445	T-storm Winds	52 kts.	0	0
Deer Park	6/25/1995	1445	T-storm Winds	52 kts.	0	0
Caroline	6/25/1995	1600	T-storm Winds	0 kts.	0	0
Balsam Lake	7/14/1995	1730	T-storm Winds	0 kts.	0	0
Balsam Lake	7/14/1995	1730	T-storm Winds	0 kts.	0	0
Osceola	8/12/1995	300	T-storm Winds Hail	1 kts.	0	0
Amery	8/12/1995	310	Hail	2.50 in.	0	0
Plymouth	8/13/1995	1522	Hail	1.75 in.	0	0
Osceola	8/13/1995	1740	T-storm Winds	0 kts.	0	0
Osceola	8/13/1995	1740	T-storm Winds	0 kts.	0	0
Frederic	5/17/1996	10:27 PM	Hail	1.75 in.	0	0
Luck	5/17/1996	10:30 PM	Hail	2.50 in.	133,889	0
Frederic	5/18/1996	10:27 PM	Hail	1.75 in.	0	0
Frederic	5/18/1996	11:30 PM	T-storm Wind	55 kts.	0	0
Centuria	5/19/1996	12:55 AM	T-storm Wind	55 kts.	0	0
Balsam Lake	5/19/1996	1:05 AM	T-storm Wind	60 kts.	0	0
Balsam Lake	7/1/1997	8:05 PM	T-storm Wind	55 kts.	0	0
Frederic	8/3/1997	7:35 PM	T-storm Wind	55 kts.	0	0
Luck	8/3/1997	7:35 PM	T-storm Wind	55 kts.	0	0
Milltown	8/15/1997	5:50 PM	T-storm Wind	50 kts.	0	0
St Croix Falls	8/15/1997	5:50 PM	Hail	1.75 in.	0	0
Frederic	5/30/1998	8:05 PM	Hail	0.75 in.	0	0
Milltown	5/30/1998	8:45 PM	Hail	1.00 in.	0	0
Dresser	9/25/1998	11:15 PM	Hail	1.00 in.	0	0
Lewis	9/26/1998	12:10 AM	Hail	1.50 in.	0	0
Luck	6/5/1999	3:50 PM	Hail	1.00 in.	0	0

Milltown	6/5/1999	3:53 PM	Hail	1.75 in.	0	0
Milltown	7/3/1999	4:50 AM	T-storm Wind	55 kts.	0	0
Eureka Center	7/13/1999	11:00 PM	Hail	0.75 in.	0	0
Osceola	7/23/1999	1:02 AM	T-storm Wind	55 kts.	0	0
Osceola Muni Arpt	7/23/1999	1:04 AM	T-storm Wind	56 kts.	0	0
Centuria	7/23/1999	1:15 AM	T-storm Wind	52 kts.	0	0
Luck	7/23/1999	1:35 AM	T-storm Wind	55 kts.	0	0
Clayton	7/23/1999	1:45 AM	T-storm Wind	55 kts.	0	0
Luck	7/30/1999	4:45 PM	T-storm Wind	52 kts.	0	0
Clam Falls	7/8/2000	6:38 PM	Hail	1.75 in.	0	0
Milltown	8/8/2000	5:30 PM	T-storm Wind	50 kts.	0	0
Frederic	8/8/2000	5:36 PM	Hail	2.75 in.	0	0
Clam Falls	8/8/2000	5:55 PM	Hail	1.00 in.	0	0
Clear Lake	8/8/2000	6:00 PM	Hail	1.00 in.	0	0
Frederic	8/14/2000	9:05 PM	Hail	1.75 in.	0	0
St Croix Falls	5/1/2001	5:22 PM	Hail	0.75 in.	0	0
Amery	5/15/2001	7:18 PM	T-storm Wind	55 kts.	0	0
Amery	5/15/2001	7:25 PM	Hail	0.75 in.	0	0
Milltown	6/11/2001	4:20 PM	T-storm Wind	55 kts.	958,423	0
Turtle Lake	6/11/2001	4:38 PM	T-storm Wind	55 kts.	0	0
Frederic	6/18/2001	5:20 AM	Hail	1.75 in.	0	0
Luck	6/18/2001	5:45 AM	Hail	1.75 in.	0	0
Osceola	7/17/2001	10:35 PM	T-storm Wind	50 kts.	11,982	0
Clear Lake	7/23/2001	5:30 AM	Hail	2.00 in.	23,963	0
East Farmington	6/25/2002	7:10 PM	T-storm Wind	60 kts.	0	0
East Farmington	6/25/2002	7:10 PM	Hail	1.75 in.	0	0
East Farmington	6/25/2002	7:26 PM	Hail	1.75 in.	0	0
Osceola	7/3/2003	12:35 AM	T-storm Wind	52 kts.	0	0
Regional	4/18/2004	1:00 PM	High Wind	59 kts.	0	0
Centuria	4/18/2004	4:00 PM	T-storm Wind	55 kts.	0	0
Luck	4/18/2004	4:03 PM	T-storm Wind	56 kts.	0	0
Balsam Lake	4/18/2004	7:20 PM	T-storm Wind	50 kts.	0	0
Luck	5/8/2004	12:15 AM	Hail	0.75 in.	0	0
Dresser	5/9/2004	5:15 PM	Hail	0.75 in.	0	0
St Croix Falls	8/2/2004	6:30 AM	T-storm Wind	52 kts.	0	0
Amery	8/2/2004	6:52 AM	T-storm Wind	52 kts.	0	0
Amery	8/8/2004	6:40 PM	Hail	0.75 in.	0	0
Horse Creek	9/5/2004	5:35 PM	T-storm Wind	50 kts.	0	0
Balsam Lake	9/5/2004	5:55 PM	T-storm Wind	50 kts.	0	0
Countywide	10/29/2004	6:35 PM	T-storm Wind	55 kts.	0	0
Balsam Lake	6/7/2005	2:50 PM	Hail	0.75 in.	0	0
Clear Lake	6/11/2005	1:40 PM	T-storm Wind	55 kts.	0	0
Clayton	6/11/2005	1:50 PM	T-storm Wind	52 kts.	0	0
Countywide	6/20/2005	1:10 PM	T-storm Wind	52 kts.	0	0
St Croix Falls	6/20/2005	1:15 PM	Hail	0.75 in.	0	0
Osceola	6/27/2005	5:58 PM	T-storm Wind	51 kts.	0	0
Countywide	6/27/2005	6:00 PM	T-storm Wind	52 kts.	0	0
Countywide	7/23/2005	10:00 AM	T-storm Wind	52 kts.	0	0

Amery	9/12/2005	10:45 PM	T-storm Wind	75 kts.	4,454,641	0
Clear Lake	7/25/2006	3:30 PM	T-storm Wind	55 kts.	0	0
East Farmington	7/25/2006	4:40 PM	T-storm Wind	55 kts.	0	0
Amery	7/25/2006	4:45 PM	T-storm Wind	52 kts.	0	0
Dresser	7/25/2006	4:45 PM	T-storm Wind	55 kts.	0	0
Luck	9/16/2006	10:30 PM	T-storm Wind	52 kts.	0	0
Amery	9/16/2006	10:40 PM	T-storm Wind	52 kts.	0	0
St Croix Falls	9/16/2006	10:45 PM	T-storm Wind	52 kts.	0	0
St Croix Falls	5/23/2007	14:30 PM	T-storm Wind	54 kts.	0	0
Frederic	5/23/2007	15:00 PM	T-storm Wind	52 kts.	0	0
Indian Creek	5/23/2007	15:15 PM	T-storm Wind	52 kts.	0	0
Frederic	6/7/2007	17:30 PM	T-storm Wind	55 kts.	0	0
Milltown	6/20/2007	16:25 PM	Hail	0.75 in.	0	0
Milltown	6/20/2007	16:25 PM	Hail	0.75 in.	0	0
Luck	6/20/2007	17:20 PM	Hail	0.75 in.	0	0
Cushing	6/20/2007	17:55 PM	Hail	1.75 in.	0	0
Wanderoos	7/3/2007	13:35 PM	T-storm Wind	52 kts.	0	0
Amery	7/3/2007	13:40 PM	T-storm Wind	52 kts.	0	0
Amery	7/3/2007	13:45 PM	T-storm Wind	52 kts.	0	0
Balsam Lake	7/8/2007	14:00 PM	T-storm Wind	52 kts.	0	0
Turtle Lake	7/8/2007	14:03 PM	Hail	1.00 in.	0	0
Amery	7/8/2007	14:15 PM	T-storm Wind	50 kts.	0	0
Wanderoos	7/8/2007	14:15 PM	T-storm Wind	55 kts.	0	0
Milltown	7/8/2007	14:20 PM	T-storm Wind	55 kts.	0	0
Clayton	8/11/2007	20:00 PM	Hail	0.75 in.	0	0
Milltown	8/13/2007	20:25 PM	T-storm Wind	52 kts.	0	0
Osceola	8/13/2007	20:31 PM	Hail	0.75 in.	0	0
Milltown	9/20/2007	20:32 PM	T-storm Wind	50 kts.	0	0
Indian Creek	9/20/2007	20:45 PM	T-storm Wind	50 kts.	0	0
Range	9/20/2007	20:50 PM	T-storm Wind	50 kts.	0	0
Dresser	9/30/2007	2:15 AM	T-storm Wind	50 kts.	0	0
St Croix Falls	9/30/2007	2:20 AM	T-storm Wind	52 kts.	0	0
Luck	9/30/2007	2:30 AM	T-storm Wind	50 kts.	0	0
Osceola Muni Arpt	5/25/2008	16:16 PM	Hail	0.75 in.	0	0
Horse Creek	5/25/2008	16:20 PM	T-storm Wind	55 kts.	0	0
Lykens	5/25/2008	16:30 PM	Hail	0.75 in.	0	0
Clayton	5/25/2008	16:45 PM	Hail	0.75 in.	0	0
Clayton	5/25/2008	16:45 PM	Hail	0.75 in.	0	0
Clayton	6/14/2008	21:28 PM	T-storm Wind	52 kts.	0	0
Amery Muni Arpt	7/10/2008	17:44 PM	Hail	1.75 in.	0	0
Osceola Muni Arpt	7/11/2008	19:55 PM	T-storm Wind	55 kts.	0	0
Wanderoos	7/11/2008	20:00 PM	T-storm Wind	52 kts.	0	0
Amery	7/11/2008	20:20 PM	T-storm Wind	52 kts.	0	0
Horse Creek	7/19/2008	14:50 PM	T-storm Wind	56 kts.	0	0
Frederic	7/25/2008	13:20 PM	Hail	0.75 in.	0	0
Luck	8/3/2008	13:50 PM	T-storm Wind	60 kts.	0	0

Clayton	9/26/2008	22:50 PM	Hail	0.75 in.	0	0
Richardson	5/5/2009	14:25 PM	Hail	1.00 in.	0	0
Cushing	5/5/2009	15:45 PM	Hail	0.75 in.	0	0
Lewis	5/5/2009	15:45 PM	Hail	1.00 in.	0	0
Clayton	7/22/2009	14:55 PM	Hail	1.00 in.	0	0
Osceola Muni Arpt	7/24/2009	7:08 AM	Hail	0.75 in.	0	0
East Farmington	8/8/2009	7:40 AM	T-storm Wind	50 kts.	0	0
Horse Creek	8/8/2009	7:47 AM	T-storm Wind	50 kts.	0	0
East Farmington	8/8/2009	21:20 PM	T-storm Wind	61 kts.	0	0
East Farmington	8/8/2009	21:25 PM	T-storm Wind	61 kts.	0	0
Richardson	7/7/2010	16:55 PM	T-storm Wind	52 kts.	0	0
Amery	7/11/2010	15:51 PM	Hail	1.00 in.	0	0
Loraine	7/14/2010	9:40 AM	Hail	0.75 in.	0	0
Loraine	7/20/2010	13:03 PM	Hail	1.25 in.	0	0
Balsam Lake	7/20/2010	16:50 PM	Hail	1.25 in.	0	0
Range	7/20/2010	17:13 PM	Hail	1.75 in.	0	0
Clayton	7/20/2010	17:31 PM	Hail	0.88 in.	0	0
Balsam Lake	7/27/2010	18:20 PM	T-storm Wind	56 kts.	15,000	0
St Croix Falls	8/10/2010	18:00 PM	T-storm Wind	52 kts.	0	0
Nye	8/10/2010	18:05 PM	T-storm Wind	52 kts.	0	0
Clear Lake	8/10/2010	23:00 PM	Heavy Rain	N/A	0	0
Dresser	8/13/2010	15:45 PM	T-storm Wind	52 kts.	10,000	0
Loraine	8/13/2010	16:15 PM	T-storm Wind	52 kts.	0	0
Clayton	9/21/2010	1:35 AM	T-storm Wind	52 kts.	0	0
Bunyan	9/21/2010	1:40 AM	T-storm Wind	61 kts.	25,000	50,000
204 events (150 since 1/1/1994)					\$6,591,310	196,445

Source: National Climatic Data Center (NCDC)

Damage estimates in 2010 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

Of the reported severe thunderstorm events recorded in Table 20 since January 1994, 91 had high winds associated with them, 57 included hail, and two were noted for heavy rains. No severe lightning events were reported for the timeframe, though many of the 91 high wind thunderstorm events were also accompanied by heavy rains and lightning. No deaths or injuries associated with these storms were given in the database. It must be noted that the NCDC database is not inclusive of all damage estimates from hazards in the County. Damages to buildings and crops, as well as general debris clean-up costs, are often under-reported and no damage data for any thunderstorm event was estimated prior to 1993.

Two significant thunderstorm events have occurred in the last decade:

June 11, 2001 – This thunderstorm caused damage in a path from the west-central portion of the County to the southeast corner. High winds caused the majority of the storm damage. Total reported damages were \$1,354,100 (adjusted for 2010 dollars), significantly above the estimate in the NCDC database.

September 12, 2005 -- Over 65 percent of the reported damages are associated with a single

high wind event in September 2005. During this event, straight-line winds estimated at 85 MPH struck the Amery area. Minor damage was reported for numerous structures while major damage was reported for one home and twelve businesses. Seven additional business structures in Amery were destroyed. A nearby feed mill and warehouse owned by the local farmers co-op was also destroyed. Moderate damage was also reported to the airport hangars and many trees in the area were severely damaged. State Highway 46 was temporarily closed due to debris.

Compared to its neighbors in Wisconsin, Polk County has experienced fewer hail events in recent decades (see Figure 27). From 1982 to 2007, there have been 41 hail events reported for Polk County. According to NCDC records, the most significant hail storm event in Polk County in recent memory occurred in the Luck area in May 1996. Over \$130,000 in damages was reported, mostly consisting of damage to vehicles in a used vehicle lot.

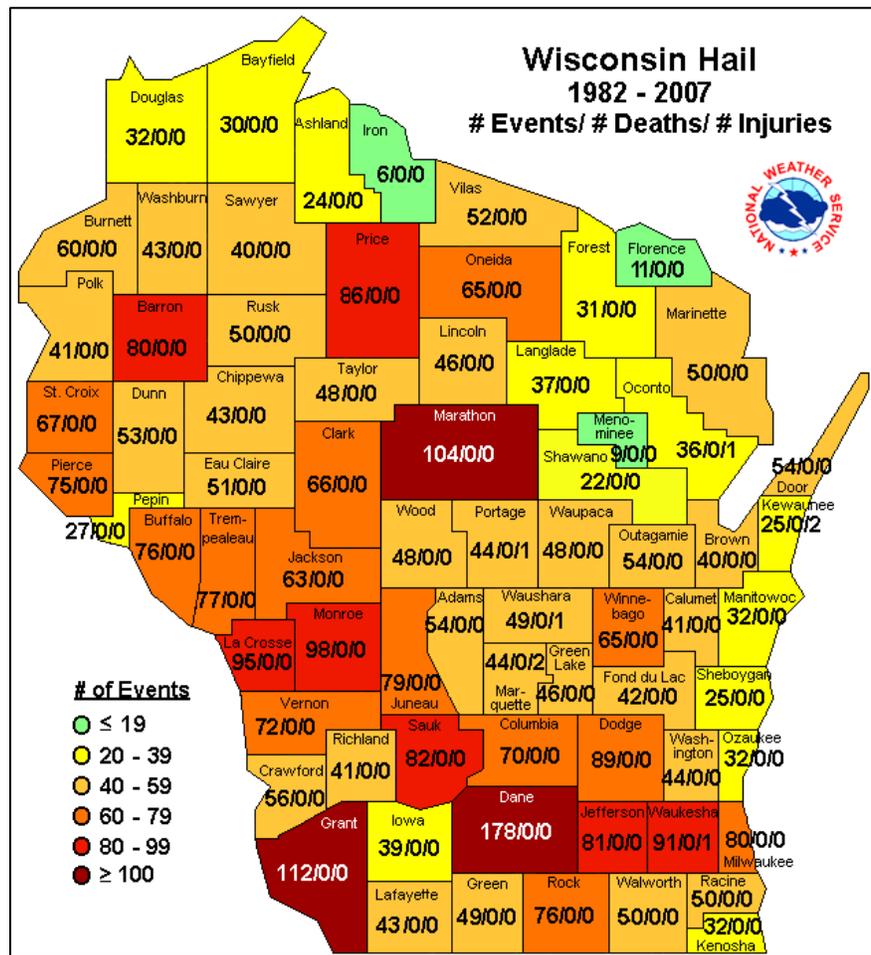
The National Weather Service is able to forecast and track thunderstorms that are capable of producing severe weather conditions such as high winds, hail, lightning, and possibly tornadoes.

Although the improvement of technology has enabled meteorologists to better forecast and monitor thunderstorms, there is no precise way to make long-term predictions of location, severity, and associated risks. As shown in Table 20, there are no clear trends which can be used to make projections on the impacts of future thunderstorm events.

Relative Level of Risk

Thunderstorms are the most frequent natural hazard event in Polk County as reflected by its relatively high ranking (see Table 10). **Based on recent trends, it is expected that an average of nine to ten severe thunderstorm, high wind, and hail events will continue to be reported**

Figure 27. Reported Hail Events in Wisconsin



in Polk County each year. Further, of the 365 days in the year, reports will be made for somewhere in the County on five days each year on average. The highest frequency of these events will occur during the months of May through August.

Vulnerability Assessment—Thunderstorms

Potential Impacts

Thunderstorms have no defined hazard area within Polk County. Due to the irregular nature of these events and lack of specific hazard areas, the impacts as a result of a thunderstorm are difficult to quantify. As Table 20 showed, most thunderstorm events occur with minimal negative impacts; and this trend will likely continue.

In general, thunderstorms, high winds, and associated hazards can cause damage to houses or property, uproot trees, and topple (or cause lightning damage to) above-ground power or telephone lines. Above-ground power lines are especially vulnerable in wooded areas with significant residential development, such as older neighborhoods and new subdivisions within pine plantation, where adjacent trees can be blown down onto the lines. Roadways can also be blocked by debris; and debris can accumulate in rivers or stormwater systems, contributing to washouts or flooding.

Note:

High wind vulnerability is further explored as part of the tornado sub-section.

Severe thunderstorms can cause injury or death from lighting, falling trees, downed power lines, and high-wind impacts. They may cause power outages, disrupt telephone service, and severely affect radio communications and surface/air transportation, which may seriously tax the emergency management capabilities of the affected municipalities. Stormwater and other flooding impacts are discussed separately as part of the flooding hazard assessment in Section III.B.iv.

Hail can cause serious injury and damage to buildings, personal property (vehicles), and crops. The most serious damage occurs when hailstones reach a diameter of 1.5 inches, which happens in less than half of all such storms. Hail and high winds can also cause significant damage to agricultural crops.

Lightning can result in serious injury, start fires, short-out electrical systems, cause widespread losses of power, and even cause death. Between 1995 and 2002, there were 364 deaths due to lightning in the United States. And in Wisconsin, insurance records show that annually, one out of every fifty farms is struck by lightning or has a fire which may be caused by lightning. Large outdoor gatherings can also be particularly vulnerable to lightning strikes that may result in injuries or death.

Based on key informant interviews, past-event history, and a review of the community, it was determined that the following general types of facilities and community assets are most vulnerable to thunderstorm (non-flooding) events:

- Mobile homes, especially those unanchored (high winds)
- Large-span buildings and buildings with many windows (high winds, hail)
- Above-ground power lines, especially in wooded areas (high winds, lightning)
- Agricultural crops (high winds, hail)

Overall, most thunderstorms result in minor damage to most buildings and structures, though all improvements and structures are potentially vulnerable to varying degrees (see Section II.C.iv. Property Values). Older, deteriorating structures may be more vulnerable (21% of the County's housing stock was built before 1939), though the condition of a structure is not inherently linked to age. Some more common impacts include leaks and flooding basements during heavy rains; damage to personal property or windows due to hail; or wind damage to roofs, trees, etc. Thunderstorm damage to structures is typically remedied by the individual owner, utilizing insurance as needed, and is not officially reported to County Emergency Management or other governmental entity. However, some high, straight-line wind events can approach tornado velocity, effectively yielding the same vulnerabilities as a tornado event, especially for mobile homes. Debate continues among some local residents whether the impacts of certain past events were the result of tornadoes or high, straight-line winds. Please refer to the vulnerability assessment for tornadoes in the previous section for a discussion of the potential vulnerabilities due to high winds.

The continuing changes in land-use and development patterns can influence the County's potential for future exposure to thunderstorms. As discussed in the community profile, Polk County is continuing to grow and develop. This creates an increasing exposure to the number of residents and properties that could be at risk from future events. Although new development is managed to ensure adequate protective services are provided and construction is governed by the most current building codes, continued growth increases the vulnerability to natural hazard events.

Vulnerable Critical Facilities

A more robust assessment of the community assets (critical facilities) and their susceptibility to thunderstorms is located in **Appendix F**. The vulnerability assessment shows that utilities and infrastructure, and, in particular, above-ground power and communication lines, have the greatest vulnerability to thunderstorm events from downed power lines and lightning strikes.

High winds and lightning can also affect radio communications and antennas, potentially impacting weather warning systems and the coordination of emergency response providers. Lightning does occasionally strike infrastructure as noted in the following sub-section. Power or communications outages as a result of thunderstorm events can indirectly affect the function of other critical facilities (e.g., hospitals, schools, government offices). Risks and vulnerabilities associated with power outages are discussed previously in the *Special Threat Analysis—Long-Term Power Loss* at the beginning of this chapter.

Unique Jurisdictional Risks or Vulnerabilities—Thunderstorms

Like tornadoes and winter storms, thunderstorms pose no risks or vulnerabilities unique to individual jurisdictions. The level of vulnerability increases with development density, population density, age/condition of structures, and value of improvements. As such, cities and villages are the highest vulnerability areas as well as those areas of with higher populations, larger numbers of housing units, and higher assessed value per square mile described previously in Section II.C. & D. of the Community Profile.

During community meetings on this project, high straight-line winds and downbursts were the most frequently mentioned thunderstorm hazard. Any notable differences between municipalities regarding their vulnerability to thunderstorms are further discussed in the *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G**. The vulnerabilities related to high winds were largely covered previously as part of the tornado section.

A number of municipalities also noted the lightning strikes have occurred to various infrastructure in recent memory:

- Village of Clayton – 2011 strike to a well
- Village of Frederic - #4 well has been struck by lightning
- Village of Luck – strike at water tower and twice at wastewater plant; 2010 especially bad

iv. Flooding (including dam failure, riverine, & stormwater flooding)

Summary—Flooding

Risk – Within the past twenty-five years, most significant flooding in Polk County has fallen into one of four general categories: road damage and closures due to stormwater flooding, fluctuating water levels on seepage lakes, stormwater flooding in developing areas, and flooding along the Apple River. There has also been significant damage related to dam failure, in particular within the Village of Osceola in September 2002. There have been four Presidential Disaster Declarations involving flooding in Polk County (1965, 2000, 2001, 2002). It is likely that Polk County will continue to experience a serious, damage-causing flood event every 1.5 to 2 years on average.



Vulnerabilities – Most flood-related damage in Polk County during recent decades has been road-related and scattered basement flooding due to stormwater or flash flooding. Structures or improvements within a dam’s shadow or in a floodplain are also vulnerable, but such flooding events have been rare for most of the County. An estimated 570 principal structures were identified as potentially being located in the 100-year floodplain in Polk County, with an estimated \$67.8 million in assessed improvements; 14 parcels were non-profit or public-owned and not assessed. Over 95% of the assessed parcels were in residential use with the greatest concentrations on lakes. Over half of these structures were located in the towns of Lincoln, Georgetown, Alden, and Apple River. Of the 44 existing and 44 planned dams in the WDNR database for Polk County, only four are high-hazard dams and four are significant-hazard dams.

1. From 1978 to November 2010, there were only thirteen National Flood Insurance Program (NFIP) claims for Polk County with \$301,806 total paid, with no Repetitive Loss Properties¹⁵. However, five of these thirteen claims were on Sand Lake in the Town of Osceola. As of November 2010, a total of 39 NFIP policies were active for Polk County landowners, 25 of which were in the unincorporated towns. As of June 2011 and prior to the NFIP map update currently in progress, all communities with designated 100-year floodplains were participating in the NFIP. No cities or villages identified significant overbank flooding concerns during this plan update.
2. Significant stormwater system and culvert improvements have been made within the County to address many stormwater problem areas since the 2005/2006 plan, yet numerous problem areas still exist, especially in “low areas” with high groundwater tables. Flood damage at the County Highway “B” bridge downstream of Atlas Dam and the periodic topping of the Clam Falls Dam at County Highway “I” are two priority

¹⁵ A Repetitive Loss Property (RLP) has 2 or more NFIP claims of \$1,000 or more in a 10-year period.

concerns in the unincorporated areas. Most incorporated communities had some level of stormwater flooding concerns, with structural damage or significant basement flooding reported in the villages of Dresser, Luck, and of Milltown, and flood damage to infrastructure reported in Frederic, Osceola, and St. Croix Falls.

3. Dam-related issues identified during the planning process include:
 - a) The Clam Falls Dam being topped if more than 1.5” of rain poses a risk to nearby roads and still remains a concern as identified in the 2006 mitigation plan.
 - b) A number of dams, such as the Black Brook Dam, have bridges and roads in their dam shadows. Emergency operating plans have been established for high- and significant-hazard dams, in addition to some other dams with critical infrastructure located downstream.
 - c) The “Schilling Dam” is a blocked culvert functioning as a dam, but is not an approved structure and does pose a risk to nearby road infrastructure; it should be improved or removed.
 - d) The Godfrey Lake Dam could be re-classified as a low hazard dam if dam shadow zoning is adopted.
 - e) 1-2 homes, some farm buildings, and the CTH “B” bridge lies within the dam shadow of the County-owned Atlas Mill Dam.
 - f) No G.I.S. data coverage of the delineated dam shadows in Polk County has been prepared.
4. Most structures outside the 100-year floodplain do not have flood insurance, though these areas may be prone to stormwater or flash flooding. Approximately one-third of all NFIP claims nationwide are for damages outside the 100-year floodplain.
5. Polk County and its communities maintain policies and floodplain zoning to discourage future development in 100-year floodplains and other areas particularly prone to flooding. Flood vulnerabilities in floodplain areas are more likely to increase from increasing frequency of heavy storm events, loss of natural flood storage areas, and increased runoff from non-floodplain areas.

Risk Assessment--Flooding

The Hazard

Flooding is the only natural hazard with officially defined hazard areas within Polk County. As such, flooding receives the greatest level of analysis within this plan.

Flooding is defined as a general condition of partial or complete inundation of normally dry land from the overflow of inland waters, or the unusual and rapid accumulation or runoff of surface waters from any source. Often, the amount of damage from flooding is directly related to land use. If the ground is saturated, stripped of vegetation, or paved the amount of runoff increases

and contributes to flooding. Additionally, debris carried by the flood can damage improvements and infrastructure, or can obstruct the flow of water and further add to flooding.

For Polk County, flooding can be further subdivided into three primary types: (1) lake or riverine flooding, (2) stormwater or overland flooding, and (3) flooding resulting from dam failure.

Lake or Riverine Flooding (Overbank) - Major floods in Wisconsin have, for the most part, been confined either to specific streams or to locations which receive intense rainfall in a short period of time. Flooding which occurs in the spring due to snow melt and/or prolonged periods of heavy rain is characterized by a slow buildup of flow and velocity in rivers, streams, or lakes over more than six hours and often over a period of days. This buildup continues until the river, stream, or lake 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.

Key Definition

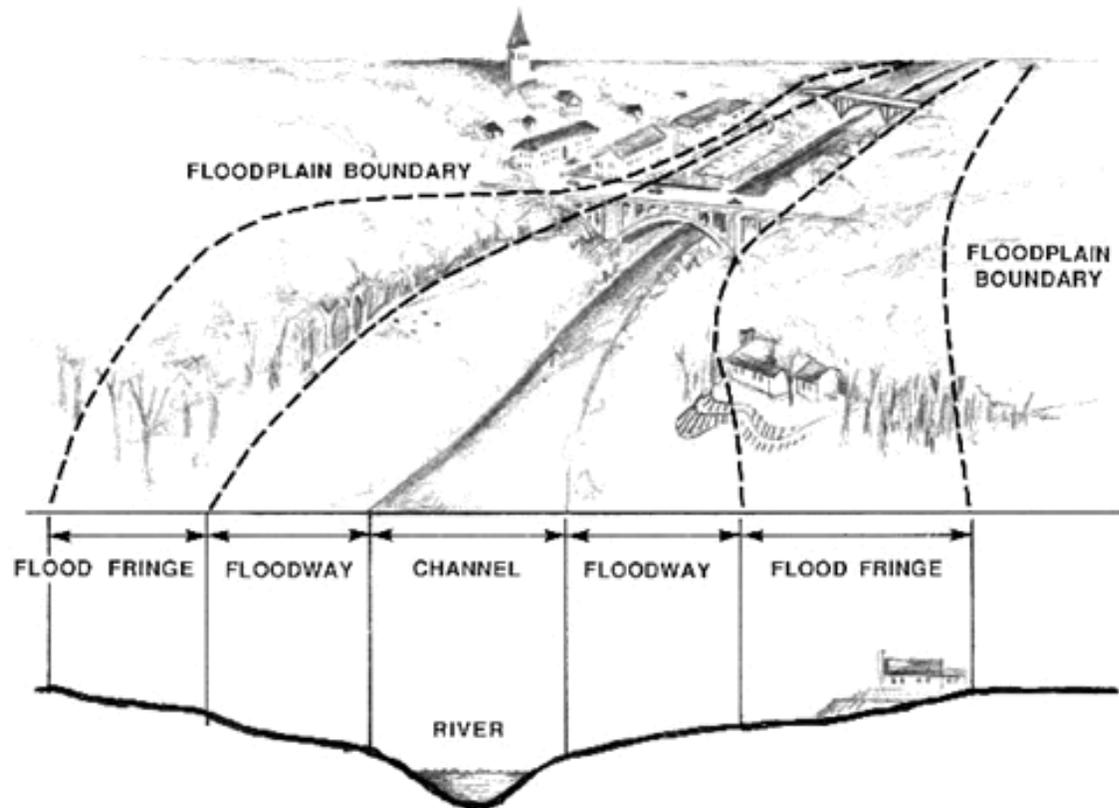
A 100-year flood has a 1% chance of being equaled or exceeded in any given year.

For regulatory purposes, the terms “100-year flood” and “floodplain” are commonly used. A **100-year flood**, often referred to as a **regional flood, special flood hazard area, or base flood**, is a flood that has a one percent chance of being equaled or exceeded in any given year. This can be misleading as a 100-year flood is not a flood that will occur once every 100 years. The 100-year flood, which is the standard used by most Federal and State agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

A **floodplain** is that land which has been or may be covered by floodwater during a flood event and includes the floodway and floodfringe areas (see **Figure 28**). The **floodway** is the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry the regional flood discharge. Since it is associated with moving water, the floodway is the most dangerous part of the floodplain. The **floodfringe** is the portion of the floodplain outside of the floodway, which is covered by flood water during the regional flood and is generally associated with the storage of water rather than flowing water. The floodfringe is also that part of the floodplain in which development may be allowed in some communities, subject to floodplain development standards.

The **regional flood elevation** is the elevation determined to be representative of large floods known to have occurred in Wisconsin or which may be expected to occur on a particular lake, river, or stream at a frequency of one percent during any given year. The **flood protection elevation** is an elevation which is 2 feet above the regional flood elevation as defined by the Wisconsin Department of Natural Resources. Development is sometimes allowed within the floodfringe if the structure is raised above the flood protection elevation. However, development in the flood fringe can decrease important floodwater storage; hydraulic analysis is often needed to ensure that the development will not result in increased flooding in adjacent areas or farther downstream.

Figure 28. Elements of a Floodplain



Source: Minnesota Department of Natural Resources.

Often, the term “floodplain” is used inappropriately by assuming that floodplains are limited to the 100-year floodplain boundary. This is not the case, and a floodplain can be identified for a 500-year flood or other such level of risk.

The 100-year floodplain is a guide for regulatory and insurance purposes. Floods greater than a 100-year regional flood event can and do occur. Nationwide, approximately 25 percent of all National Flood Insurance Program claims are for structures outside the 100-year floodplain. This is a surprisingly high number, since many homes or structures outside the 100-year floodplain do not have flood insurance; and flood insurance is typically not required by lending institutions for mortgages on structures not within the 100-year floodplain. But this demonstrates that most properties are at risk of flooding to some degree.

Generally, the 100-year floodplain should be considered the high flood-hazard risk area. The 100-year floodplains are shown as the “A” zones on the FEMA Flood Insurance Rate Maps (FIRMs). Nationwide, 26 percent of the 100-year floodplains experience or exceed a 100-year flood event within a typical 30-year mortgage period. The 500-year floodplains (the shaded “X” zones on the FIRM maps) are the medium-risk flood-hazard areas. The remaining unshaded “X” zones on the FIRM maps should be considered the low-risk flood-hazard areas.

Also, high-hazard flood areas can exist which are not shown on the Flood Insurance Rate Maps. And floodplains can change in hazard risk and size as development occurs or with other physical changes in the environment. Municipalities can take the initiative to have new flood risks added to the FIRM maps as a Letter Of Map Change (LOMC) or otherwise consider them during their planning and regulatory processes. Allowing inappropriately planned development to occur with knowledge of such potential hazards could be a source of potential liability for a community should a flood event occur which impacts the development.

The letters of final determination (LFDs) for the updated Flood Insurance Rate Maps for Polk County were distributed in late March 2011, and municipalities have begun the adoption process. These updated maps are available in a digital format (D-FIRMs). Most floodplain areas were digitized from the existing floodplain maps and adjusted to best-available topographic information. A handful of areas had more detailed studies performed in past years which provided additional information incorporated into the D-FIRMs, such as the determination of base flood elevations on Balsam Lake, Big Butternut Lake, and Clam Falls Flowage. The Village of Osceola had two-foot contour data which was also used; no countywide LIDAR data was available. According to the FEMA Flood Insurance Rate Study dated September 16, 2011, only one LOMC was incorporated into the updated D-FIRMs.

Stormwater Flooding (Overland) and Flash Flooding (Overbank or Overland) - The type of flooding which occurs primarily from surface runoff as a result of intense rainfall is referred to as stormwater flooding or overland flooding. These flooding events tend to strike quickly and end swiftly. If 6" of rain falls on 2,000 square feet of roof and concrete (about the size of a typical roof, driveway, and garage), 1,000 square feet of stormwater will runoff from that single home.

Flash flooding is more difficult to distinguish and can, in fact, be either riverine (overbank) or stormwater (overland) flooding. In this plan, flash flooding has been grouped with stormwater flooding due to its often unpredictable nature and the intense, rapid rise and velocity of the water levels. 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." Like stormwater flooding, flash flooding is typically the result of intense rainfalls possibly in conjunction with already saturated soils, though very sudden snow melts can also contribute to stormwater or flash flooding.

Areas with steep slopes and narrow stream valleys are more vulnerable to stormwater and flash flooding, as the water can achieve high velocity in a short time. Developed areas with substantial impervious surfaces can further contribute to stormwater and flash flooding. Flash floods often occur in smaller watersheds or are very localized and are, therefore, not necessarily reflected on most FEMA Flood Insurance Rate Maps. Flash flooding can also be the result of dam failure.

Dam Failure - According to the FEMA Federal Guidelines for Dam Safety, dam failure is defined as a:

“Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. It is recognized that there are lesser degrees of failure and that any malfunction or abnormality outside the design assumptions and parameters that adversely affect a dam's primary function of impounding water is properly considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure. They are, however, normally amenable to corrective action. (FEMA 148).”

Technically, dam failure could be considered a man-made hazard and, thus, outside the scope of this hazards mitigation plan. However, given the County's ownership and management of a number of dams and the inherent relationship and similarities between dam failure and other types of flooding, a decision was made to include a discussion of this hazard as part of the flooding assessment.

Dam failure can occur from structural problems at the dam, hydrologic problems, malfunction of equipment, or human error in the monitoring or release of water. As such, dam failure can occur with little or no warning and on clear days with no rain, unlike the other types of flooding.

Older dams which have been poorly maintained have a larger potential of dam failure. Hydrologic problems may occur when there is heavy precipitation or snow melt, resulting in more water being impounded than by design or more than the spillway can handle, resulting in adjacent flooding, overtopping, or structural failure. A partial or complete failure of a dam can release great amounts of water, leading to loss of life and substantial damage downstream. A dam failure may lead to additional failures of other downstream dams. And the sudden, prolonged disappearance of an impoundment due to dam failure can also have serious impacts on wildlife habitat, recreation, and tourism.

Regional Trends

Low-lying areas of those Wisconsin counties that border the Wisconsin and Mississippi Rivers and many nearby tributaries are prone to riverine flooding. As development has increased, agricultural flooding in some areas has increased as well. Shoreline development has also increased both the risk and vulnerabilities to flooding. Since the 1960s, the number of homes along northern Wisconsin lakes has increased over 216 percent. Statewide, an estimated 250,000 structures lie within 100-year floodplains. Nationwide, floodplains have been slowly increasing in size due to increases in runoff and decreases in flood storage areas.

Flooding is the principal cause of damage in 26 of 32 Presidential Disaster Declarations in Wisconsin from 1971 through July 2008. From 1971 until 1993, the total flood damages in Wisconsin were estimated at \$300 million. In June 1993, flooding over large areas of the State resulted in an estimated \$352 million in damages from this single event. Even worse flooding damage was experienced in Wisconsin in June 2008 with damages estimated at roughly \$697 million.

There have been very few dam failures in Wisconsin that resulted in major damages or loss of life. The June 1993 flood event included the failure of an embankment associated with the Hatfield Dam on the Black River which contributed to flooding damage downstream in the City of Black River Falls. In June 2008, the Lake Delton Dam broke which resulted in mudslides which washed out a number of homes. Closer to home in 2002, a small privately owned dam in Osceola washed out and caused significant damage to a mobile home park. Many of Wisconsin's approximately 3,800 dams are small logging or milling dams built prior to 1900 and have little or no associated vulnerabilities. Between 1990 and 1995, more than 75 dam failures were documented in Wisconsin. Several of these incidents resulted in injuries and serious property damage, but no loss of life.

Local Events

Since 1953, there have been four Federal Major Disaster Declarations which encompassed Polk County—April 1965, June/July 2000, April/May 2001, and September 2002. All four of these events involved flooding. The fact that three of these events have occurred since 2000, supports the opinions of many local officials that stormwater and flash flooding problems have been increasing in recent years for many areas of the County.

Most of the County's rivers and lakes stay within their banks during heavy rains or spring run-off. For those areas prone to overbank flooding, precautions have been implemented to mitigate flood damage, such as floodplain zoning and dam controls. The most significant flooding problems over the past decade have occurred when natural or man-made drainage and stormwater systems have been unable to handle heavy rain events, especially in low-lying areas or when the ground is already saturated.

Data from the National Climatic Data Center for flood events is not available for prior to 1993 (see **Table 21**) and only includes seven flood event reports for Polk County, with three of the reports for a single date in October 2005. Table 21 also indicates that flood-related damages have been relatively low over the past decade, though most damages are under-reported or go unreported. No injuries or deaths associated with the events were reported in Polk County.

**Table 21. Flood Events in NCDC Database • Jan 1993 to Sept 2010
Polk County**

Location	Date	Time	Type	Property Damage	Crop Damage
Regional	4/6/1997	6:00 AM	Flood	\$11,981,536	0
Regional	4/1/2001	12:00 PM	Flood	0	0
Osceola	9/1/2002	1:30 AM	Flash Flood	\$471,802	0
St Croix Falls	7/23/2005	10:30 AM	Flash Flood	0	0
Countywide	10/4/2005	6:15 PM	Flash Flood	0	0
Regional	10/4/2005	11:00 PM	Flood	0	0
Clayton	8/11/2010	1:00 AM	Flash Flood	0	0
			7 events	\$12,453,338	\$0

source: National Climatic Data Center (NCDC)

Damage estimates in 2010 dollars based on Consumer Price Index by U.S. Bureau of Labor Statistics

A closer review of the recent flood events in Polk County provides a better understanding of the frequency, characteristics, and damages related to flooding in the County.

April 1997 On April 12, the St. Croix River reached a crest about 3.5 inches above flood stage at Stillwater, MN, which was the third highest crest ever measured. Landing Park in Osceola was inundated by flooding. No specific information on the types of flood damages as a result of this event within Polk County is available.

June/July 2000 Severe thunderstorms accompanied by heavy rains, high winds, and stormwater flooding struck Polk County. This event was part of a Presidential Disaster Declaration, though it is strangely absent from the NCDC database. Damages in Polk County were estimated at \$592,500 (over \$757,700 in 2011 dollars), the majority of which were due to the washout of roads, shoulders, and culverts.

April 2001 Heavy snow fall during the winter largely remained on the ground through March, then rapidly melted. Water quickly began to fill ditches, streams, and rivers. Two significant rainfall events further contributed to the flooding. Kennedy's Mill Dam became clogged with debris causing an adjoining embankment to collapse, but damages were confined to the area just downstream of the dam and no structures (except the dam itself) were impacted. Some leaks and erosion also occurred at Woodley's Country Dam, which was privately owned at the time, and the dam came close to failure, but local emergency measures saved the structure. Total damages in the County from this event were estimated at \$1,600,717 (over \$1,990,000 today).

September 2002 This was Polk County's third flood-related Presidential Disaster Declaration in three years with characteristics similar to the June 2000 event with stormwater flooding and high winds as a result of thunderstorms. More than five inches of rain fell within a few hours resulting in documented damages of \$573,340 (over \$700,000 today). The Village of Osceola was the hardest hit in the 2002 disaster when a privately owned dam failed and caused damage to a private mobile home park and the Village-owned Mill Pond Park. This dam failure also caused damage to the lower dam which runs under State Highway 35, Wilkes Glen Park, and Cascade Falls on the St. Croix River. But on a regional scale, the damages associated with this event in the Osceola area were overshadowed by the tornado which struck the City of Ladysmith about 85 miles to the east in Rusk County.

During the 2002 flooding, the St. Croix River exceeded the 100-year flood and was the largest flood on historic record. Water rushed down-river at a rate of 62,000 square feet per second or 26.7 million gallons per minute. However, damage within the St. Croix River floodplain was minimal and limited primarily to parks and landings.

July 2005 Localized stormwater or flash flooding occurred throughout the region when several inches of rain fell in less than two hours. The City of St. Croix Falls was especially hard hit, and a significant washout occurred at the intersection of Kentucky Street and Adams Street just east of Highway 87.

October 2005 Heavy rains were experienced countywide, especially in northern parts of the County, leading to stormwater/flash flooding. Several roads were flooded. Some driveways were damaged and washouts were reported in and around some culverts. A number of roads in northern portions of the County between Frederic and Lewis remained flooded for multiple days.

August 2010 Several rounds of heavy rainfall led to significant flash flooding throughout parts of west-central Wisconsin. Southern portions of Polk County were particularly affected. An observer in Clayton, Wisconsin, reported basement flooding with approximately two inches of water covering the floor.

Appendix I lists the FEMA project applications for Polk County as a result of the 2000, 2001, and 2002 disaster events. Altogether, \$3,028,989 (over \$3.7 million in today's dollars) in applications were submitted, which addressed damages in 18 of the County's 24 towns and five cities and villages. Over one-third of these damages were road, culvert, and shoulder repairs associated with flash flooding.

During the planning process, County staff and local officials identified a number of areas in unincorporated Polk County which are particularly prone to flooding as shown in **Figure 29**; flooding concerns of villages and cities will be individually discussed later in this section. These rural flooding concerns generally fell into four categories:

- 1) **Road Damage and Closures Due to Stormwater and Flash Flooding, especially in "Low Areas"** – During the 2006 planning process, Town of Alden Chairman Brad Johnson wrote, "The largest hazard, as far as frequency, is heavy rain. We have not experienced heavy flooding in a specific area repeatedly, but it has created problems in various areas."¹⁶ The Town of Alden experience is shared by much of the County, where heavy rains can produce stormwater flooding "hotspots", but the risk of damage due to repetitive riverine or lake flooding is relatively minimal.

One interviewee during the planning effort noted that heavy rains and flooding seem to have been worse in the northern portion of the County in recent years. Yet Figure 29 shows that flooding problems are located throughout the County in low areas where roads cross or follow streams, wetlands, and areas with high groundwater tables. One such area is along CTH "D" north of Range which is frequently underwater and lacks sufficient ditching. Almost all of the "hotspots" identified for the unincorporated towns were associated with over-the-road flooding and potential roadway closures and related damage, rather than damage to buildings and structures. Such flooding events can result in vehicle accidents and deaths, as well as damage to road shoulders, culverts, bridges, etc.

It is notable that numerous flood "hotspots" identified in the 2006 hazard mitigation plan have been mitigated through road, culvert, and/or ditch improvements and were deemed to no longer be a flooding "hotspot." For example, significant roadway improvements

¹⁶ Johnson, Brad. *Letter to West Central Wisconsin Regional Planning Commission on Local Hazards*. letter dated 12/5/03.

have been made along STH “65”, CTH “A”, STH “87”, and USH “8”. Improvements were made to CTH “W” in the Town of West Sweden which has decreased the problem areas from about six in the past down to one or two spots.

- 2) **Fluctuating Seepage Lakes** – Overall, water levels at most lakes in the County have been very stable. But two seepage lakes, in particular, have had past problems with flooding. Seepage lakes are primarily spring-fed with no natural outlet. Due to drought conditions over five of the last seven years, water levels of these seepage lakes have been down and no significant flooding problems have been reported.

The 2006 plan identified two seepage lakes—Sand Lake (Town of Osceola) and Sand/Sandhill Lake (Town of Laketown)—as the only overbank flooding hotspots in unincorporated Polk County which had repetitive problems in the past, could potentially impact a large enough area, and include multiple improved properties to potentially warrant site-specific mitigation activities. Together, properties at these two locations represent six of the thirteen NFIP claims in Polk County to date. Significant development has occurred around both of these lakes. At least 20 lakeshore homes can be found at Sand (or Sandhill) Lake in the Town of Laketown, while over 45 surround Sand Lake in the Town of Osceola.

Mitigation measures have been undertaken at both locations, and no additional damage or problems have occurred in the interim. At Sand Lake in the Town of Laketown, cabins were moved farther back from the lake; and an overflow pipe was installed to help maintain water levels. At Sand Lake in the Town of Osceola, local springs have greatly contributed to the flooding problems in the past, but there has not been reoccurring problems since the recent raising of the adjacent road. Both locations are being monitored and no further action is warranted at this time.

- 3) **Stormwater Run-off in Developing Areas** – Stormwater runoff problems have also been a concern for some residential subdivision and commercial developments. Recently, more attention has been given to stormwater management during the planning and site plan review process by both local governments and builders to address this concern. Those areas experiencing new development are particularly prone to stormwater problems, especially those growth areas of south-west and south-central portions of the County as discussed in the *Community Profile—General Development* section earlier in the Plan. Also prone to stormwater runoff issues are areas at the interface of incorporation boundaries, as stormwater moves from municipality to municipality. The Village of Dresser and Village of Luck both have had such issues, as will be explained later in *Unique Jurisdictional Risks or Vulnerabilities—Flooding* section. Significant commercial development and added hardscape east of St. Croix Falls, especially along USH 8, have changed drainage patterns in the area leading to some stormwater flooding concerns.

- 4) **Flooding along the Apple River** – Over the past fifty years, damage from overbank flooding along Polk County rivers has been relatively small. The St. Croix River has been well above flood stage numerous times in the last two decades with minimal damage, though numerous roads and bridges were underwater in 2001. According to the FEMA Flood Insurance Study dated September 16, 2011, “[f]looding problems in Polk County are due primarily to the overflow of the Apple River,” though the study does not identify the extent of these problems. As of December 2010, there had only been two National Flooding Insurance Program policy claims for properties on the Apple River. Based on the town hazard surveys (see Figure 29), the most significant flooding concerns along the Apple River are concentrated in the Town of Apple River.

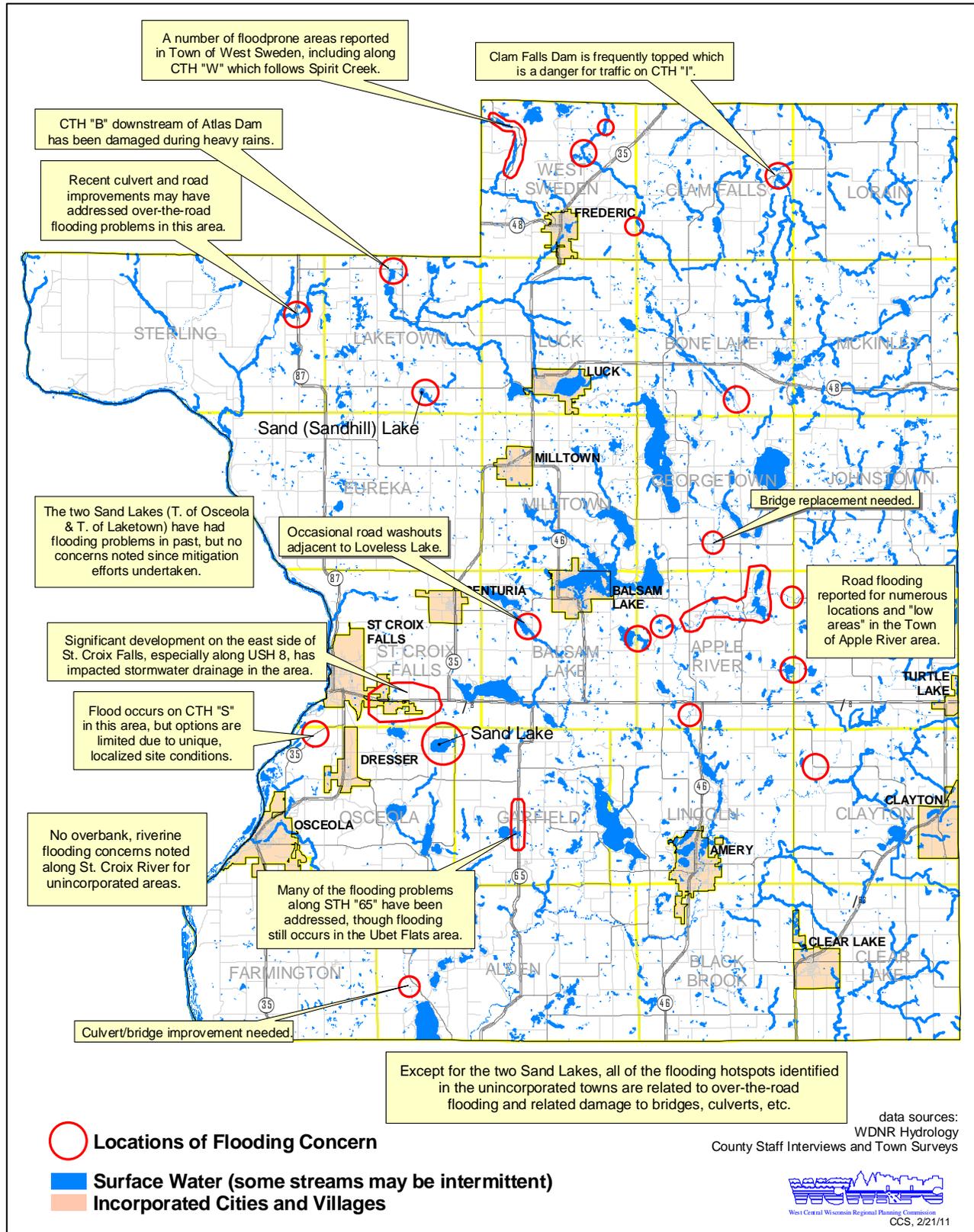
It is important to note that of eight flood events since 1997, there were three instances for significant damage at dam structures. Two of these dams (Woodley and Osceola) have since been removed, while significant improvements have been made to Kennedy’s Mill Dam. However, these events demonstrate the important of dam maintenance and monitoring as well as the potential risks downstream within the dam shadow.



**The Woodley Dam on the Apple River
has been removed since the last mitigation plan.**

Notably absent from Figure 29 and the previous discussion are any concerns with overbank flooding along the St. Croix River. The St. Croix River is a National Wild and Scenic River. This status, combined with local floodplain management and extensive public-owned lands along the river, has mitigated the potential of building and property damage. Flood impacts along the St. Croix are typically limited to recreational areas, such as boat landings. A picnic area within Interstate State Park is frequently flooded in the spring or following severe rain events which prevents access, but actual damage is relatively minimal.

Figure 29. Areas Prone to Flooding (Unincorporated Towns Only)



Relative Level of Risk

Flooding in Polk County will continue to be a significant risk for residents and improvements. The drought for much of the past decade likely contributed to a reduction of recent flood events, though there have been about seven significant flood events in the County over the past decade. A smaller overland or stormwater flood event can be expected to occur annually in some areas, with multiple events in a single year not uncommon. Such flash flooding can be expected to primarily result in basement flooding, washing out of road infrastructure, and contributing to soil and bank erosion. Those areas most prone to the typical annual riverine flooding associated with snow melt are well known and potential damages have been largely mitigated.

Based on the past decade, it is likely that Polk County will continue to experience one serious, damage-causing flood event every 1.5 to 2 years on average. Some of these events may be localized in nature, only impacting a portion of the County, while multiple events may be experienced in the same year or even month. Flash flooding due to heavy rains will be the most frequent cause of flood damage in the County and can occur any time of the year. Significant overbank and flash flooding caused by heavy snow melt, often in conjunction with rainfall, can be anticipated once or twice a decade, typically in the months of March, April, or May. These events also have the potential to cause significant damage, but as the September 2002 flood showed, the riverine flooding risks tend to be greater along the smaller rivers, rather than the St. Croix River. Flooding on seepage lakes is also very difficult to predict due to the cyclical nature of the groundwater levels and seriousness of the recent droughts.

If the dams within Polk County continue to be well maintained, flooding related to dam failure should not occur and is not expected. In fact, most of the smaller, privately owned dams would cause very minimal or no damage downstream if a failure should occur. The larger dams with significant- or high-hazard ratings were built to strict engineering standards, have related emergency plans, and are more closely monitored. Yet the County does have a recent history of damage or washout of dams, so ongoing attention to this risk is needed.

Vulnerability Assessment--Flooding

Flooding can be the most destructive of hazards, affecting large areas for long periods of times. Since flooding is tied to topography, a substantial amount of flood damage is the result of basement flooding, though floods can also move or destroy entire structures. Deaths and injury are relatively rare with river and lake flooding, since adequate warning time is usually available, though flash floods or dam failures can be very deadly as they may form very swiftly.

Floods can wash out roads, hindering the flow of traffic, and can cause havoc to water supply and wastewater treatment systems. Debris carried by flooding can result in direct damage to bridges, structures, or property; or this debris can obstruct the flow of water, causing additional flood damage. The resulting moisture build-up in the home (HVAC systems, carpeting, drywall, etc.) can cause additional, long-term health problems with mold and mildew once the floodwaters have retreated. Nearly half of all reported flood damage in Wisconsin in the 1990s was to crops, though obtaining accurate crop damage estimates at the County level is difficult; and Polk County lacks the large expanses of river bottomland found in other areas of the State.

Potential Development in Floodplains

In 2003, the County Land and Water Resources Director stated that impervious surfaces along the lakes had tripled in the previous ten years. However, floodplain development has decreased dramatically overtime with stricter enforcement of floodplain zoning and a decrease in available shoreland properties. Today, new development of Polk County's 100-year floodplains is very limited.

Data was not readily available to perform a comprehensive, detailed vulnerability assessment of flooding in Polk County. Instead, through the use of D-FIRM maps and available G.I.S. data, those principal structures potentially located within a 100-year floodplain were identified. This information is further supplemented through the previously provided flooding "hotspots" map (Figure 29) to guide the development and prioritization of flood-related mitigation strategies. A full description of the flood assessment methodology and related data challenges is included in **Appendix B**.

Figure 30 on the following page identifies the 100-year floodplains within Polk County. Areas of 100-year flood¹⁷ were taken from the recently produced Digital Flood Insurance Rate Maps (D-FIRMs) which will become effective in September 2011.

Figure 30 also shows the location of all likely principal structures located partially or wholly within the 100-year floodplains of Polk County using the methodology discussed in Appendix B. Principal structures are those buildings located on a parcel within which the main use of the parcel takes place. However, data for individual structures is not currently available, so principal structures were identified using aerial photography; and some errors undoubtedly exist. For most parcels, the principal structure will be a home or commercial business, as opposed to ancillary structures (e.g., garages, barns, sheds, boat houses).

Table 22, which immediately follows Figure 30, provides a synopsis of those potentially floodprone principal structures by municipality. The assessed use and estimated value of improvements is based on 2010 tax data for those parcels associated with each of the principal structures identified in Figure 30. Parcel mapping had not been completed for seven municipalities, so the 2010 medium assessed value of improvements for all improved residential parcels in those seven communities was used to determine the estimated value of potential floodplain improvements.

In total, 570 principal structures have been identified as potentially being located within the 100-year floodplain in Polk County. Of these, over 95 percent are likely residential in nature; only three commercial, fourteen exempt, and two other structures were identified. No industrial/manufacturing structures were identified as being potentially located in a 100-year floodplain. The total estimated assessed value of improvements for those parcels with a principal structure likely within the floodplain was \$67,768,676.

¹⁷ Also commonly known as "Zone A or AE" when referring to FEMA FIRM maps.

Almost 90% of these principal structures potentially located in a 100-year floodplain were located in an unincorporated town. Further, over half of these structures were concentrated in four towns—Town of Lincoln (113), Town of Georgetown (70), Town of Alden (66), and Town of Apple River (56). The Town of Alden was highest in terms of assessed improvements on these “floodplain parcels” at over \$11.2 million.

It must be noted that **the structures identified on Figure 30 and in Table 22 may not have had flooding problems in the past.** To the contrary, the majority of these properties have no history of flooding and may not be vulnerable to flooding in the future. In some cases, due to topography at the building site or construction methods, the structure may actually be elevated higher than the adjacent 100-year floodplain.

Further, as discussed in Appendix B, for properties with multiple buildings and ancillary structures, the exact use and nature of each structure within the floodplain is not known and tax assessment data is only available at the parcel level, not for specific structures. And in some cases, an ancillary structure (e.g., barn, shed, boathouse) is located in the floodplain but is not reflected in Figure 30 or Table 22 since the principal structure on that parcel was located outside the delineated floodplain. In short, this analysis should only be used as a general guide and not for site-specific, flood-related decision-making.

The map also shows the lack of development in the floodplain of the St. Croix River, the County’s biggest river. Much of the 100-year floodplain along the St. Croix within Polk County is State and Federally owned and managed for recreation. Further, the St. Croix River has Federal Wild and Scenic River status which significantly regulates development and encroachment along the river. Some annual snow melt flooding on the river is not uncommon, through the actual vulnerability to structures and improvements is very low.

Figure 30. Polk County Floodplains & Potential Floodplain Structures

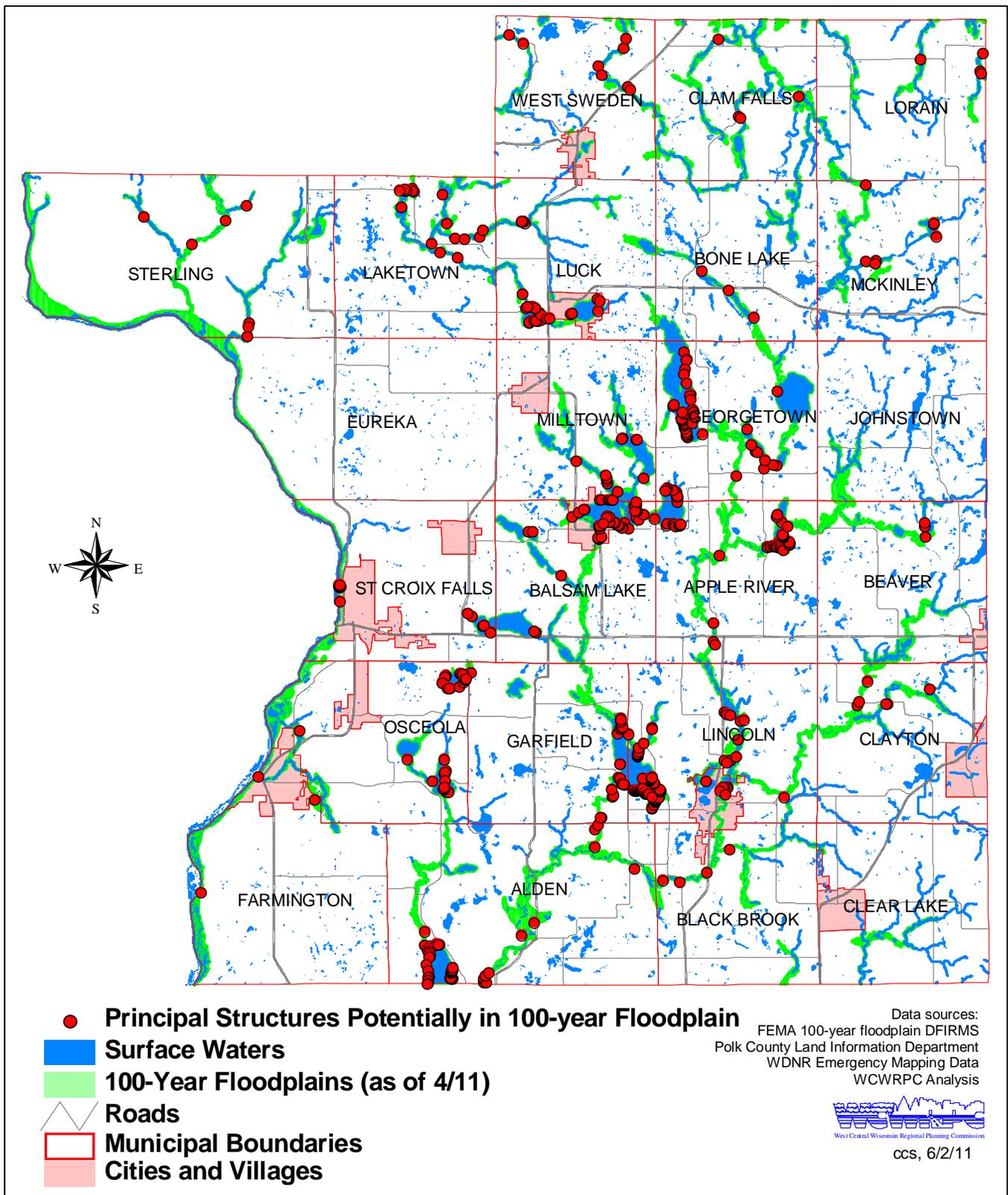


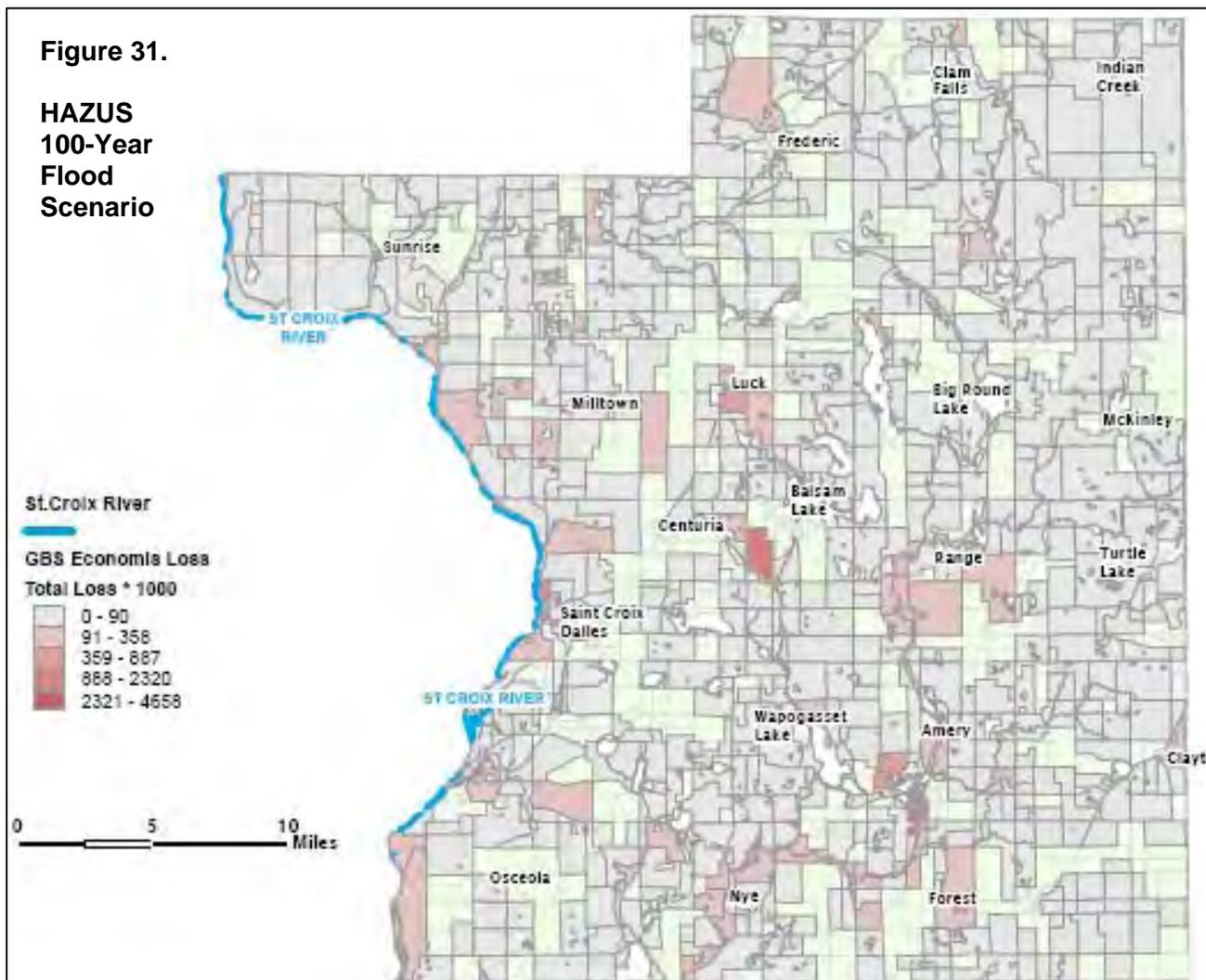
Table 22. Principal Structures potentially in 100-Year Floodplain

Municipality	Buildings by Primary Assessed Use						Est. Value of Assessed Improvements
	Residential	Commercial	Industrial	Other	Exempt	Total	
Towns							
Alden	65	0	0	0	1	66	\$11,241,700
Apple River	53	0	0	0	3	56	\$4,715,000
Balsam Lake	not available					18	\$2,169,936
Beaver	not available					3	\$352,080
Black Brook	4	0	0	0	0	4	\$569,700
Bone Lake	not available					3	\$394,177
Clam Falls	3	0	0	0	0	3	\$264,600
Clayton	6	0	0	0	0	6	\$469,600
Clear Lake	0	0	0	0	0	0	\$0
Eureka	0	0	0	0	0	0	\$0
Farmington	1	0	0	0	0	1	\$43,800
Garfield	24	0	0	0	1	25	\$5,253,700
Georgetown	not available					70	\$10,365,527
Johnstown	0	0	0	0	0	0	\$0
Laketown	16	1	0	1	1	19	\$1,704,100
Lincoln	110	0	0	1	2	113	\$10,619,400
Lorain	4	0	0	0	0	4	\$203,800
Luck	31	0	0	0	1	32	\$2,532,100
McKinley	6	0	0	0	1	7	\$410,200
Milltown	not available					20	\$3,297,104
Osceola	37	0	0	0	2	39	\$4,041,600
St Croix Falls	6	0	0	0	0	6	\$958,200
Sterling	not available					7	\$482,671
West Sweden	8	0	0	0	0	8	\$684,800
Town Sub-Total:	374	1	0	2	12	510	\$60,773,795
Villages							
Balsam Lake	33	2	0	0	1	36	\$4,090,200
Centuria	0	0	0	0	0	0	\$0
Clayton	0	0	0	0	0	0	\$0
Clear Lake	0	0	0	0	0	0	\$0
Dresser	0	0	0	0	0	0	\$0
Frederic	0	0	0	0	0	0	\$0
Luck	6	0	0	0	1	7	\$824,690
Milltown	0	0	0	0	0	0	\$0
Osceola	2	0	0	0	0	2	\$163,800
Turtle Lake	0	0	0	0	0	0	\$0
Village Sub-Total:	41	2	0	0	2	45	\$5,078,690
Cities							
Amery	7	0	0	0	0	7	\$772,500
St. Croix Falls	not available					8	\$1,143,692
City Sub-Total:	7	0	0	0	0	15	\$1,916,192
County Total:	422	3	0	2	14	570	\$67,768,676

HAZUS Analysis of Flood Vulnerabilities

HAZUS is a natural hazard loss estimation software package which is used in conjunction with geographic information system (GIS) software to simulate potential losses due to flooding, earthquakes, and hurricanes. HAZUS is distributed free-of-charge through FEMA and is becoming the national standard for disaster modeling for these events.

In 2008, Wisconsin Emergency Management prepared flooding analysis reports for each county in the State using the latest HAZUS software (HAZUS-MH) for a 100-year flood scenario. Based on this analysis, the scenario showed that Polk County flood damage would quite scattered. Some concentrations of areas of higher risk are found along the Apple and St. Croix Rivers as shown in **Figure 31** below. Twenty-three census blocks, in particular, would experience losses exceeding \$1 million. An estimated 154 buildings (150 residential and 4 commercial) would be damaged for total building losses of \$39.3 million and total economic losses of \$91.3 million. No industry, critical facilities, or other structures were damaged under the HAZUS scenario, though 976 households would be displaced.



While the above scenario does attempt to consider flood depth and topography using the enhanced quick look (EQL) function, the analysis relies heavily on State and Federal data sources, such as census block information. Parcel data for Polk County was not used. The potential exists to supplement the HAZUS scenario with local data in the future, though this does require expertise and knowledge of the HAZUS-MH software package.

The comparison of the HAZUS scenario with the analysis in Figure 30 and Table 22 does show that the overbank flood vulnerability in Polk County is scattered, and both analyses note sizable risks along portions of the Apple River and within the Village of Balsam Lake. Both analyses also showed that the flood risk is primarily limited to residential structures and a handful of commercial structures.

The size of the census blocks used in the HAZUS analysis, however, resulted in a higher estimated risk in certain areas compared to the previous analysis, such as along the St. Croix River and northwest of Frederic, which may be misleading. The other major difference is that the HAZUS analysis estimated much lower losses along many of the lakes, which does reflect that water levels along many of the lakes are fairly stable. However, Figure 30 and Table 22 are based on newer D-FIRM maps and do consider that the primary structures in these rural lakefront development areas tend to be concentrated nearer to the shorelines, while the HAZUS methodology assumes building inventories are dispersed evenly across census blocks.

Projecting Future Flood Vulnerabilities

Three primary factors are key to projecting future flood vulnerabilities:

1) **Changes in Precipitation** - Section III.A.v. previously discussed predicted climate changes for the region, including more precipitation during the winter months and more frequent heavy rainfall events. The projected 36 percent increase in 2" rainfall events per decade would likewise increase flooding potential and may result in additional areas being considered 100-year floodplains in the future. However, with a projected increase in summer drought conditions, surface water levels would likely be lower overall. No detailed modeling on the full impacts of such climate changes on Polk County surface waters has been performed.

2) **Changes in Flood Storage** – Overall, the floodplains and wetlands of Polk County are well protected. Encroachment of wetlands and new development often require the creation of new flood storage areas. Instead, the loss of flood storage will primarily be the accumulated loss or disruption of smaller stormwater storage areas, natural infiltration systems, and natural drainage systems. Every hardscape which is created (e.g., buildings, roads, parking lots), results in a change in potential stormwater or flood storage. This factor can be mitigated through stormwater management planning and mechanisms such as rain gardens, natural swales, rain barrels, pervious surfaces, and the creation and maintenance of flood storage areas.

3) **Floodplain Development** – While demand for shoreland living is high, new floodplain development is well regulated and rarely allowed. Public land ownership and restrictive easements along the St. Croix River further limit potential floodplain development in Polk County. Very little new floodplain development is occurring, so the number of structures in

Table 22 should not significantly increase over time unless the physical extent of the 100-year floodplain grows. The overall vulnerability of floodplain development is expected to increase as the market value of these structures increases and some older, seasonal structures are renovated as year-round retirement homes.

In short, floodplain development vulnerabilities are projected to increase in the future not from new development within the floodplain, but rather from increasing precipitation (and runoff), the increasing market value of existing structures, and the improvement of existing structures. No significant floodplain development is currently planned. Instead, the increasing flood vulnerability in Polk County will likely be from overland stormwater flooding as a result of additional heavy rainfall events and changes in natural stormwater storage and drainage patterns as new development occurs.

National Flood Insurance Program Claims and Repetitive Loss Properties

As of November 23, 2010, there were a total of 39 National Flood Insurance Program (NFIP) flood insurance policies in Polk County covering approximately \$6 million in property, which is a relatively low compared to many counties. The majority of these policies (25) were for property in the unincorporated towns. Of the incorporated communities, the Village of Osceola had the highest number of policies with four.

Since 1978, there have been 13 NFIP claims within Polk County with \$301,806 in paid claims for damage and contents. Further investigation of their locations has yielded that the community names given in the NFIP records for these claims are not accurate in all cases which resulted in an error in the 2006 hazard mitigation plan—none of the claims were verified as being located within the Village of Luck or City of St. Croix Falls. All verified locations are located within the unincorporated towns, with one location unknown:

- Town of Osceola (5 locations on Sand Lake)
- Town of Laketown (3 locations on Little Mirror, Sand Lake, and Long Trade Lake)
- Town of Apple River (2 locations on Apple River and Balsam Lake)
- Town of Lincoln (1 location on Apple River Flowage)
- Town of St. Croix Falls (1 location)

Based on available records, it does not appear that any property had more than one claim. Sand Lake in the Town of Osceola represented the only area with a concentration of claims, all of which were made in 1983-1985. There have been no NFIP claims in Polk County since 2001.

No Repetitive Loss Properties (RLP) have been identified for Polk County. Repetitive Loss Properties are those properties participating in the National Flood Insurance Program that have filed two or more NFIP claims of \$1,000 or more in a 10-year period.

Critical Facilities in Floodplains

As the natural hazards vulnerability assessment in **Appendix F** discusses, critical facilities located in floodplains are primarily limited to infrastructure (e.g., roads, bridges, dams). Community interviews and G.I.S. analysis was used to identify critical facilities potentially at risk of flooding. G.I.S. point data is available for the following critical facilities: governmental,

nursing homes, hospitals, schools, and hazardous materials facilities. Of these, only the Luck School was identified as being located (albeit partially) within a 100-year floodplain.

No County buildings were identified as having flooding problems. The electric company in Frederic is located in a low area, but has not had flooding problems in recent memory according to Village officials. Stormwater wash-outs and damage to roads, culverts, and bridge abutments have been the most common flood-related problems in the past for unincorporated Polk County.

Risk and Vulnerability Assessment – Agricultural Flooding

As will be discussed later in the drought assessment, agriculture is a big part of Polk County's landscape and economy. Though the focus of the flood assessment has been on principal structures and infrastructure, it is important to recognize the flooding risks to agriculture.

Agricultural Flooding

Approximately 42 percent of reported damages from Wisconsin floods between 1993 and 2000 were from crop losses. Flooding can have additional agricultural impacts as well. Since many floodplains are used for forage, the loss of these crops (e.g. alfalfa) may require farmers to supplement feed for livestock. Due to the low value of forage and high insurance costs, most farmers do not have multi-peril crop insurance for forage crops. The remaining forage in flooded areas can be lower in quality, reducing milk production and complicating or reducing pregnancies and births. Feed and water quality problems which result in sick animals also increase veterinary costs. Agricultural flooding impacts can also be long-term and more difficult to quantify. The harvesting of crops in wet areas can compact soils, further reducing crop yields for years to come.

Fewer than 1,000 acres of non-forest, cropped agricultural lands fall within the 100-year floodplains of Polk County. While crop damage due to flooding is occasionally experienced in some areas, statistics regarding crop losses in the past or future vulnerability due to flooding is not readily available. These potential losses can vary depending on the type of crops planted, though it is common practice to often use such floodprone areas for hay, forestry, or pasture. While prolonged flooded conditions are not common, periods of excessive soil wetness can delay spring planting and indirectly hinder yields by shortening the growing season.

Standing water following heavy rains or prolonged wet periods is a more significant problem for croplands which is not limited to floodplains. Denitrification and oxygen depletion of crops can severely reduce yields or result in plant death after prolonged water logging.

An additional agricultural flood-related threat is associated with non-point pollution, such as manure, nutrient, and pesticide run-off. Heavy rains, flooding, and unexpected snow melt can result in such run-off into surface waters, resulting in high levels of contaminants. Heavy rains and ice damming can also result in the failure of improperly maintained or sited manure storage facilities. Some small fish kills due to run-off have occurred in Polk County in the past. And such non-point pollution can create health concerns for swimming and fishing, thus impacting tourism. Issues related to animal waste and nutrient management are primarily monitored and

addressed by local farmers and the Polk County Land and Water Resources Department with partnership support of the Polk County UW-Extension Office and other State and Federal agencies (e.g., DATCP, WDNR, NRCS). However, it is very important to note that many sources of non-point pollution are not agricultural related, such as urban stormwater, road and parking lot run-off, and soil erosion from new development.

In addition, about 5,800 acres of forest lands and 5,100 acres of forested wetlands are located in floodplains, though past impacts of flooding on forest lands in Polk County are believed to have been minimal. Compared to other agricultural croplands, forested areas are typically less impacted by and more resilient to flooding. The potential flood impacts to these forest lands are considered minimal, overall, though river or lake flooding can cause some trees to topple, especially in areas of steep slopes or within the floodway. New plantings, if covered by floodwaters for an extended time, would be most vulnerable.

Overall, riverine or lake flooding of agricultural and forest lands is largely addressed by the individual landowner with a relatively low vulnerability. Local farmers are very aware of the flood risks and vulnerabilities on their lands and, if needed, most obtain crop insurance to mitigate the impacts of flooding on their farm businesses. In fact, the 2008 Farm Bill now requires insurance in order to be eligible for disaster assistance. **Riverine and spring snow-melt flooding of some croplands is an annual event in some locations, and this is anticipated to continue in the future. And an occasional manure storage facility failure can be expected.** But with nutrient management practices and care in application, the natural hazard threats to water quality from agricultural practices can be mitigated.

Agricultural flooding does not require additional mitigation action by Polk County or its municipalities within the scope of this plan at this time. County officials note that prevention is the best way to avoid additional scrutiny and rules which can pose additional hardships to the farmer. Emptying storage facilities on schedule, avoiding spreading prior to rain or heavy snow melt, planting fall cover crops, and following a nutrient management plan are all important steps to preventing manure spills and runoff.

Unique Jurisdictional Risks or Vulnerabilities—Flooding

The number and value of structures potentially within the high-hazard floodplains areas of each incorporated community was previously discussed (see Figure 30 and Table 22). This subsection summarizes the specific flooding issues and areas of concern unique to each of the cities and villages in the County as further summarized in the table and maps in **Appendix G**. For most of these communities, overland stormwater flooding has been of more significant concern in recent years rather than overbank flooding. In fact, many Polk County villages do not have a designated 100-year floodplain within their municipal limits.

The effective date of the current Flood Insurance Rate Maps (FIRMs) for NFIP-mapped communities in Polk County is September 9, 2011. As of 9/9/11, all applicable cities and villages have adopted the revised NFIP maps and are fully participating in the NFIP program, except for the Village of Clear Lake which was mapped for the first time in 2011 and required additional time to address this change in status. The NFIP status and effective map dates of each community's initial Flood Hazard Boundary Map (FHBM) and initial FIRM are also noted.

Village of Balsam Lake *(NFIP participant; FHBM 5/3/74; initial FIRM 7/1/88)*

The Village of Balsam has significant 100-year floodplain and lakefront development, and has more principal structures potentially located in the floodplain compared to other cities and villages in the County. However, river and lake levels fluctuate little within the Village; and no history of overbank flooding or related damage was identified by Village officials. Stormwater improvements have been completed in the business park and Park Point Drive areas since the previous plan. No significant stormwater flooding issues or vulnerabilities were identified.

Village of Centuria *(NFIP not applicable)*

The Village of Centuria has no 100-year floodplain. There are no significant issues, and past problem areas have been largely addressed.

Village of Clayton *(NFIP not applicable)*

The Village of Clayton has no 100-year floodplain, and no known stormwater flooding damage to structures has occurred in recent years. Stormwater has infiltrated the sewer system on the north side in the past, but most of these problems have been resolved since the previous plan. A ditch on private land east of 10th Street needs clearing, but flood damage to date has been limited to adjacent farm fields.

Village of Clear Lake *(NFIP being considered locally; FHBM none; initial FIRM 9/16/11)*

The Village of Clear Lake has a very minimal amount of 100-year floodplain in the far northern portion of the Village, with no development or identified vulnerabilities in the immediate area. This area was mapped for the first time in 2011. Stormwater drains from the north through the Village, but there is typically minimal standing water with no major damage in recent years. Past problems with stormwater infiltration into basements has been largely addressed through maintenance and inspections, including the cleaning of the stormwater system.

Village of Dresser *(NFIP not applicable)*

The Village of Dresser has no 100-year floodplain. Stormwater drains through the community

from the hills to the north and east and exits the community on its west side into fields and through ditches. Areas of the community have no stormwater systems, though some improvements have been made since 2005. Flooding in the area near the school and child care center could still be problematic, though improvements have been made. Stormwater improvements are needed in the Peterson Drive neighborhood on the southwest side of the Village; many homeowners use sump pumps in this area. These problems could escalate if additional growth occurs on the southwest side.

Village of Frederic (*NFIP participant; FHBM 5/31/74; initial FIRM 9/1/86*)

According to Village officials, Frederic's 100-year floodplain areas have no history of flooding concerns or structures at risk. Two areas of stormwater flooding concern were identified. Portions of the industrial park flooded 3-4 times in 2010, with water up to a foot deep on Industrial Way. The Village is conducting an engineering study on this problem area. A second, lesser, stormwater flooding concern is behind the library located downtown, which could increasingly become a problem in the future.

Village of Luck (*NFIP participant; FHMB 5/24/74; initial FIRM 7/2/87*)

Though some structures are located within the 100-year floodplain, including a portion of the school, there has been no recent history of overbank flooding in the community. Topography along the lake minimizes the potential for lake flooding. Silt build-up and beaver dams are ongoing maintenance concerns for some other floodplain concerns which could contribute to over-the-road flooding if not addressed. Stormwater run-off from the north has been causing some basement flooding. This run-off problem has been exacerbated by the re-designed Highway 48 and the new curb-and-gutter which has effectively created a dam with no outlet to the lake for overland flood waters. Some stormwater management activities are being addressed as part of a lake management grant project.

Village of Milltown (*NFIP not applicable*)

The Village of Milltown has no 100-year floodplain. Past problems with stormwater entering basements and backing-up wastewater systems to the south of Main Street to Bank Street appear to have been addressed through the installation of balltraps and other improvements. A more significant problem has been stormwater flooding on Main Street, which has occurred 1-2 times in past decade. Flood waters have reached depths of 6-8 inches and caused damage in the first floor of one structure which is not elevated above these flood depths.



Village of Osceola (*NFIP participant; FHMB 5/24/74; initial FIRM 1/5/84*)

As noted previously, no significant structural damage occurred as a result of the 2002 record-setting flood on the St. Croix River; and there is very little floodplain development within the Village.

The failure of the Upper Osceola Dam in September 2002 was the most significant

flood event in the Village in recent history. The dam failure caused significant damage downstream to a mobile home park, community park, highway bridge, and Cascade Falls, along with contributing to significant silt loading to endangered mussel habitat on the St. Croix River. This failed dam was later removed, flood mitigation funding was obtained for the buy-out of at-risk mobile homes, and improvements have been completed at the Highway 35 bridge. To date, the complete removal of the dam appears to have largely addressed the past problems of flooding on Osceola Creek.

Today, stormwater flooding is the more significant concern for the Village of Osceola; and the community lacks a complete study or plan to address these concerns. Stormwater draining towards the St. Croix River has contributed to road washout concerns on Ridge Road and on 2nd Avenue, which are located along steep slopes; a WisDOT-planned roundabout on Highway 35 may address the Ridge Road concerns. Third Avenue south of the railroad tracks has experienced over-the-road flooding 2-3 times in the past five years.

Village of Turtle Lake (*NFIP not applicable*)

The Village of Turtle Lake has no 100-year floodplain. The Village of Turtle Lake was not part of the scope of this planning effort. The Village is largely located in Barron County and is covered under Barron County hazard mitigation planning initiatives.

City of Amery (*NFIP participant; FHMB 12/28/73; initial FIRM 9/18/91*)

Amery has significant 100-year floodplain, though the Amery Dam is managed for flood control. During the 2001 flooding, which was the last major event on the Apple River, the river within the City of Amery did not leave its banks. The only significant flooding concern in the community is along an urban creek and drainage system which flows through the middle of the City. The culvert under Highway 46 for this creek constricts flow and has caused some localized flooding, but no structural damage has been reported to date.

City of St. Croix Falls (*NFIP participant; FHMB 5/24/74; initial FIRM 5/1/87*)

Like Osceola, the historic flood on the St. Croix River in 2002 demonstrated that the risk of riverine flooding along the St. Croix is relatively low. Ice damming has been a more significant river flooding concern about once a decade, but no serious structure damage has been reported in recent memory. Like many communities, stormwater flooding has been a bigger problem in St. Croix Falls, with the steep hillsides a contributing factor. Substantial progress has been made in system improvements in recent years and one home prone to flood damage was acquired using mitigation grant funds. The north side of the City along State Highway 87 has had a history of flooding problems and may require additional improvements and mitigation in the future. Continued stormwater planning and management is needed for commercial development and increasing hardscape within the growth area along U.S. Highway 8 on the east side of the City.

Polk County Dams—Vulnerability to Dam Failure

As of December 2010, Polk County had 44 existing dams in the WDNR dam database summarized in **Appendix J**. The database also identifies 44 planned or un-built dams, which is a relatively high number compared to many neighboring counties. The number of dams with ten

or less acres feet of maximum storage also totaled 44, the far majority of which are planned or un-built.

Most dams in Polk County are small earthen works for livestock or recreational ponds. In nearly all cases, if these smaller dams failed, the runoff and impacts downstream would hardly be noticed. Of the 88 existing and proposed dams in Polk County, 64 are classified as small, including all of the planned and un-built dams.

The dams of Polk County are shown in **Figure 32**, along with their Wisconsin Department of Natural Resources hazard ratings.¹⁸ Hazard ratings are assigned by the Wisconsin Department of Natural Resources based on the potential for loss of life or property damage should the dam fail.

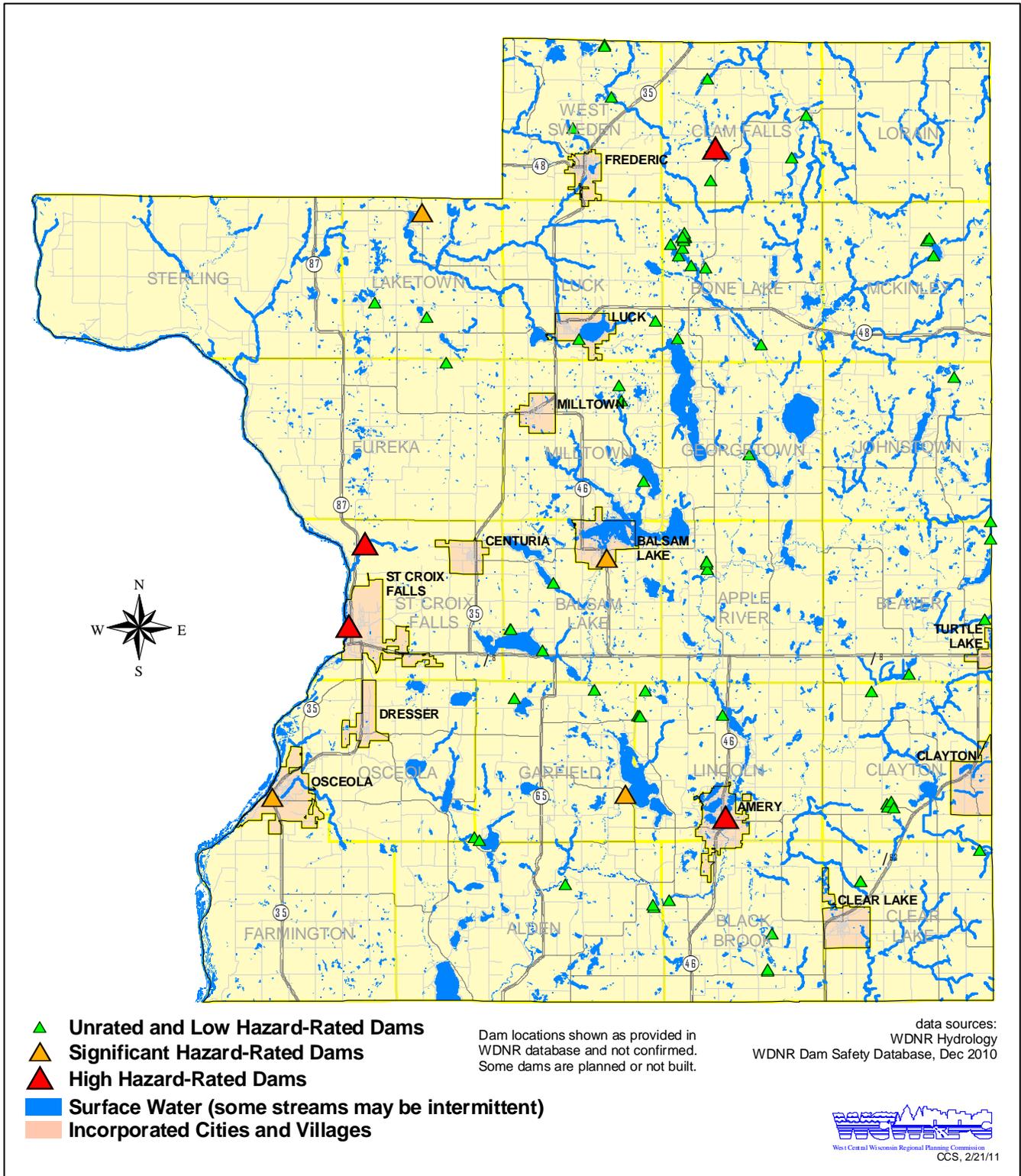
The dam hazard ratings are defined by FEMA as follows:

- Low Hazard** Dams assigned the low-hazard potential classification are those where failure or mis-operation result in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property. Large low-hazard dams are inspected every ten years by the Wisconsin DNR Dam Safety Engineer, and the spillway must be sized to accommodate a 100-year event.
- Significant Hazard** Dams assigned the significant-hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant-hazard dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure. Large significant-hazard dams must be inspected every five years (5th year private engineer; 10th year WDNR Dam Safety Engineer), and the spillway must be sized to accommodate a 500-year event.
- High Hazard** Dams assigned the high-hazard potential classification are those where failure or mis-operation will probably cause loss of human life. Large, high-hazard dams must be inspected every two years (2nd, 4th, 6th, 8th years private engineer; 10th year WDNR Dam Safety Engineer), and the spillway must be sized to accommodate a 1,000-year event.

All large dams on navigable waters are required to have a dam failure analysis which shows the hydraulic shadow and structures subject to potential flooding should a failure occur. The geographic scope of this analysis should extend downstream until the dam failure shadow converges with the 100-year floodplain. These analyses are used to determine the hazard rating. Floodplain zoning controls can then be put into place for the dam shadow. For dams without an analysis, an estimated hazard rating is given by the WDNR Dam Safety Engineer based on development and zoning controls downstream of the dam.

¹⁸ Two existing small dams and five planned dams did not have locations in the WDNR G.I.S. database.

Figure 32. Polk County Dams (existing and planned) by Hazard Rating



As shown in Appendix J, Polk County has sixteen large dams. Ten of these large dams are rated low-hazard due to lack of vulnerabilities downstream. Four of the large dams have a high-hazard rating and two have a significant-hazard rating.

High Hazard Dams (4)

Only four dams in Polk County have been given HIGH-hazard ratings:

1) ***St. Croix Falls Dam*** (owned by Xcel Energy)

In terms of maximum storage feet, this is the second largest dam in Polk County; and it is the largest in term of structure size and height. It is actively used for power generation and is in good repair. If a sudden dam failure should occur, there would be potential bridge damage on Highway 8 at St. Croix Falls and Highway 243 at Osceola, which would significantly impact travel. However, development within the dam shadow has been limited due to scenic easements, public lands, floodplain zoning, and topography along the St. Croix River. No concerns regarding this dam were noted. An emergency plan for this dam is maintained by Xcel Energy and is on file in the Sheriff's Department and the Polk County Emergency Management Office.

2) ***Amery Dam*** (owned by City of Amery and Town of Lincoln)

Significant repairs were made to this dam in 1993. No concerns regarding this dam were noted.

3) ***Big Rock Creek Farm Dam*** (privately owned)

This dam supports a licensed trout hatchery. No concerns regarding this dam were noted.

4) ***Godfrey Lake Dam*** (owned by Town of Clam Falls)

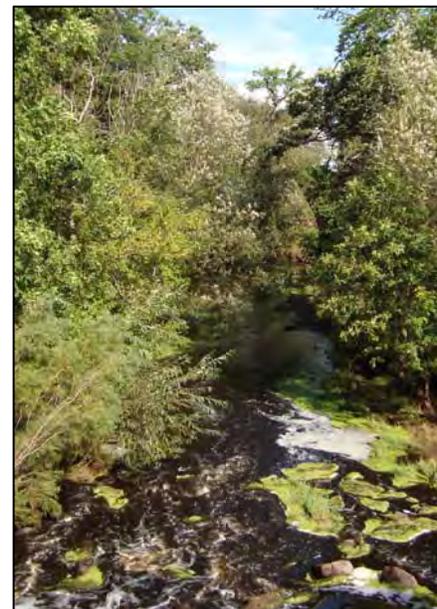
This dam is officially classified as high-hazard, but could potentially be re-classified to low-hazard if appropriate zoning was adopted for the dam shadow. No other concerns regarding this dam were noted.

Significant Hazard Dams (4)

Four additional dams were given SIGNIFICANT-hazard ratings by the WDNR:

1) ***Atlas Feed Mill/Long Trade Lake Dam*** (owned by Polk County)

This dam was reconstructed in 1994. An emergency operating plan was recently updated by the County. There is limited development within the dam shadow, including 1-2 homes and a county highway bridge which is in need of reconstruction or replacement according to the County Highway Department.



**downstream of
Atlas Feed Mill Dam**

2) ***Lower Osceola Dam*** (owned by Village of Osceola)

This dam is part of the State Highway 35 structure within the Village of Osceola on Osceola Creek. The structure was recently re-built as part of highway improvements. No concerns regarding this dam were noted.

3) **Sucker Lake/Wapogasset Dam** (owned by Wapogasset Lake Association)
No concerns regarding this dam were noted.

4) **Lower Balsam Lake Dam** (owned by Village of Balsam Lake)

The hazard rating of this dam was reduced from “high” to “significant” in 2010, following adoption of appropriate floodplain zoning within the hydraulic shadow by the County. No concerns regarding this dam were noted.

Recent Dam Removals (3)

There have been three recent dam removals, two of which addressed significant concerns identified in the 2006 hazard mitigation plan. In 2006, the **Upper Balsam Lake Dam** owned by Northwestern Wisconsin Electric Company was abandoned. Also in 2006, the abandonment of the privately owned **Upper Osceola Dam** was completed. More recently, Polk County acquired the **Ridler/Woodley Dam** on the Apple River which was removed in 2009 and was a priority concern in the 2006 plan.



Woodley Dam was removed in 2009

Other Dam Concerns or Notes

1) **Clam Falls Dam** (owned by Northwestern Wisconsin Electric Company)

This dam has been leased by Northwestern Electric for hydro-electric power generation. The 2006 hazard mitigation plan noted that the Clam Falls Dam is being topped with significant rainfalls of 1.5 inches or more within a short time. This concern with the dam being topped



Clam Falls Dam and adjacent highway

several times over the past decade was again noted during this plan update. The dam structure is built into a highway which results in dangerous conditions and road closures when topped. The 2006 plan states that the dam owner was intending to install steel slide gates to allow easier and safer control of water levels, but no actions or improvements at this dam have been noted in the interim. The owner recently updated the emergency operating plan for the dam.

2) **“Schilling Dam”** in the Town of Bone Lake

This is not an approved dam structure, but is a box culvert of limited size which has been blocked by debris over time and, thus, water levels upstream have increased. This unusual circumstance has resulted in adjacent road washouts which necessitates action. Nearby landowners have supported the creation of an approved dam structure, though a funding source for required improvements has not been identified.

3) **Black Brook Dam** (owned by North American Hydro)

This is an electric power-producing dam located in the Town of Black Brook. An emergency plan for this dam is maintained by the owner which includes bridge-closing procedures in case of a dam failure. The potentially impacted bridges are all located downstream in the Town of Alden. Copies of the plan are on file with the Sheriff’s Department, the Polk County Emergency Management Office, Highway Department, Amery area emergency responders, Amery School District, and the Town of Alden. No action on this dam is currently needed, though it is important to keep the emergency plan updated.

As documented previously, development and population growth in Polk County have been generally highest in those towns with significant surface waters. There continues to be development pressure along the shorelines of the County, including above and below dams. Overall, **the potential of dam failure in Polk County is considered quite low**, though the potential for damage and injury is high should failure of a larger dam occur. Polk County and its municipalities continue to work with the Wisconsin Department of Natural Resources to ensure proper maintenance of the dam facilities in the County and mitigate the potential vulnerabilities should failure occur.

v. Drought



Summary—Drought

Risk – Drought-related risks and vulnerabilities for Polk County are generally three-fold: (1) impacts to agricultural crops and livestock, (2) impacts to surface and ground water quality and quantity; and (3) increased wildfire risks. While Polk County has been in a period of drought for five of the last eight years, serious droughts have been experienced about once every five to ten years on average. Very serious droughts last occurred in 1976 and 1988/1989. Some climate change projections have agricultural droughts, especially during the summer months, increasing in frequency.

Vulnerabilities – Agricultural crops have the highest vulnerability to drought in Polk County. Over 40 percent of the County’s assessed land base is in agricultural use and the market value of crops produced in 2007 (which was a drought year) exceeded \$20 million. During the 2003 drought, it is estimated that the County lost in the neighborhood of \$5.77 million in grain corn and soybean value alone. During the 1976/1977 and 198/89 droughts, some private wells dried up and needed to be replaced. And more recently, water levels on many lakes and ponds have been significantly lower (until they rebounded in Summer 2010) with a range of habitat, recreational, shoreland erosion, water quality, and property value implications. Wildfire risks and vulnerabilities also increase during drought periods, which are discussed further in the wildfire section.

1. Most agricultural producers have adequate crop insurance to cover drought-related losses, though some do take chances. Crop insurance is prohibitive for many, if not most, smaller specialty crop operations, CSAs, and direct-market farms.
2. Overall, groundwater quantity and quality has been good, but demands for groundwater have been increasing for new development, industrial use, irrigation, etc. In all, there are 108 permitted high-capacity wells in Polk County, of which only 30 were for irrigation; these numbers are relatively low. From 1979 to 2005, it is estimated that water use in Polk County more than doubled from 5.4 million to 10.9 million gallons per day.
3. Surface water concerns related to drought include lower water levels on many lakes and streams in the County, reduced water quality, and changing water temperature impacts on trout and other wildlife. Fish kills at Long Trade Lake (Atlas Mill Dam) were a very real concern in Summer 2008 and 2009.

Risk Assessment--Drought

The Hazard

A drought is an extended period of unusually dry weather which may be accompanied by extreme heat (temperatures which are ten or more degrees above the normal high temperature for the period). Drought conditions may vary from below normal precipitation for a few weeks to a severe lack of normal precipitation for multiple months.

There are two basic types of drought in Wisconsin—agricultural and hydraulic. Agricultural drought is a dry period of sufficient length and intensity that markedly reduces crop yields. Hydraulic 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 at the same time. Soil types greatly influence agricultural drought risk. Some sandier, well-drained soils experience drought-like effects almost annually, and can experience the lowest yields when a true drought is declared.

Regional and Local Trends

Drought is a relatively common phenomenon in Wisconsin and has occurred statewide in 1895, 1910, 1939, 1948, 1958, 1976-77, 1988-1989, 2003, 2005, and 2006. The drought of 1929-1934 (Dust Bowl Years) was probably the most significant in Wisconsin history, given its duration; some of areas of the State experienced drought effects until the early 1940s.

A Presidential Emergency Declaration was issued for the statewide drought in 1976, during which agricultural losses in the State were estimated at about \$2.4 billion in today's dollars and some private wells in Polk County dried up. Point wells in certain areas of the County also dried up during the drought of 1988-1989, and agricultural losses in the State were estimated at approximately \$2.5 billion.

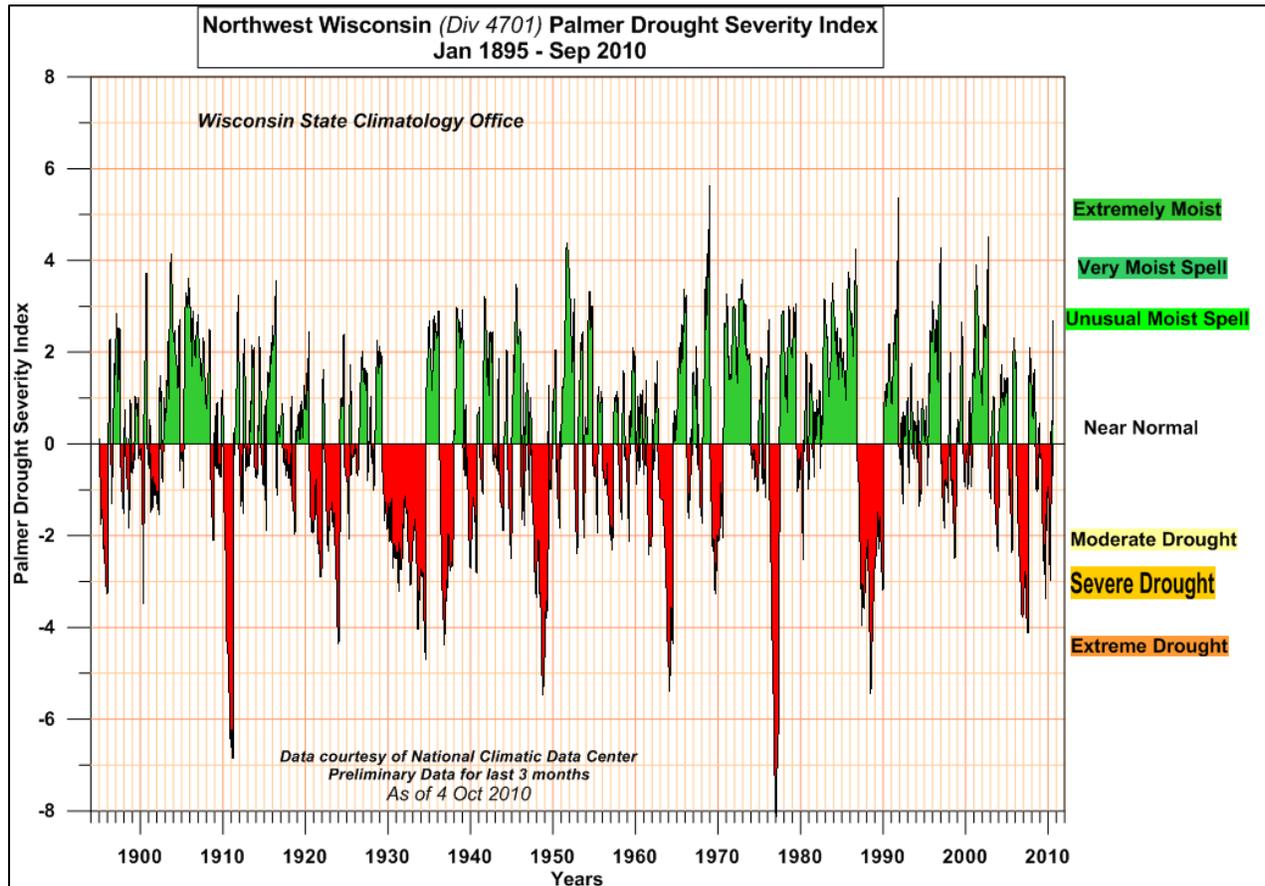
Until recently, drought conditions have been impacting corn and soybean yields to some degree in the County about once in every decade. However, for about the past eight years, northern Wisconsin has been experiencing ongoing drought conditions as shown in **Figure 33**, with serious impacts to agricultural producers and hydraulic levels of surface and ground waters. As a result, the Governor has issued State of Emergency drought declarations, which included Polk County, in five of the last eight years (2003, 2005, 2006, 2007, and 2009).

Summer 2010 brought some significant relief from the region's drought conditions as a new record for the average statewide summer rainfall was established (18.65 inches). In June through September 2010, northwest Wisconsin experienced total monthly rainfall amounts of about 2 inches or more above the mean in each of these four months. Though the rainfall provided relief for agricultural crops, water levels in many surface waters remain below average and monthly rainfall amounts were still below average for six of the months of the year.

As discussed in Section III.A.v., research from the Wisconsin Initiative on Climate Change Impacts¹⁹ (WICCI) shows that annual precipitation in Polk County has been increasing since 1950, though most of these increases have been occurring during the winter months. During the summer months, average precipitation levels have been decreasing over the northern half of the County. Concurrently, Polk County's average annual temperatures have increased 1.5°F to 2.5°F since 1950. WICCI has projected that Polk County's climate will continue to become much wetter overall, but drier during the summer months, with significantly higher temperatures.

¹⁹ Wisconsin Initiative on Climate Change Impacts website: www.wicci.wisc.edu

Figure 33. Northwest Wisconsin Drought Severity Index



Relative Level of Risk

Drought has become a near-constant phenomenon over the past decade, with droughts declared for five of the last seven years. **If weather patterns return to longer-term trends, drought conditions can be expected to occur once every five to ten years on average.** However, the frequency of drought events, especially agricultural drought, could be expected to increase under the projected scenarios provided by the Wisconsin Initiative on Climate Change Impacts.

Vulnerability Assessment—Drought

Snapshot of Polk County's Agricultural Economy

Drought can impact parts or all of Polk County's entire agricultural base. Almost 43 percent of all assessed lands in the County are agricultural. Polk County has approximately 322,628 acres of prime farmland in crop production, in addition to an estimated 284,718 turkeys, 46,162 head of cattle, 4,091 layers, and 3,936 sheep and lambs according to the 2007 Census of Agriculture. In 2007, the County ranked very high among all Wisconsin counties in a number of agricultural statistics:

#3	Sheep and lambs		
#4	Turkeys	#14	Value of sales by aquaculture
#8	Value of sales by poultry and eggs	#17	Broilers and other meat-type chickens
#11	Value of sales by sheep, goats, and their products.		

In 2007, Polk County ranked 38th in the State of Wisconsin in the market value of agricultural products sold at \$103,660,000.

Other notable trends include:

- From 1990 to 2007, the County experienced a 35.8 percent reduction in assessed agricultural land. That is a loss of about 2.1 percent per year during that period.
- The number of farms in Polk County decreased from 1,659 farms in 2002 to 1,582 farms in 2007. About 18 percent of the farms in 2007 hired farm labor.
- The average farm size decreased by 36 acres from 2002 (213 ac.) to 2007 (177 ac.).
- Between 2002 and 2007, the number of farms that sell agricultural products to individuals for consumption (direct market farms) increased 62 percent (120 farms to 194 farms) and the value sold increased 231 percent to \$712,000.
- The number of dairy farms has decreased 73 percent from 696 farms in 1987 to 187 farms in 2007.
- 80.3 percent (over \$83 million) of the market value of products sold in 2007 were from livestock, poultry, and their products. At \$57,835,000 of market value, milk and other dairy products constituted 55.8 percent of the County's total agricultural product sold.
- Over \$20 million of the market value of products sold in 2007 were from crops including nurseries and greenhouses. Grains, oilseeds, dry beans, and dry peas account for just under \$15 million.
- In 2007, Polk County was home to 24 organic farms (18 of which were crop productions), which produced \$.6 million of sales. It is anticipated that these numbers have increased.

Drought Vulnerabilities and Potential Impacts on Agriculture

It is very unlikely that any single hazard would endanger all livestock or crops, though large proportions could be at-risk from a prolonged, severe drought or the introduction of a new pest or disease. With milk production constituting a very large percentage of the total market value, yet being concentrated in an increasingly smaller number of farms, threats to this industry are particularly important.

Large-scale impacts to crops or livestock from a natural hazard can also have devastating impacts on the local economy, related industries (e.g., food processing), and related service providers. The state of the agricultural economy is tenuous for the local farmer, and a hazard event may result in farmers making fewer purchases or getting out of the business all together. Our local, small town economies are already going through significant transitions with the decreasing number of farms. Additional farm losses would further impact local businesses (e.g., implement dealers, feed stores, granaries, food processing, banks, general goods). To compensate for additional farm losses, the costs for such services may also be increased, or the local businesses may close, further burdening the remaining farmers in the area.

In general for Wisconsin, droughts have the greatest impact on agriculture. Even small droughts of limited duration can significantly reduce crop growth and yields, while making crops more susceptible to pests and diseases. More substantial events can decimate croplands and result in total loss. Droughts also greatly increase the risk of forest fires and wildfires because of extreme dryness. The loss of vegetation due to drought can result in flooding, even from an average rainfall.

The vulnerability to agricultural drought is high for Polk County. Crop yields can dramatically decrease; and livestock, especially those kept in close quarters, can experience decreased milk production or even death. Since the severity of drought can vary, determining its financial impacts on crop and livestock operations is difficult.

To gain insight into potential crop losses, the Polk County University of Wisconsin-Extension Office provided total crop cash receipts for the years of two droughts (1977 and 1989), and the receipts for each of the following non-drought years (1978 and 1990). These losses are summarized in **Table 23**. Using the 2003 adjusted numbers, we see a decrease in receipts of \$4 to \$6 million in drought years, representing a 50% to 70% drop.

**Table 23. Cash Crop Receipts Comparison
Polk County**

Cash Crop Receipts for Polk County Producers	1977	1978	difference	1989	1990	difference
	almost \$2.4 mil.	almost \$4 mil.	approx. \$1.6 mil.	\$4.8 mil.	\$8.6 mil.	\$3.8 mil.
<i>adjusted 2010</i>	\$8.6 mil.	\$13.4 mil.	\$4.8mil.	\$8.4 mil.	\$14.4 mil.	\$6 mil.

Sources: Ryan Tichich. Polk County University of Wisconsin-Extension.

Adjusted 2003 estimates based on Consumer Price Index by U.S. Bureau of Labor Statistics

More recently, the agricultural drought in 2003 resulted in the following losses according to the USDA-Farm Service Agency County Emergency Board:

alfalfa	32% yield reduction and estimated \$3 million loss
other hay	32% yield reduction and estimated \$200,000 loss
soybeans	46% yield reduction and estimated \$1.67 million loss
corn	26% yield reduction and estimated \$4.1 million loss

These losses are a significant financial hardship, especially for an industry that is struggling overall. In 2009, grain corn prices averaged \$3.7 per bushel and soybeans averaged \$9.45 per bushel²⁰.

Typically, farmers will supplement feed before allowing a drop in milk production due to drought. Additional feed purchases could also vary based on drought severity and length, but \$1,500 of additional feed per mature cow is not unrealistic (\$1,500 x 46,000 head of cattle = \$69 million) resulting in many millions in required supplemental feed for Polk County farmers under a typical, single-season drought event. Drought conditions can also result in the build-up of nitrates in feed and silage to levels that are toxic to cattle. In recent years, there has been a small number of cattle deaths in the region due to nitrate toxicity. Extreme heat and drought can also result in the build-up of toxic gases within grain silos to lethal levels or result in fires or explosions. Extreme heat within large confined livestock buildings can also be a concern.

The far majority of local farmers understand and practice good management to reduce the vulnerabilities associated with drought conditions, but some knowingly take chances. Most farmers carry some type of crop insurance, especially in drought-prone areas. Most farmers also participate in Farm Service Agency programs which require multi-peril crop insurance and protect losses at average County yields. But such insurance is very expensive, and participation will often increase as the price received for the commodity increases. It is typically not cost-effective to insure low-value crops, such as alfalfa. And for many smaller specialty growers and community-supported agricultural operations, it is extremely cost prohibitive to carry crop insurance.

Other Potential Drought Vulnerabilities

Drought conditions can stress forest vegetation, making it more vulnerable to certain pests and diseases. And the potential for wildfires can increase. These risks and vulnerabilities are discussed within the next section which covers wildfires.

Drought conditions can also dry up private wells and ponds, as well as impact surface and ground water levels. Private wells dried up within Polk County in 1976 and 1988/1989. Under such circumstances, wells are often re-drilled at significant cost; or a farmer whose livestock relied on a pond in the past may have to install a well and pump to provide water for stock. County staff noted that water levels had decreased significantly on Long Trade Lake (Atlas Mill Dam) in recent years which increased the potential for sizable fish kills, but surface waters rebounded somewhat in 2010.

²⁰ http://www.nass.usda.gov/Statistics_by_State/Ag_Overview/AgOverview_WI.pdf

Agricultural irrigation has been increasing in the County due to recent drought events, which does have the potential to further impact groundwater levels in some areas. The sizable aquaculture industry has also increased agricultural groundwater demands. As of January 2011, the Wisconsin DNR reports that 108 high-capacity wells have been permitted for Polk County, of which only thirty were used for irrigation. Regardless of the increased demand, ground quantity in the County is reported as being good overall.

Spring-fed or seepage lakes and ponds with no inlet or outlet have been especially vulnerable to long-term droughts and decreasing groundwater levels within the County. The result is a loss of habitat and recreational value, falling property values in shoreline areas, and potential shoreline encroachment.

Also as surface waters decrease, shoreline areas are more vulnerable to erosion, water temperatures can change, and contaminants and nutrients become concentrated which can further contribute to toxicity, eutrophication, and fish kills. Some of the longer-term consequences of rising temperatures and drier summers were discussed previously in the section on the possible hazard impacts of climate change, such as the loss of cold-water trout streams and further loss of surface waters through increasing evaporation.

Vulnerable Critical Facilities

No critical facilities or infrastructure are directly vulnerable to drought, with the exception of water supplies. Overall, private and community wells have excellent water quality and quantity to meet existing demand. Groundwater quantity in Polk County is good overall.

However, the demand for water is increasing substantially. Between 1979 and 2005, it is estimated that water use in Polk County have more than doubled from 5.4 million gallons per day to 10.9 million gallons per day²¹. Residential growth, aquaculture, and public use were identified as some of the primary reasons for this increase. And when an extreme drought occurs (e.g., 1976, 1988) or if prolonged droughts continue to increase in frequency, it should be expected that some private wells may need replacing and water demands for irrigation would further increase. Even so, no municipalities reported drought-related concerns for infrastructure or critical facilities.

Unique Jurisdictional Risks or Vulnerabilities—Drought

The *Unique Jurisdictional Risk or Vulnerabilities Table* in **Appendix G** notes that all participating cities and villages currently have good well capacity for fire protection, though the Village of Clear Lake may have need for an additional water tower in the future if significant new development occurs.

²¹ USGS and UW-Stevens Point-Wisconsin Center for Land Use Education.

vi. Wildfire



Summary—Wildfire

Risk – About 41% of Polk County’s landscape is forested, though the predominance of hardwoods in the forested areas of the County and the fragmentation of forest lands helps to limit fire sizes. In many areas, grass fires can be of greater risk due to their ability to spread and to quickly change direction and intensity.

The last major forest fire in Polk County occurred in 1945 when 4,970 acres were burned in the Town of Sterling. Within the WDNR Intensive Fire Protection areas of the County, an average of ten to twelve wildfires occur each year, with a fire greater than 20 acres in size occurring about once every seven years. However, this wildfire data is limited to about 24% of the County; wildfire data is not centrally collected for the remaining portion of the County with Cooperative Fire Protection. The frequency of wildfire events will likely increase due to population growth, development in wildland-urban interface areas, and changes to seasonal housing in the most at-risk communities.

Vulnerabilities – Residents, homes, agricultural operations, and other structures within or adjacent to areas of vegetative fuels susceptible to wildfire are the most at risk. Parts or all of eight Polk County municipalities are located in a WDNR intensive fire protection area. Six additional municipalities have been rated as communities-at-risk largely due to the predominance of hazard fuels (e.g., pine, oak) and development within the wildland-urban interface. Together, these fourteen communities represent about 48% of the County’s population and 38% of the total assessed value of improvements. Polk County has a relatively modest amount of County Forest land (abt. 17,000 acres), though an additional 75,000 acres or so is held privately in managed forest and significant State and Federal forested lands also exist. In 2008, WDNR estimated that the County had over 9.5 million oven-dry tons of live timber biomass which could be potentially lost to a forest fire event.

1. The western three-quarters of the Town of Sterling falls within the Northwest Sands wildfire landscape which has the highest level of risk in Wisconsin and has been a priority focus for WDNR mitigation efforts.
2. Residential development has been occurring within some forested areas and former pine plantation. Some landowners are unaware of the risks and do not maintain defensible spaces around structures.
3. Some roads and numerous driveways are inaccessible by larger response vehicles. This problem is typically more serious in wooded areas and, often, in areas with significant waterfront development. Overall, access to water for fire protection is good, though some fire departments identified a need for additional dry hydrants.

4. Some landowners are absentee and may be unaware of local burning permit and forest fire warning systems, and enforcement of burning permits between municipalities can vary significantly.
5. No municipalities identified critical concerns or priority strategies related to wildfire. The Town of Eureka identified a few areas with a higher risk of wildfire, such as pine plantation. The Village of Luck identified concerns on the east end of the community where residential development has occurred in wooded areas on long, dead-end roads.
6. Support for continuing current educational efforts was expressed. There may be a need for additional educational signage or Firewise-type efforts in higher risk areas. No critical gaps in wildfire training, gear, or equipment were specifically noted during the planning effort. The Lorain Fire Department noted the value of continued wildland training with WDNR and its benefits for coordination among neighboring departments.
7. Climate changes plus increasing threats to forest health from disease and pests may contribute to increases in the number of wildfire events in the future. Drought conditions, such as those experienced over the past seven years, are pronounced in areas of sandy soils, such as those found in the pine barrens of the Town of Sterling. A Jack Pine Budworm outbreak is possible, if not probable, for this area in the near future.

Risk Assessment—Wildfire

The Hazard

A **wildfire**, in the context of this plan, is an uncontrollable fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be human-caused through arson, campfires, prescribed burns, or carelessness, or can be caused by natural events such as lightning.

Any wildfire in Wisconsin, no matter what type of vegetation it is burning, is legally termed a “forest fire.” A forest fire is defined in Wisconsin State Statutes as “an uncontrolled, wild or running fire burning in forest, marsh, field, cutover, or other lands.” As such, wildfire and forest fire are often used interchangeably within this plan.

This document also does not attempt to make great distinctions between the different types of wildfires, though more wildfire data is available for the WDNR Intensive Fire Protection area which has a higher predominance of forest vegetation. It is not uncommon for a large wildfire to include a mix of vegetative types. Grass fires fueled by low-lying vegetation are generally more easy to control compared to a wildfire in a forest area, but also will typically spread the most quickly. Grass fires can be the most dangerous in terms of safety due to the highly variable speed, intensity, and direction. In wooded settings, access is often the biggest challenge. In areas of hardwoods, a wildfire is typically less intense with the fire being commonly limited to the leaf litter. Wildfires in coniferous forest which climbs into the top of the tree canopy (crown fires) can be the most difficult to control and can produce spotting when large, burning embers

are blown to areas outside of the main fire. Regardless of the fuel types, local topography and weather conditions also influence the characteristics of a wildfire.

Regional Trends

Wildfires are not uncommon for Wisconsin and can occur at any time of the day and during any month of the year, though the peak fire season in Wisconsin is typically from March through November; and the season length and peak months varies from year-to-year. Land use, vegetation, amount of combustible materials present, and weather conditions (e.g., wind, low humidity, lack of precipitation) are the chief factors determining the number of fires and acres burned. Forest fires are more likely when vegetation is dry from a winter with little snow cover, followed by a spring and summer with sparse rainfall.

Did you know?

The 1871 Peshtigo fire resulted in the greatest single loss of human life due to wildfire in American history.

The most disastrous forest fire in Wisconsin history occurred on October 8, 1871, when more than 1.2 million acres were burned and the communities of Peshtigo and Brussels were obliterated. “All hell rode into town on the back of a wind” one survivor described. In about two hour’s time, a swath of forest ten miles wide and 40 miles long was burned. Though overshadowed by the Great Chicago Fire of the same time period, the Peshtigo fire resulted in 1,152 people killed, 350 missing, and an estimated 3,000 people left homeless.

More recently, a total of 4,144 forest fires and wildfires occurred in Wisconsin during the drought year of 1976, with drought conditions continuing into 1977. Likewise, 1988 was one of the driest years on record with a total of 3,242 fires occurring and 9,740 acres burned in Wisconsin.

The April 1977 Five Mile Tower Fire which started in northern Washburn County burned 22 square miles at a rate of one mile every 41 minutes and destroyed 64 structures. The book “*Monster Fire at Minong—Wisconsin’s Fire Mile Tower Fire of 1977*” by Bill Matthias provides an excellent account of this project fire and its impacts on fire management in its aftermath.

In April 1980, more than 16,000 acres were burned and over 200 buildings were lost in the Ekdall Church and Oak Lake fires. The Ekdall Church fire originated less than 20 miles north of Polk County in the Grantsburg area. The fire started in oak scrub and timber slash, but embers then created spot fires in nearby pine plantation. Within three hours time, the fire was consuming 1,000 to 1,600 acres an hour. Within eight hour’s time, it had run nine miles and was 2.5 miles in width at its widest point.

More recently, the May 5, 2005, Cottonville wildfire began in northern Adams County and 3,410 acres of grass, pine, and scrub oak burned quickly before the fire was contained eleven hours later. During the fire, over 100 people were evacuated. Nine year-round residences, 21 seasonal homes, and at least 60 outbuildings were completely destroyed. Lack of access (long, narrow driveways) and a lack of defensible spaces around buildings were significant contributing factors to the loss of these structures, offering important lessons to be learned.

Local Events

Forest fire is not a new threat to Polk County. In 1898, an “immense sea of flames” burned over 600 square miles of pine lands in northern Wisconsin and Minnesota²². Just over four years later, a great forest fire again ravaged the region resulting in over 1,000 persons homeless and leaving large portions of Cumberland and Turtle Lake in ruins and resulted in “heavy loss of farm property” in eastern Polk County²³.

As the pine forests were logged and agriculture came to dominate much of Polk County, the forest fire risk also changed. The potential for a large forest fire was chiefly limited to forested areas less suitable for agriculture and in the “resort areas” typically associated with recreational surface waters.

In May 1945, a large fire burned 4,970 acres in the Town of Sterling. This represents the last major wildfire event in Polk County. But this also reflects that there is the potential for a major forest fire in Sterling today.

Figure 34 on the following page shows the approximate location of the 222 reported wildfires in Polk County between 1982 and 2003 which are identified in the WDNR database. However, caution should be used when interpreting this data. These wildfire reports are mostly limited to events which involved the WDNR and lie within an intensive protection area which constitutes about one-third of the County; wildfires do occur in the remaining cooperative protection areas, but are not typically reported.

The Town of West Sweden had the greatest number of reported wildfires during this period with 53—just over one-fifth of all fires reported. The towns of Clam Falls (46) and Sterling (33) had thirty or more reported wildfires. From 1982 to 2003, an average of ten to eleven wildfire events were reported per year in Polk County within the WDNR database.

Of the 222 reported wildfires during this time period, 213 (or 96%) were less than ten acres in size. Only three fires were greater than 20 acres. Seventeen fire records did not have an associated acreage in the database. The largest fire recorded

²² The Daily Gazette. Janesville, WI. Number 148 and 149. 9/4/1894 & 9/5/1894.

²³ The Daily Northwestern. Oshkosh, WI. 10/3/1898. The Weekly Wisconsin. Milwaukee, WI. 10/8/1898

The Daily Northwestern
Oshkosh, October 3, 1898

MANY ARE HOMELESS.

MUCH DISTRESS AMONG WISCONSIN
FOREST FIRE SUFFERERS.

AID IS SADLY NEEDED.

Adj't. Gen. Boardman Has Reported Over
250 Families Left Homeless and in
Need of Assistance—Reported
Loss Will Be Large.

Madison, Wis., Oct. 3.—Adjutant General Boardman who is in the northern part of the state investigating the needs of forest fire sufferers sent the following report from Rice Lake to Governor Scofield: “At Cumberland there are sixty-three families burned out, most of whom have lost everything. At Barron there are twenty-three reported now, fifteen of whom are entirely destitute. The needs of these people are similar to those at Turtle Lake. They are all farmers. At Cumberland shipment should be made to S. H. Waterman, mayor of the city. At Barron, to R. L. Haskins, chairman of relief committee. Will wire you later regarding condition of people in the country tributary to this place. Mr. Wyman is now with me.—C. R. Boardman.”

Cumberland, Wis., Oct. 3.—General Boardman and party, representing the state plan of relief, arrived Sunday morning and after taking a census of the people in the fire district drove to Rice Lake. General Boardman has listed seventy-three destitute families in the town of Cumberland, forty families in the towns of Stanford and Rice Lake, thirty families in the towns of Clinton and Barron, and nineteen families in the city of Cumberland, all of whom need immediate assistance. He has arranged for distribution of relief from Turtle Lake, Cumberland, Rice Lake and Barron and supplies will be forwarded immediately to these points.

The danger is now thought to be over, though it is still unsafe to travel through some of the burned districts in the vicinity of Cumberland. The property loss in this county will aggregate \$400,000, besides the farm buildings and crops. A large amount of stock has been burned and much hardwood timber destroyed. A crew of men was engaged today burning the bodies of animals in the fire district south of here. They were strawn along the highways and through the timbered sections.

for the time period was estimated to have covered 40.5 acres in April 2002 within the Town of Alden and outside the WDNR Cooperative Protection Area.

Wildfires were reported in every month except January between 1982 and 2003, though only four total were reported for the months of December through February. By far, the largest number of wildfires occurred in the month of April with 107 fires (48% of all reported fires). May, March, and October were the next highest months in terms of wildfire frequency with 15.8 percent, 10.8 percent, and 6.3 percent of the reported fires, respectively.

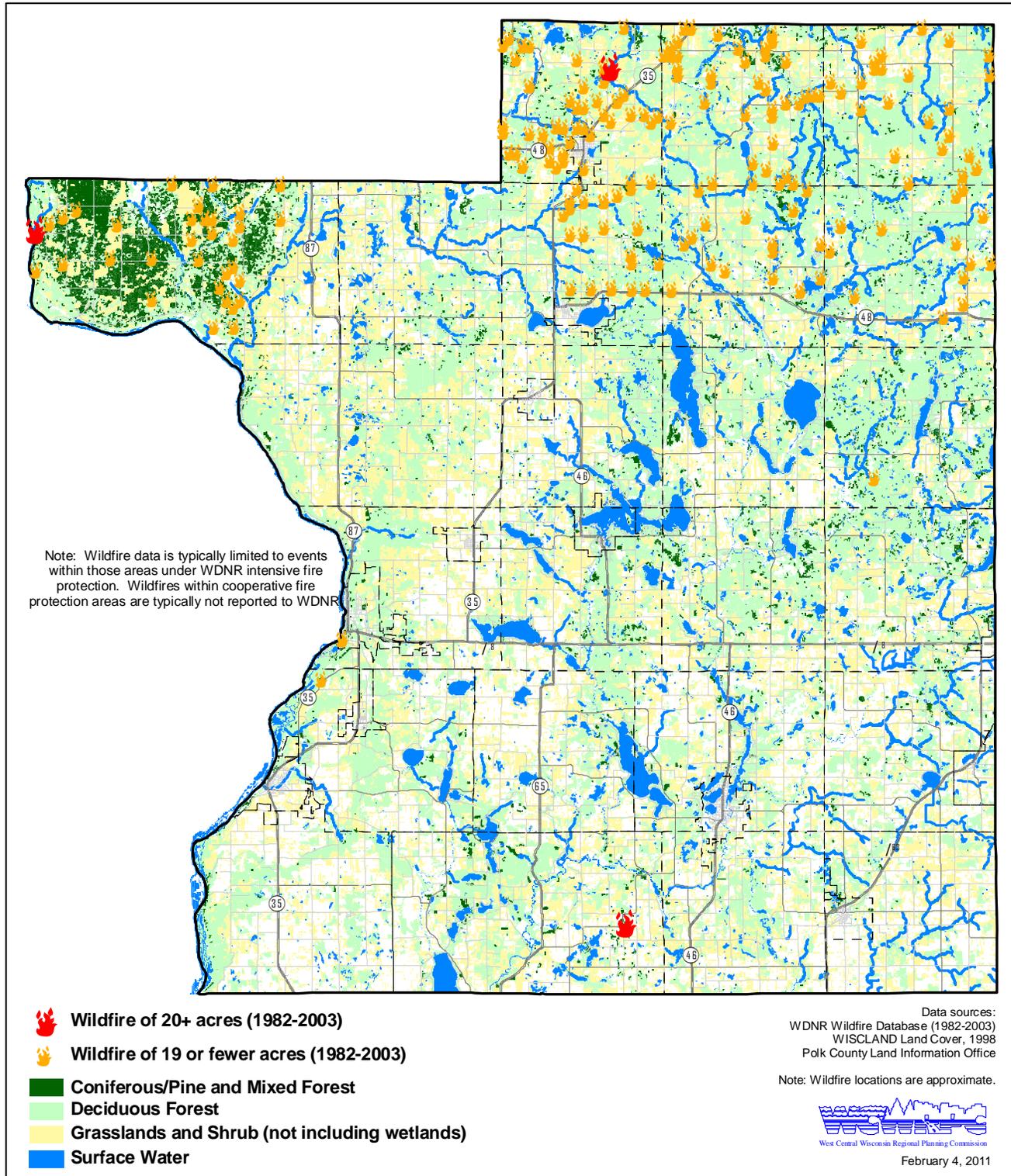
Over the last forty years, there has not been a Presidential Disaster Declaration for a wildfire in Polk County and research for preparation of this plan did not discover any recent serious injuries or deaths related to a large wildfire event. According to the WDNR, there have been no recent “project class” wildfires in Polk County with an Incident Command Center and fires lasting eight or more hours.

The largest, most recent wildfire in Polk County occurred in March 2010 in the Town of Sterling. About 153 acres were burned and the fire jumped the Trade River which becomes a challenge for responders. As the fire approached structures, air support was called, but no significant damage to structures occurred.

As part of this plan update, all towns were sent a survey requesting the identification of any unique natural hazard and emergency management concerns or needs in their communities. Of the respondents, only the Town of Eureka noted any specific wildfire concerns, consisting of pine plantations in Sections 18 and 19. More generally, the Town of Alden noted that “access for emergency vehicles on private roads is a very serious concern” and that “additional first responders would be great”.

An additional survey was distributed to fire departments in the County, with eight of the fourteen departments responding. Of these, three departments rated access as a moderate concern, two rated it as a moderately high concern problem, and one rated it as a critical concern. The Cushing Fire Department suggested that their service area may benefit from a Firewise Program. The Lorain Fire Department noted that mowing of ditches is important in mitigating the wildfire threat and recommended additional training with WDNR which helps with the coordination between neighboring departments.

Figure 34. Reported Wildfires in Polk County • 1982 to 2003



Risk Factor – Vegetative Fuels

Vegetative cover type is directly related to wildfire risk. The degree of flammability for different vegetative covers is in the general following order:



Approximately 41 percent (abt. 252,000 acres) of Polk County is forested and 26 percent (abt. 160,000 acres) is non-agricultural shrub and grasslands. But keep in mind that many forested areas are actively managed for timber production; thus, vegetative characteristics can change from year-to-year as part of the timber growth and harvesting cycle. As shown in Figure 34, deciduous trees (e.g., aspen, oak, maple) are, by far, the predominant forest type. While some significant areas of pine and other coniferous forest exists, the County no longer has the vast expanses of pine forest which were burned in the deadly fires of the late 19th Century. In addition, forest lands in the County have been increasingly fragmented over time, which reduces the chance of a large-scale wildfire event.

Most of the forest lands in the County are privately owned. There are approximately 17,000 acres of County Forest, five county parks, and over 43,000 acres of State and Federal recreational lands and natural areas. Almost 40% of this public land is located in the Town of Sterling. The Town of Sterling also owns approximately 3,000 acres and retains its own forester. Though public forest lands tend to be more actively managed against wildfire risks, not all of these public lands are forested. Of the private forest lands, over one-third (about 75,000 acres) are in managed forest law or forest crop law status.

Forest health also influences the risk of wildfire ignition and can increase the difficulty of fire suppression. Tree damage from storm events, diseases, insect infestation, and exotic species can weaken plants, making them more susceptible to storm damage, or can kill a forest stand outright. The Wisconsin Department of Natural Resources has rated significant portions of Polk County, especially in the north half, as having medium or high levels of risk for experiencing 25% or more tree mortality between 2009 and 2024 due to native and exotic insects and diseases.²⁴ Wisconsin's average annual temperature has also been increasing with shorter winters and recent droughts²⁵, which not only affects forest health, but also increases the wildfire risk.

Forests have a natural life cycle. Humans can interrupt this cycle by introducing new species or diseases, encouraging certain growth patterns, or through timber harvest practices. Characteristics such as dense stands of unmanaged pine plantation or creating large piles of slash

²⁴ Wisconsin Department of Natural Resources. *Wisconsin Statewide Forest Assessment 2010*.

²⁵ Ibid.

can increase wildfire risks. Creating brush piles and allowing for the accumulation of dead plant litter in home ignition zones or along roadways also increases wildfire risks. Forest management practices can increase wildfire risks or help to mitigate the ignition or spread of wildfires.

Risk Factor - Ignition

Most wildfire starts are human caused, whether accidental or deliberate. And areas of higher population within wildlands can be expected to have a higher risk of ignition. Of the fires shown in Figure 34, 41 percent were caused by debris burning, with the burning of brush piles, vegetation, household trash, and burn barrels being the most common sources. An additional 19.8 percent were caused by equipment (non-railroad). Only ten wildfires were caused by smoking, eight were caused by campfires, five were caused by fireworks, and six were caused by playing with matches or experimenting. Nine of the 222 wildfires were determined to be purposefully set, likely with malicious intent or for the excitement.

Review of WDNR Wildfire Risk Assessments

In 2008, the WDNR-Division of Forestry performed a statewide wildfire risk assessment to identify those communities most at risk. **Figure 35** on the following page shows the result of this risk assessment.

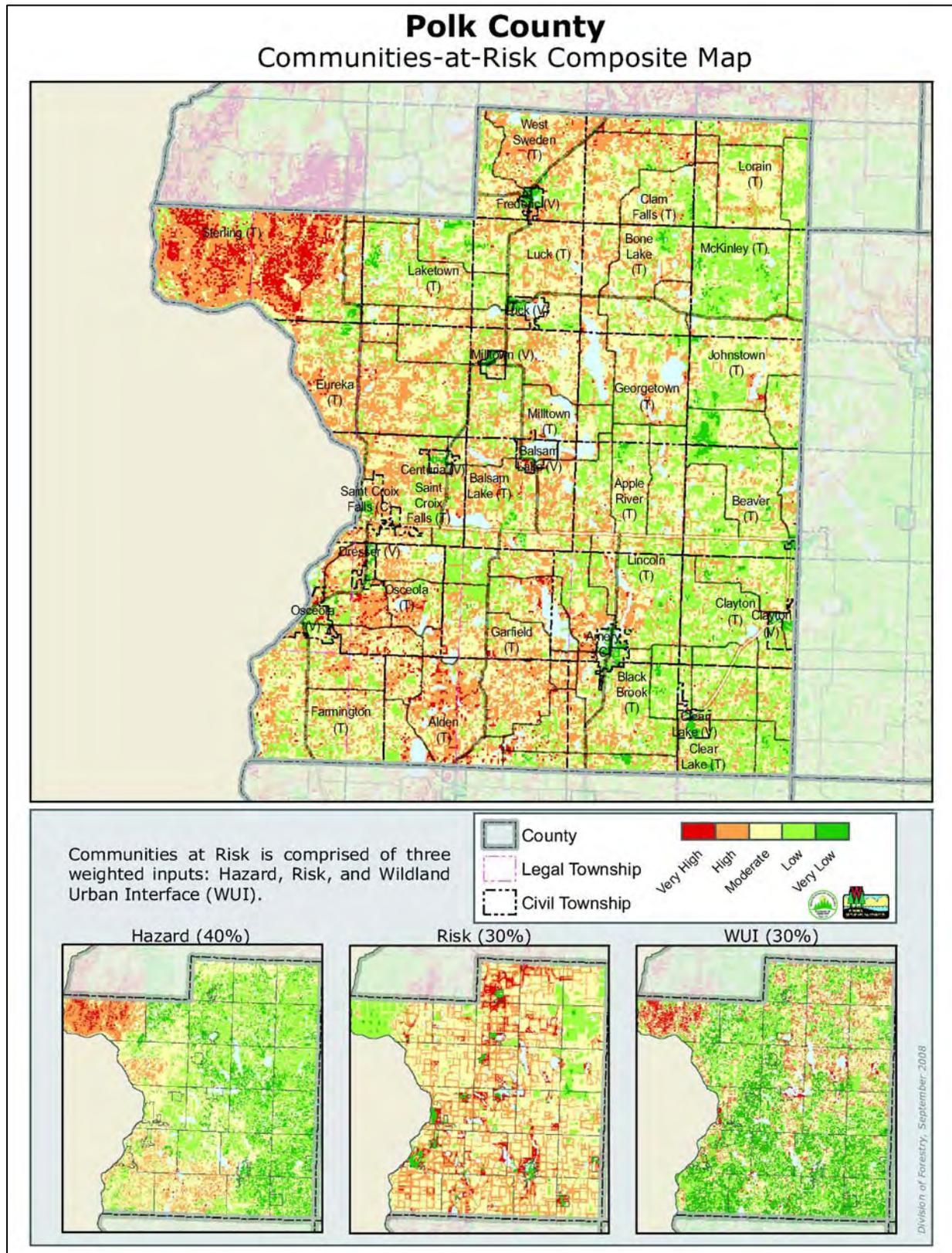
Three inputs were used to determine the risk as reflected by the three individual maps at the bottom of the figure:

- Hazard (Wildfire Fuels) – The hazard encompasses vegetative fuel types based on satellite imagery, historic fire regime data, pre-settlement vegetative data, and moisture index data.
- Risk (Potential for Ignition) – The risk is based on past fire occurrence data, population density, and distance from roads and railroads.
- Wildland-Urban Interface (Value) – The wildland-urban interface (WUI) reflects housing density and the proximity to flammable vegetation, thus reflecting the potential value of development (and residents) at-risk of destruction by wildfire.

The main map in Figure 35 is a weighted composite of each of the three factors—hazard (40%), risk (30%), and WUI (30%). After weighting occurred, natural breaks were used in the model to identify the different risk ratings. Wildfire planning and preparedness resources can then be focused on those communities and areas of highest concern.

Within Polk County, only the Town of Sterling was rated as having a very high risk overall. But as the “risk map” on the previous page reflects, Sterling’s development levels are relatively low and the municipality received a medium risk.

Figure 35. Polk County Communities-at-Risk Map (Wildfire)



Seven other municipalities were rated as communities of high risk as shown in **Table 24**. Seven additional towns not shown in Table 23 were rated as communities-of-concern: Black Brook, Bone Lake, Clam Falls, Farmington, Garfield, Lincoln, and Milltown.

Table 24. Communities-at-Risk (Wildfire)

Municipality	Hazard (40%)	Risk (30%)	WUI (30%)	2009 Pop. Est.	2000 to 2030 prj. Pop. Change
Alden (T)	H	H	M	2,959	+52.6
Balsam Lake (T)	M	H	H	1,462	+41.0
Balsam Lake (V)	M	H	VH	1,082	+45.5
Eureka (T)	H	H	M	1,634	+60.8
Osceola (T)	H	H	M	2,818	+125.4
St. Croix Falls (T)	M	H	M	1,267	+46.6
Sterling (T)	VH	M	VH	790	+34.9
West Sweden (T)	M	VH	H	771	+17.4

The Polk County towns with the highest wildfire risks are also some of the fastest growing communities in the County, so the risk of ignition will likely similarly grow. And as the housing discussion early in this document identifies, it is some of these same areas which have significant seasonal housing, with many of these homes are transitioning to year-round housing. For instance, in the 2000 Census, over 45 percent of the housing in the Town of Balsam Lake was seasonal with the greatest use during the summer months. Many of these landowners are absentee and may not be fully unaware of local burning permit requirements, local warning systems, and the wildfire risks. But as retirees and commuters begin to live year-round in these formerly seasonal homes, wildfire ignition could proportionately increase, especially during the non-summer months when populations have traditionally been lower.

The risk areas identified in Figures 34 and 35 are also consistent with the fire landscapes identified by the Wisconsin DNR in their *Wildland Fire Management Program Assessment* completed in March 2010. This assessment divided the State into 16 management zones based on vegetation, ecology, soils, development, and forest sizes. The zones were then used to help guide and prioritize resources and mitigation efforts.

The far southeastern portion of the County largely falls into the “Western Prairie” fire landscape which has limited potential for a fire in excess of 500 acres. The majority of the County falls within the “St. Croix Moraines” fire landscape which has a higher wildfire risk due to development in wooded areas and pockets of sand and conifers, but the potential for a fire of 500+ acres is not high. The analysis recommends limited mitigation activities for this area which focus on specific situations, in addition to possible school fire prevention programming and local public service announcements when the fire danger is elevated.

The western half of the Town of Sterling is part of the “Northwest Sands” fire landscape, which has the highest level of wildfire risk in the State. The potential for very large wildfires within this landscape are possible. School fire protection programming, mitigation planning, public relations efforts, and targeted outreach is supported in this area.

While the fire landscape approach is valuable for State- and regional-level resource planning, the communities-at-risk assessment (Figure 35) provides a better understanding of local variations. For instance, the Town of Sterling may have the physical landscape of continuous pine and sandy soils which support the potential of very large wildfires. But there are other areas of the County which do not have the extensive pine forest but are also of wildfire concern due to higher levels of development.

WDNR Fire Protection Areas

About 76 percent of Polk County has Cooperative Fire Protection, while the remaining 24 percent has Intensive Fire Protection. These are defined as follows:

Intensive Fire Protection areas are the most heavily forested and contain the most fire hazards and risks in the State. Limited assignment of skilled personnel, specialized equipment, and facilities provide for an adequate degree of forest fire prevention, detection, and suppression efficiency and effectiveness at a minimum cost. Wisconsin Department of Natural Resources (WDNR) equipment is designed to suppress fires that are beyond the capability of the local fire department. The WDNR by statute takes whatever action is necessary to suppress the fires. Fire detection is provided by WDNR aircraft, and there is a strong reliance on public reporting of fires. Burning permits are required whenever the ground is not snow covered.

WDNR has produced G.I.S.-based structure zone maps for the intensive fire protection area to assist with emergency response and has provided these maps to Polk County for use. No community wildfire protection planning efforts have been completed or proposed for Polk County, in large part due to the relatively sparse population within most of this protection area. However, there have been periodic bulk mailings on Firewise materials (e.g., creating defensible spaces), wildfire awareness signage installed, public service announcements in local media, and other public awareness outreach. There is also a high level of coordination between WDNR and local fire departments within this area and local fire departments participate in WDNR field exercises with structural protection about once every five years in Grantsburg. Additional WDNR training and/or exercises are available annually each winter.

Cooperative Forest Fire Protection is aid and counsel from WDNR, upon request, to the town authorities who are legally responsible for forest fire prevention, detection, and suppression activities in territory outside boundaries of established extensive fire control areas. Town Chairmen, by virtue of their office, are fire wardens. Costs of forest fire prevention and suppression incurred by a town chairman, acting in his capacity as town fire warden, are paid by the town. Burning permits are issued when the town board deems it necessary.

The intensive fire protection areas of Polk County reflect Figures 34 and 35. Most or all of the towns of West Sweden, Clam Falls, Lorain, Luck, Bone Lake, and McKinley, as well as the Village of Frederic, fall within the WDNR Webster Fire Response Unit which is part of the Cumberland Dispatch Group. The majority of the Town of Sterling (from River Road to the west) falls within the WDNR Grantsburg Fire Response Unit which is also part of the Cumberland Dispatch Group

Local volunteer fire departments play a very important role in fighting wildfires and most departments maintain mutual aid agreements with neighboring fire departments. When

surveyed, no fire departments noted specific wildfire equipment needs, though some concerns with communication equipment and the transition to narrow-banding was noted. Two departments (Apple River and Cushing) noted a need for dry hydrants. Six of the eight departments responding to the mitigation survey ranked maintaining an adequate emergency response vehicle envelope along driveways as a moderate, moderately high, or critical concern. Many departments participate in some level of training with long-term care facilities, public housing, or other such critical facilities in their respective districts.

Relative Level of Risk

The wildfire risk is considered low-to-moderate for Polk County overall. This is in large part due to most of the forest lands being significantly fragmented and having predominantly deciduous vegetation which will help slow and limit the spread of wildfires.

In the near term, it can be expected that Polk County will continue to experience ten to twelve wildfires per year on average within the intensive fire protection area, and perhaps greater if current droughty conditions continue or worsen. The far majority of these fires will be small, with a wildfire greater than 20 acres in size occurring about once every seven years. Estimates for wildfires in the remaining 76 percent of the County within cooperative fire protection are not currently available. Vegetation fuel types and the fragmented forest landscape combine to make the fast-spreading, regional fires of the late 1800s very unlikely within Polk County for the foreseeable future.

However, a number of factors could significantly contribute an increase in the number and size of wildfires over the long term. Foremost, population increases, development in the wildland-urban interface, and the transition from seasonal to year-round housing has great potential to increase the frequency of wildfires in Polk County. Climate changes, insect infestation, and plant disease are additional factors which may also increase wildfire risks.

Vulnerability Assessment—Wildfire

Potential Impacts

Forest fire can cause significant injury, death, damage to property, and loss of natural resources. As shown in Table 25, those communities most at-risk of wildfire had over \$1 billion in assessed improvements on 9,200 parcels and over \$9.1 million in assessed personal property in 2009, as well as a combined population of about 17,000. The far majority of these parcels were residential; only 337 parcels were commercial in use and eighteen were manufacturing.

Among the thirteen communities most at-risk, those within the Intensive Fire Protection areas are generally less developed and are projected to grow at a slower rate, with the exception of the Town of Bone Lake. This reflects that the fire protection areas are determined based more on vegetation types, rather than population and development vulnerabilities which were included as part of the risk input reflected in the Figure 35.

Table 25. Population and Improvements of Communities Most At-Risk

Municipality	Population			2009 Assessed Improvements		2009 Assessed Value of Personal Property
	Est. 2009	Proj. 2030	% Chng. '09-'30	# of Imp. Parcels	Total Value of Improvements	
Grantsburg Fire Response Unit — Intensive Fire Protection						
Sterling (t) (75%)	790	977	+34.9%	518	\$36,068,600	\$682,600
Webster Fire Response Unit — Intensive Fire Protection						
Bone Lake (t) (67%)	818	1,121	+57.9%	518	\$64,105,400	\$182,180
Clam Falls (t)	599	555	+1.5%	368	\$30,093,200	\$346,800
Lorain (t)	338	367	+11.9%	197	\$12,481,100	\$72,000
Luck (t) (48%)	866	851	-3.9%	495	\$45,682,200	\$526,400
Frederic (v)	1,242	1,318	+4.4%	470	\$46,051,450	\$1,281,878
McKinley (t) (80%)	361	366	+11.6%	298	\$20,966,000	\$196,700
West Sweden (t)	771	858	+17.4%	424	\$40,264,000	\$104,000
Other Communities-at-Risk (see Table 24)						
Alden (t)	2,959	3,991	+52.6%	1,454	\$227,701,600	\$535,500
Balsam Lake (t)	1,462	1,951	+41.0%	1,185	\$141,447,900	\$322,800
Balsam Lake (v)	1,082	1,382	+45.5%	581	\$75,169,600	\$2,102,100
Eureka (t)	1,634	2,151	+60.8%	780	\$94,029,900	\$201,500
Osceola (t)	2,818	4,700	+125.4%	1,250	\$196,332,600	\$1,380,000
St. Croix Falls (t)	1,267	1,641	+46.6%	662	\$83,117,000	\$1,195,000
Totals	17,007	22,229	+30.7%	9,200	\$1,113,510,550	\$9,129,458

* These towns are partially within an intensive fire protection area with a rough percentage in parenthesis, though numbers provided are for the entire town.

The above table includes half of Polk County's 24 towns, 48 percent of the County's population, 40 percent of the County's improved parcels, and 38 percent of the County's total improvements. While we do not have the wildfire data to state with certainty that the above communities have a higher wildfire risk than all other municipalities in Polk County, their WNDR risk rating and intensive fire protection status and was based, in part, upon their vegetative fuels types and wildfire vulnerabilities.

For 2008, WDNR estimated that there was 9,526,000 oven-dry tons of live timber biomass in Polk County, less than five percent being a variety of pine.²⁶ State and Federal harvest timber value per acre in 2009 ranged from \$514 to \$638 per harvested acre. To provide a rough idea of the value of the County and private productive forest in the County, the 252,000 forested acres would have a timber value of about \$160 million at \$638 per acre. However, timber values vary by forest type, forest age, and market conditions.

Not only are public forest lands an important direct income source for Polk County through logging, but it is an important recreational resource as well. The loss of related tourism would also reduce revenues for Polk County campgrounds, resorts, and other businesses, though no

²⁶ <http://dnr.wi.gov/forestry/um/pdf/report/TimberHarvestWisconsin.pdf>

such current study on the extent of potential financial impacts is available. Forest landowners would also incur significant costs associated with salvage and restoration following a large forest fire event.

The Polk County Forest is intensively managed to mitigate the potential of large wildfires and a range of other forest-related hazards (e.g., drought, invasive species) through the *Polk County Forest 15-Year Comprehensive Land Use Plan*. Privately owned woodlots are sometimes less intensively managed than adjacent County Forest lands, especially in cases of absentee land ownership.

Within non-wooded areas, wildfires in grasslands have the potential to spread more quickly than fires in wooded areas. Homes, agricultural operations, livestock, crops (especially hay and grains), and travelers on roadways are all potentially vulnerable depending on proximity to vegetative fuel. Large, contiguous areas of grasslands do exist within the County.

Vulnerable Critical Facilities

Any critical facility located in pine plantation, forested area, or adjacent to grasslands is potentially at risk from wildfire. Within forested areas with Intensive Fire Protection, vulnerable critical facilities are primarily limited to above ground utilities, such as power lines. Electric substations in the Village of Frederic and Town of Luck may be in forested areas, as well as the Bone Lake Town Hall. A number of substations are located within forested areas of other parts of the County, but no other critical facilities were identified as being uniquely vulnerable to wildfire.

While not technically critical facilities, Polk County does have approximately 85 campgrounds, tourism-related cottages, RV parks, and resorts, many of which are located within the at-risk communities and other forested areas of the County. For such facilities, the priority concern is for the visitors as a potential source of fire ignition and as a vulnerability should a wildfire occur.

Unique Jurisdictional Risks or Vulnerabilities—Wildfire

All participating cities and villages currently have good well capacity for fire protection, though the Village of Clear Lake noted that an additional water tower may be needed in the future if significant new development occurs.

Only the Village of Frederic and a small portion of the Village of Luck are located within a WDNR intensive fire protection area. Only the Village of Luck identified significant wildfire concerns during the planning process. The Village noted that residential development has occurred in wooded areas along the north and south sides of Big Butternut Lake on the east end of community. This risk is heightened due to access being limited to long dead-end streets which could pose evacuation challenges during an event.

SECTION IV. CURRENT MITIGATION ACTIVITIES

In the context of the natural hazards facing Polk County, it is important to consider the mitigation activities and strategies already implemented. Polk County and its municipalities have been proactive in mitigating the impacts of natural hazards. The following section summarizes the current mitigation activities that are being carried out within the County and demonstrates a strong tradition of communication and inter-agency cooperation. **Appendix H** provides additional insight into recent or current mitigation activities for each of the participating cities and villages in the County, along with some of the related challenges for these communities. Section V discusses those mitigation activities completed for each of the strategy recommendations from the 2006 plan.

A. PLANNING AND REGULATORY ACTIVITIES

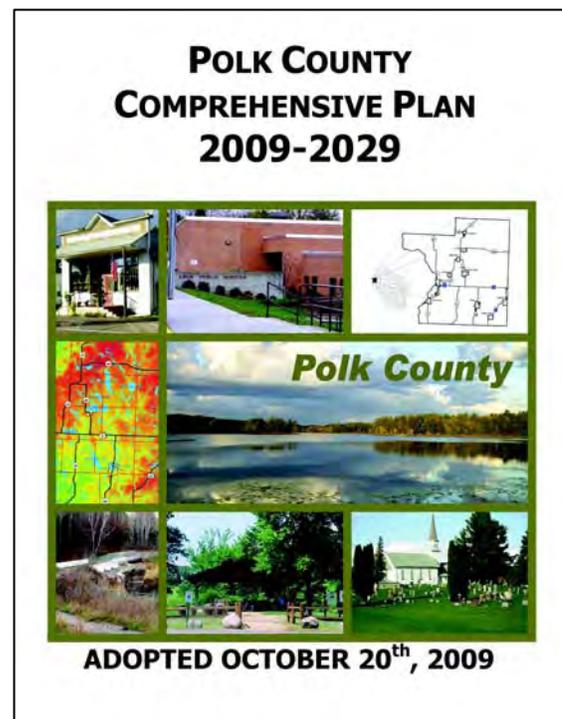
For a broad review of the various plans and land use policies in Polk County, please refer to the *Inventory of Plans, Programs, and Land Use Policies in West Central Wisconsin* compiled by West Central Wisconsin Regional Planning Commission in October 2008.

Comprehensive Planning

Polk County and all participating cities and villages have adopted comprehensive plans under Wisconsin Statute §66.1001. These plans provide a vision for future development and identify strategies to help achieve this vision. Mitigating hazards, floodplain management, and other emergency preparedness measures can be an important component of these plans. Polk County and some of its communities are actively revisiting and updating their ordinances based on the recommendations of their comprehensive plans.

Building & Sanitary Permits

Building permits under the Uniform Dwelling Code are required for all new one- and two-family dwellings and are administered through the local city, village, or town. In addition, a Sanitary Permit through Polk County is also required for new private, on-site wastewater treatment systems (POWTS).



Land Use Controls

At the County level, the ordinances described in this section are primarily enforced through the Polk County Land Information Department-Zoning Division. Many cities, villages, and towns also enforce similar ordinances for their jurisdictions.

Zoning – The majority of towns in Polk County are covered under the *Polk County Comprehensive Land Use Ordinance*, more commonly known as the Zoning Ordinance. The exceptions are:

- Have their own zoning- Farmington, Garfield and St. Croix Falls
- Unzoned – Balsam Lake, Bone Lake, Laketown, Sterling

The County's zoning ordinance does not require that emergency storm shelters or related plans be provided for mobile home park development, though such actions could potentially be pursued as part of conditional use permitting. Right-of-way standards for local roads and driveways are regulated at the town level.

Subdivision Regulations – The *Polk County Subdivision Ordinance* covers all unincorporated areas of the County and includes a site plan review process by the Land Records Director and County Surveyor, working in conjunction with the Land & Water Resources Department. The 1996 ordinance update increased attention to stormwater issues, and the County may require the applicant to submit stormwater management and erosion control plans based upon accepted State of Wisconsin guidelines. Drainage easements may be required to accommodate anticipated stormwater discharge from the development. Many of the cities, villages, and towns have also adopted subdivision regulations with similar standards.

Floodplain Ordinances – In order to better protect the residents of Polk County, and to minimize the loss of property, the State of Wisconsin, under Wisconsin Statute 87.30(1), requires counties, cities and villages to adopt and enforce floodplain zoning. In addition, Wisconsin Administrative Code NR116, Floodplain Management Program, has been promulgated for the protection of property and public investments from the effects of flooding. Development within the floodplain is analyzed through the use of the Flood Insurance Rate Maps (FIRM) developed by the Federal Emergency Management Agency (FEMA) and site surveys as needed.

The FIRM maps for Polk County were recently updated and the Letters of Final Determination were distributed to municipalities in March 2011. The maps are scheduled to be effective on September 16, 2011. As of June 2011, not all municipalities had yet fully adopted the FIRMs or updated their floodplain ordinances for consistency with the new maps and latest Wisconsin DNR model ordinance. Communities which do not adopt the updated maps would be deemed non-participants in the National Flood Insurance Program which impacts the ability to obtain Federal flood insurance and certain flood-related grant dollars.

Polk County Shoreland Protection Zoning Ordinance – This ordinance was last updated in October 2008. Shorelands provide valuable habitat for both aquatic and terrestrial animals and vegetation, and also act as buffers and thus serve to protect water quality. However, shorelands are also considered prime residential building areas because of their scenic beauty. Recognizing

this conflict, and in order to maintain the environmental, recreational, and economical quality of our water resources, the State of Wisconsin requires counties to adopt and enforce a shoreland ordinance.

As required by the State, shorelands are defined as:

- all land within 1,000 feet of the ordinary high water mark of a lake, pond or flowage; or
- all land within 300 feet of the ordinary high water mark of a river or stream or to the landward side of the floodplain, whichever is greater.

Each county must meet or exceed the minimum State standards for shoreland protection. The identified shoreland areas are based on the standards as defined in the Polk County Shoreland Ordinance. The ordinance establishes shoreland and wetland zoning districts in which uses are restricted, setbacks required, and a land-use run-off rating established. This is an important stormwater management tool to protect water quality.

Land Information and Parcel Mapping

The Polk County Land Information Department-GIS Division has a very strong working relationship with the County's Emergency Management Department. The Geographic Information Systems (GIS) Division provides Enhanced 9-11 System mapping for the County, including rural addressing, and maintains a growing GIS dataset in terms of usefulness for hazard mitigation management. Parcel mapping for Polk County has been completed for about 70 percent of the County with work continuing on five remaining towns. Many of the critical facilities in the County have been mapped, including governmental buildings, emergency services, schools, nursing homes, and hospitals. Mobile home parks, resorts, and campgrounds have also been mapped for reference.

Recently, the GIS Division has worked with Polk County ARES/RACES to produce maps for "clear views" for communications. The WDNR's recently updated D-FIRMs provided a more accurate delineation of the County's 100-year floodplain. The D-FIRMs incorporated the limited LIDAR information available in the County.

Point data for structures was developed as part of a WDNR project and is limited to the Intensive Fire Protection areas and provides little insight into the characteristics of the structures. The Wisconsin Department of Natural Resources has also created and maintains a number of additional GIS sources of emergency management value, including emergency map books with designated response zones within intensive fire protection areas.

Land and Water Resources Department

Polk County has an active Land and Water Resources Department responsible for a variety of educational and enforcement activities to protect the farmlands, waters, and natural resources of the County under the guidance of the *Polk County Land and Water Resource Management Plan*. This department provides water management planning for surface waters, works closely with lake districts and lake associations in the County, administers the volunteer-supported Adopt-a-Stream program, and performs a wide variety of other related activities. The department also enforces a number of related ordinances, such as the *Polk County Non-Metallic Mining*

Ordinance, Polk County Illegal Transport of Aquatic Plants and Invasive Animals Ordinance, and the two ordinances summarized below.

Polk County Stormwater Management and Erosion Control Ordinance – This ordinance is intended to meet the current State of Wisconsin construction site erosion control and post-construction stormwater management regulatory requirements. The Polk County Land and Water Resources Department enforces the County’s stormwater management and erosion control ordinance which requires permitting, site planning, and/or erosion control measures depending on site conditions, land use, and the amount of land disturbance. This ordinance applies to all of the unincorporated towns, unless a town adopts their own ordinance which is at least as restrictive of the county ordinance. Cities and villages often have similar ordinances.



Polk County Manure and Water Quality Management Ordinance – The Polk County Land and Water Resources Department also administers an ordinance requiring nutrient management plans for agricultural operations greater than 300 animal units or for the doubling of herd sizes in sensitive areas. Additional standards and planning may apply in Water Quality Management Areas due to local physical characteristics (e.g., depth to bedrock, karst).

St. Croix National Scenic Riverway – Federal Wild and Scenic River

Flooding vulnerabilities along the County’s most notable water body—the St. Croix River—are very low largely due to the river’s Federal Wild and Scenic River status. The far majority of the floodplain along the River is federally or State-owned, and development along the river is mostly limited to park and recreational land. Scenic easements and shoreland setbacks apply to the remaining private lands, which has limited floodplain development. Management of the St. Croix National Scenic Riverway falls under the National Park Service in cooperation with the states, counties, and local jurisdictions along the riverway. Additional partners, such as the St. Croix River Association, perform a variety of advocacy and support roles.

B. PHYSICAL CONSTRUCTION ACTIVITIES

Natural hazard impacts, especially for flooding in Polk County, can potentially be mitigated through infrastructure improvements and construction projects. Such activities can range from the construction of stormwater retention ponds to the installation of storm shelters to the removal of homes from flood-prone areas. These tend to be very costly projects for which grant dollars are often pursued or required. Some activities, such as the use of snow fences in areas prone to drifting snow, are less costly and temporary methods of hazard mitigation employed by Polk County.

Road and Culvert Improvements

In Polk County, such projects are often in response to a hazard event, such as those funding requests to FEMA for recovery from flooding in 2000 and 2001. Most of these projects tend to be road, culvert, and drainage system repairs or improvements to mitigate a stormwater/flash flooding hazard or over-the-road flooding. The County and many local municipalities replace culverts and make other road improvements as time and money allow.

As noted previously in the flood assessment, a number of stormwater flooding “hotspots” identified in the 2006 plan have since been addressed and do not appear in this plan update. Culvert replacements and road improvements on County Highway A and State Highway 65 are two such examples of construction projects completed since the 2006 plan which have mitigated flooding potential. Improvements were also completed to State Highway 35 and the lower dam in the Village of Osceola.

Flood Control by Dams

According to the FEMA Flood Insurance Program Study dated September 16, 2011, “Polk County has no existing flood protection measures.” However, many of the dams in Polk County play an important role in flood control. Overall, the Polk County dams are in good repair and functioning well. Maintenance at the County- or municipal-owned dams, such as vegetation removal and repairs due to animal damage, is ongoing. Policies, warning systems, and evacuation procedures are in place for the County-owned dams, and these will be reassessed based on future dam shadow analysis or environmental changes. Recent and proposed improvements and planning regarding dams in Polk County was discussed previously as part of the flooding assessment.

Emergency contact information for the larger dams is available in the Polk County Emergency Management Office. Polk County Emergency Management has established warning systems and evacuation procedures for those persons in areas that may flood due to dam failures. This includes road closings and rerouting of traffic to keep travelers out of these danger areas. In the event of a failure of the Black Brook Dam, existing policy would be to shut down traffic to and from the following bridges:

- 1) State Highway 65 bridge in the Town of Alden
- 2) County Road “C” bridge in Town of Alden
- 3) 150th Street bridge in Town of Alden

Xcel Energy has developed emergency action plans for all their power dams. Copies of these plans are available at the Sheriff's Department, Polk County Emergency Management Office, and the Northwest Area Wisconsin Emergency Management Office. Included in the plans are the warning procedures, areas of anticipated flooding if a failure should occur, and extensive mapping of the associated river systems. The large Xcel Energy dam at St. Croix Falls has two on-site operator shifts and an alarm system tracked remotely in Eau Claire. When a watch or warning is required, Xcel's dispatch in Eau Claire would be alerted; and the necessary local contacts down river from the dam would be made.

Other Flood Mitigation Improvements

Recent flood mitigation efforts in Polk County have primarily been limited to planning and regulatory strategies and improvements to infrastructure. Many of the communities have undertaken various surface and sub-surface stormwater system improvements. In the unincorporated towns, such improvements are largely limited to ditches and road right-of-ways, except in some developing areas and subdivisions. More extensive stormwater improvements and controls can be found in the cities and village. The 2006 plan noted that homes have been moved to prevent damage from future lake flooding at Sand Lake in the Town of Laketown. And the Village of Osceola implemented a buy-out and removal of trailer homes from the Osceola Creek floodplain. Similar improvements are on-going, such as the \$64,000 grant for stormwater control upgrades currently being constructed by the Village of Dresser.

Other Infrastructure Activities

While most recent efforts across Polk County have focused on stormwater system improvements, ongoing maintenance of the County's infrastructure and properties is also required. Local utilities maintain aggressive tree-cutting programs to reduce the frequency of downed power lines, with some power lines being buried in areas prone to weather-related outages. Polk County Emergency Management also maintains a limited stock of sandbags to assist in flood containment and has worked with schools, businesses, and municipalities to identify "best available" severe weather/tornado safety areas.

C. EMERGENCY PREPAREDNESS AND COMMUNICATION ACTIVITIES

Flood Monitoring Systems

The flooding of area rivers and streams is typically a result of persistent heavy rainfall or significant snowmelt during the spring. During these conditions, the County utilizes a combination of resources to assist them in evaluating the potential flood conditions. Most notably, the National Weather Service observes, predicts, and provides warnings related to storm events and flooding, which are closely monitored by Polk County Emergency Management.

For the St. Croix River, the National Weather Service's Advanced Hydrologic Prediction Service provides on-line access to river gauge observations, 48-hour forecasts, and warnings:

<http://water.weather.gov/ahps2/index.php?wfo=mpx>

Gauges are available at Danbury, St. Croix Falls, and Stillwater. This information is used to predict the crest of rising waters and time of the crest. The National Weather Service also provides longer-term flood outlooks which are also available via their website and periodic webcasts.

When conditions are favorable for a flood, the National Weather Service issues a warning alerting people to the potential through radio, television, and weather alert radios. When conditions begin to threaten an area, residents are further notified through press releases and press interviews. Law enforcement and other emergency service agencies also notify residents of the advancing flood using public address systems on emergency vehicles and through door-to-door contacts. Since flash flooding can occur quickly, people are alerted as early as possible of the flood potential so they are aware and watchful of changing conditions. The observations of law enforcement and fire agencies add assistance in determining the timing and need for evacuations.

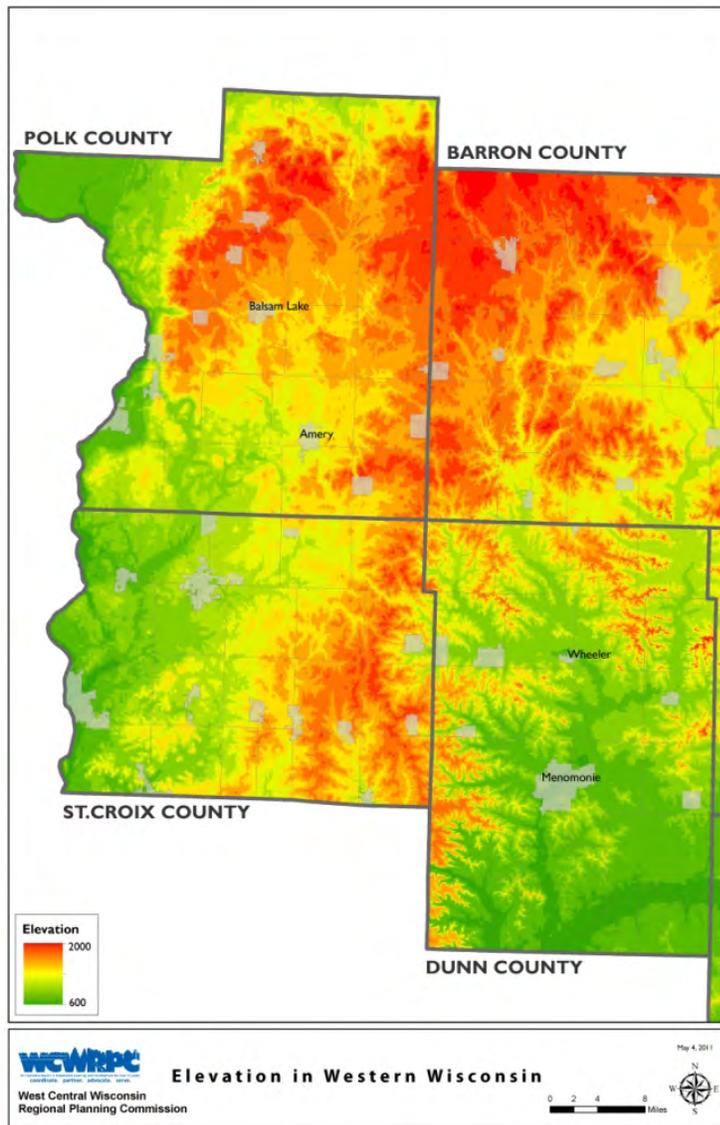
When a disaster is imminent or does occur, the public is informed of changing conditions and predictions through an incident command system. Typically, there is not an urgent, immediate need to evacuate people quickly. Should it be determined that an area will be inundated by floodwaters, residents are notified by public service agencies that are monitoring conditions. People can evacuate with their own resources. Emergency service agencies ensure that notifications are received in the local area through announcements and door-to-door contacts as determined necessary.

Weather Radios

Polk County Emergency Management participates in the training of the Informer, a Voice Activated Receiver (VAR) System. The Informer will alert and inform persons concerning severe weather. The Informer is available to any individual or business at Radio Shack locations. Currently, Polk County has 47 Informers/Voice Activated Receivers in place at critical facilities and large employers around Polk County, though most of these units are now about twenty years in age.

Since the majority of current VARs are aging, an NOAA weather radio project is being contemplated. According to the National Weather Service website, Polk County is primarily served by four NOAA radio stations located at Menomonie WI, Spooner WI, Pine City MN, and Minneapolis/St. Paul MN. The NOAA coverage area maps show nearly complete coverage, except in some areas along the St. Croix River and a few other isolated locations due to topography.

However, during community meetings, some residents noted that there was weak or no coverage in some central portions of the County (i.e., Balsam Lake area). This was confirmed by the project consultant during the project with the use of a personal NOAA All Hazards Radio with a built-in standard antennae; reception was very poor or non-existent in the municipal buildings of Balsam Lake, Amery, and Clayton.



The map to the left shows that the region's topography is the likely cause of the poor weather radio reception in central Polk County. Signals from the Wheeler, Spooner, and Pine City towers are blocked by large changes in elevation, while signal strength from Minneapolis tower is weak due to the distances involved.

According to the National Weather Service (NWS), there is a seventh NOAA weather radio frequency available. However, the tower site must be carefully selected to maximize coverage. Weather radio stations must be on a radio tower, not a water tower or other such structure.

Initial equipment costs for the transmitter, antenna, etc., is the neighborhood of \$30,000. Funds must also be available for ongoing maintenance, and tower rent if applicable. If these barriers can be overcome, there is the possibility of adding an additional weather radio frequency to improve coverage in central Polk County.

Other Weather Warning Systems

Polk County Emergency Management coordinates with the National Weather Service in training and sponsoring a semi-formal network of volunteer Skywarn Spotters which assist local law enforcement in watching and identifying potentially hazardous severe weather. Many local municipalities use their local fire siren as a weather warning device, though coverage areas are limited outside the incorporated areas. Television, radio, and Internet are other primary ways local residents receive weather warning information.



Polk County also has a memorandum of agreement with Chisago County, Minnesota, to the west. Since severe thunderstorms almost always travel from a generally west-to-east route in the region, Chisago County would typically experience such weather prior to Polk County. When severe weather occurs in Chisago County, their dispatch will notify Polk County's Dispatch. Polk County's Dispatch in turn utilizes the VAR radios to issue local alerts, then contacts Barron County's Dispatch to the east.

Such communication is particularly important for the Village of Turtle Lake which lies on the eastern part of the County, but is primarily located in Barron County. During a hazard mitigation planning with Village officials in August 2010, it was discussed that Turtle Lake's location County often resulted in late weather warnings through Barron County. In some cases, the warning siren would be activated after the storm had passed. Realizing the seriousness of the situation, Barron County Emergency Management took prompt action to facilitate a remedy. This one example of the benefits of undertaking a mitigation planning effort.

Communications

Overall, emergency communications in Polk County is in solid shape. Polk County has a single emergency dispatch and paging system for the entire County; an agreement has been executed with Barron County to provide back-up 9-1-1 service if needed. An enhanced 911-system with fire numbers is in operation, but the County does not have Reverse 911 capability. Polk County has largely completed implementation of the recommendations in a 2006 study to make its emergency communications backbone infrastructure narrow-banded and P-25 compliant and is well positioned for the foreseeable future. The backbone tower system is in place, and the replacement of older portable radio equipment with digital-capable equipment for narrow-banding is scheduled for 2011. During a 2010 storm, the County's central communication's tower was twisted and demonstrated a vulnerability in the system.

Though much improved, some gaps in communication (cell and radio coverage) due to local topography and distances remain. Some responders noted that reception can be especially poor when inside buildings in some areas. The Cushing Fire Department noted that radio coverage problems occur west of the River Road in the Town of Sterling and the Apple River Fire Department reported that reception is spotty around White Ash Lake. Two fire departments expressed concerns that the move to narrowbanding would degrade reception further in some areas and create new communication gaps, such as in southern parts of the Town of Farmington.

Emergency Response and Operating Plans

All incorporated cities and villages of the County, and many of the towns, have adopted emergency operating plans, though some of these plans are in need of updating. Polk County also maintains an *Emergency Operating Plan* which identifies evacuation and shelter arrangements. This plan details how hospitals within the County will coordinate with responding agencies to ensure the best utilization of services and mitigate the loss of life or injury from a disaster situation.

Did you know?

**75% of companies
without a business
continuity plan fail within
3 years of a disaster.**
– Crisis Management
International

A County emergency animal disaster plan is included as an appendix to the *Emergency Operating Plan*.

Polk County Special Needs Registry

As discussed previously in the long-term power outage analysis, Polk County Aging, Public Health, and Emergency Management have cooperatively developed a registry to identify and reach out to independent special needs populations in times of emergency. Participants are self-registered by themselves, a family member, or friend.

Continued efforts are underway to increase the visibility of this program. This registry will be valuable for reaching out to and monitoring seniors and those persons with special needs who live independently during a disaster event.

Incident Response Exercises

Polk County periodically plans and coordinates disaster and mock event exercises with municipal emergency medical personnel, local hospitals, ambulances, police, County Sheriff's Office, and volunteers. In 2010, Polk County Emergency Management and other local stakeholders participated in the State Long-Term Power Outage Preparedness effort administered by the Wisconsin Office of Justice Assistance.

Planning for Pandemics

A great variety of mitigation and planning measures for pandemics have been undertaken in the last decade ever since the SARS epidemic in 2002-2003. Avian Flu (H5N1) and Swine Flu (H1N1) outbreaks have further increased awareness, cooperation, monitoring, and planning for large-scale disease or viral outbreak. Activities are being undertaken at all levels of government—from international to local.

A wealth of information on pandemic flu and related plans can be found at <http://www.pandemicflu.gov/> which is managed by the U.S. Department of Health and Human Services. The State of Wisconsin maintains a similar website focusing on State initiatives at:

What will you do during an emergency or disaster? Do you have a plan? Who will you call? Are you prepared to be on your own for 3 days?



These are important questions that every resident of Polk County should have answers for, but unfortunately many do not.

Although individual preparedness begins with you, Polk County understands that there are residents with severe health and medical conditions who will require special help in an emergency. That's why Polk County has developed the Polk County Special Needs Registry. The Registry is:

- Completely voluntary.
- Provides emergency responders with information to develop an effective response.
- Secure and confidential.
- Free to register.



For more information about the
Polk County Special Needs Registry

Visit the Polk County Emergency Management Website at www.co.polk.wi.us/emgd or call the Emergency Management Office at (715)485-9280

<http://pandemic.wisconsin.gov>. Within Polk County, the Public Health Office has been the primary coordinating entity on pandemic flu. Local planning and preparedness activities have been occurring under the coordinating efforts of the Western Regional Partnership for Public Health Preparedness (WRPPHP), the State-recognized consortium for the region. Additional information regarding WRPPHP and their activities can be found at their website: <http://www.wrpphp.org>.

The addition of this sub-section is intended to recognize that planning for pandemics is a very important emergency preparedness activity for Polk County. Given the other intensive efforts underway to address this potential threat, the steering committee decided to not include pandemic flu within the scope of this plan. However, this does not diminish its importance or the efforts being made to plan for a possible outbreak.

D. EDUCATIONAL ACTIVITIES

The following is a synopsis of the many educational and public outreach activities regarding natural hazard risks and mitigation in Polk County. This description is not exhaustive or complete.

General Public Education on Natural Hazard Risks

Polk County Emergency Management has a variety of materials available covering a wide range of hazard mitigation topics. This information is distributed countywide throughout the year by use of displays, news media, radio, County web site, presentations to local groups, etc. Information and media packets are disseminated in conjunction with an associated season, with a substantial effort to educate the public on natural hazards made during Tornado and Severe Weather Awareness Week in April.

Outreach to Seniors and Long-Term Care Facilities

The Polk County Aging Office, working with County Emergency Management, work cooperatively to prepare seniors and those with special needs for disaster events. Information is distributed through the Aging Office newsletter, through its “meals-on-wheels” service, and at the meal sites. In July 2010, the Polk County Aging Office provided “meals-on-wheels” services to 110 different clients on an average day, many of which reside alone. In total, the Aging Office provides 35,000 meals per year, of which 70-75 percent are home delivered. Many seniors also take advantage of the meals and services provided at one of the five County meal sites or from adult day care services.

Did you know?

Polk County Aging serves approximately 35,000 meals each year.

The Aging Office also maintains a contact list of rural elderly residents through its “meals-on-wheels” and assistance programming. Their familiarity and relationship with these residents would be critical should emergency assistance to special populations be needed. These drivers know which of their clients may be most at risk should an event occur. Such contacts are also made to those who might be more at risk during periods of high temperature.

In part due to the recent long-term power outage preparedness efforts, Polk County offices have seen an increase in contacts with long-term care facilities. As of December 2010, Polk County has five nursing homes and twenty other such facilities. Some of these facilities are now turning to the County with expectations for planning assistance, evacuation assistance, or other such support.

Educational Efforts Related to Agriculture

The Polk County University of Wisconsin-Extension Office, County Land and Water Resources Department, and the local USDA Farm Services Agency implement various educational efforts on mitigating the impacts of natural hazards upon agricultural operations. These efforts include



pamphlets, press releases, presentations, web sites, and one-on-one discussions with farmers. Some common educational themes include how to minimize the winter kill of alfalfa, controlling pests and invasive species, bio-security, nutrient management, manure storage, and crop residue management to prevent losses in times of drought. The Extension Office often works through local agri-businesses for distribution of this information.

Polk County farmers may contact the Polk County University of Wisconsin-Extension Office, the Polk County Land and Water Resources Department, and the Farm Service Agency Office for information and guidance related to drought and other weather-related disasters. Various Federal and State publications are available from these agencies on ground water movement, the hydrologic cycle, soil conservation, and irrigation methods. These agencies will also be the lead agencies in obtaining emergency food and water supplies for agricultural use.



Educational Efforts Related to Forestry and Wildfire

The Wisconsin Department of Natural Resources, the UW-Extension Office, Polk County Land and Water Resources Department, the Polk County Forester, and local fire departments work cooperatively to educate residents, visitors, and landowners on wildfire risks and appropriate preventive practices. Educational efforts also encompass working with landowners on woodlot management and methods to reduce the vulnerabilities to pests or disease (e.g., gypsy moth, oak wilt, emerald ash borer).

Wildfire educational outreach particularly targets the intensive protection areas in the northern portions of the County through radio and newspaper public service announcements, Smokey Bear presentations at schools and community events, fire danger signs, distribution of educational materials, and similar activities. Educational pamphlets on burning permits are periodically distributed with tax bills in select towns. The WDNR also conducts annual winter workshops in the area on wildfire issues and techniques for local fire departments and emergency management personnel, with a large tabletop simulated incident command system exercise in the area about once every five years. The WDNR efforts are increasingly taking an all-hazard approach to preparedness and mitigation, as reflected in their compilation of the structure zone maps (emergency map books) which could be useful during a variety of disaster scenarios.

E. STRATEGIC PARTNERSHIPS

Based on past events locally and in the region, the residents of Polk County respond to the call for help in times of need, as reflected by the volunteer Skywarn Spotter network. And such cooperation does not stop at municipal or county lines. Police services fall under the statewide Wisconsin mutual aid agreement, with additional support and coordination through Wisconsin Emergency Management—Emergency Police Services in times of crisis. Mutual aid agreements exist with adjacent county emergency management offices, though such intergovernmental support has been available in the past during times of need (e.g., the Siren tornado). Hospitals in Polk County have mutual aid agreements with those in Hennepin and Ramsey Counties in Minnesota. Additional support for mitigation and response is also available from the Federal and State government in times of need.

Most Polk County communities have written, formal mutual agreements for fire protection services. Informal or “handshake” mutual aid is still quite common between many communities for other services, such as public works, though formal agreements are becoming more common due to liabilities, funding resources, and the sophistication of equipment and required training.

Additional support for mitigation and response is also available from other private and governmental sources. For example, many county offices coordinate and work closely with private sector and non-profit entities for disaster preparedness and during an emergency, including health care providers, electric providers and other utilities, Salvation Army, religious organizations, and youth groups. Polk County Interfaith Caregivers are a particular valuable resource for supporting the County’s seniors and adults with disabilities. Housing authorities, community action programs, and care facilities are other important partners.

During times of drought, the Polk County Land and Water Resources Department works with the UW-Extension Office and USDA Farm Service Agency to survey crop damage and soil status for drought declarations. And the County and its municipalities work closely with the Wisconsin Department of Natural Resources on topics such as wildfire prevention, floodplain management, and dam safety.

West Central Wisconsin Regional Planning Commission (WCWRPC)

Polk County is a member of WCWRPC and three representatives from Polk County are members of the Commission’s “board”. WCWRPC provides community planning, economic development, and grantsmanship support for Polk County and local communities. This document represents the second hazard mitigation planning effort facilitated by WCWRPC on behalf of Polk County. During the past two years, WCWRPC also played a key coordinating role in the development and implementation of the Wisconsin long-term power outage preparedness effort which included participation by Polk County Emergency Management and other local stakeholders.





ARES/RACES

ARES/RACES functions in Polk County are coordinated through the Polk County Amateur Radio Association. ARES (Amateur Radio Emergency Service)/RACES (Radio Amateur Civil Emergency Service) groups are typically made up of residents who provide volunteer communication support using HAM radios in times of extraordinary need. During time of war, only RACES members may use amateur HAM radios. The ARES/RACES group's radios have the advantage of being operable on batteries and having a large broadcast area. Equipment for the group's use is available within the County's old law enforcement building. The group is further deploying members to assist emergency services and expanding their automatic packet reporting system (APRS). Recruitment of additional members is also a need.

American Red Cross

As of Summer 2011, the American Red Cross is undertaking significant organizational changes. The Balsam Lake office is expected to close and it is uncertain if Polk County will continue to be served by the St. Croix Valley Chapter of the American Red Cross.



Working with County Emergency Management and local communities, the Red Cross takes a lead role in the identification of emergency shelters (not storm shelters) in Polk County. Shelters have been identified in every city and village.

On-call volunteers are provided locally for the victims of emergencies through the Red Cross Disaster Action Teams (DAT). The County has a good DAT core group but there is a need for more volunteers. House fires are the most common emergency for which the Red Cross is contacted. In recent years, the Osceola Creek flooding in the Village of Osceola represents the only flooding event in the County to which the Red Cross was called in.

St. Croix Chippewa Tribe

The St. Croix Band of Lake Superior Chippewa Indians has a small community of about 52 homes, a health clinic, and a community center at Round Lake Village. The community center is available for use as a Red Cross shelter. Scattered Tribal heirship lands are also located within the County. Intergovernmental agreements may be advisable in some cases to ensure the on-going provision of County and local emergency services on Tribal trust and heirship lands.

As of September 2010, the St. Croix Chippewa is developing an emergency plan for Round Lake Village. In recognition of the St. Croix Chippewa Nation's sovereign status, Polk County has executed a memorandum of understanding with the St. Croix Chippewa which covers EPCRA planning and review related to hazardous materials and includes Tribal representation on the Polk County Local Emergency Planning Committee.

F. OTHER MITIGATION AND EMERGENCY MANAGEMENT CHALLENGES

The following issues address multiple hazard types or identify opportunities to improve hazard response and recovery:

1. Emergency vehicles have difficulty accessing some driveways due to width, height clearance, or grades. These problems are often localized in wooded areas, areas of waterfront development, and hilly areas. During the town hazard survey, the Town of Alden described access for emergency vehicles on private roads as a “very serious concern”. Six of the eight fire departments responding to a mitigation survey ranked driveway access as being a moderate or higher concern within their service areas.
2. Development with lengthy cul-de-sacs and dead ends has occurred in some areas and communities of the County, which can pose access and egress challenges for emergency vehicles and snow removal.
3. Some communities have not formally adopted mutual aid agreements for public works and heavy equipment, though many are using the Rural Water Association’s model. It is not entirely clear if this model applies to all services and support beyond water and wastewater systems. But cooperation between municipalities is strong when emergencies do occur.
5. Emergency management and hazard mitigation planning is often a low priority for communities, with the exception of maintaining basic fire, police, fire responder, and ambulance services. Local emergency response plans can quickly fall out of date due to turnover of local government officials and these plans (and associated maps, resident information, etc.) may not be readily available to local officials should a disaster occur. It is also fairly common that hazard mitigation and emergency response issues are not integrated into other local planning and regulatory efforts, such as comprehensive plans. Education and outreach to cities, villages, and towns on emergency management issues is an ongoing effort and challenge. During the town hazard survey, two towns suggested that more emergency management training was needed for employees and board members.
6. Recruiting and sustaining a volunteer base for community services (e.g., fire departments, First Responder, Red Cross Disaster Action Teams, ARES/RACES) is an ongoing challenge. The many opportunities for volunteerism and public service place great demands on volunteers, some of which may become “burned out” with time. As more and more residents travel further for employment, it is increasingly difficult for many would-be volunteers to be on-call for emergency situations. The ever increasing amount of time being required for training and certification is an additional barrier. The Red Cross and some small fire departments are struggling to maintain an adequate volunteer

base. The Town of Alden noted a need for additional first responders during the town hazard survey.

7. Many critical facilities (e.g., long-term care, child care, hospitals) lack weather radios and many of the radios currently in use do not have Specific Area Message Encoding (SAME) technology. The Voice Activate Receivers (VARs) used by many facilities are now aging. According to the stakeholder interviews and informal “testing” by the project consultant, gaps in the NOAA All Hazards Weather Radio coverage exist within central areas of the County.
8. Polk County has a “boiler plate” continuity of government plan. This plan needs to be revisited, updated, and expanded.
9. The current County Emergency Operating Plan does not include a section or annex regarding livestock-related events (e.g., disease outbreak, evacuation, disposal).



SECTION V. PROGRESS ON THE 2006 MITIGATION PLAN STRATEGIES

This section reviews the progress on each of the strategy recommendations from the *Polk County Natural Hazards Mitigation Plan* adopted and approved by FEMA in 2006. As discussed in the 2006 plan, the availability of resources and changing priorities affect implementation. For instance, some strategies were contingent on grant funding. The 2006 strategy list was comprehensive, and there was not an expectation that all strategies would be fully addressed within five years time.

Table 26 also includes a recommendation on how each strategy may be addressed in this plan update plan based on the input of the responsible parties identified in the 2006 plan and the steering committee. Later in this report, the recommendations in Table 26 are further considered and analyzed for feasibility by the steering committee.

Table 26. Progress on 2006 Plan Strategies

2006 Plan Strategy	Progress	Recommendation for Plan Update
Physical Infrastructure Strategies		
1. Assess stormwater flooding hotspots and develop comprehensive, long-term solutions using engineering analysis when necessary and through appropriate sizing of ditches, culverts, & other systems.	A number of “hotspots” in 2005/06 plan addressed, but problem areas remain.	Keep in plan, but specify any priority projects for any flooding concerns.
2. Continue to assess snow drifting problems areas and snow removal challenges, and pursue needed right-of-way acquisition or re-construction efforts as deemed feasible.	No major projects undertaken to remedy. Generally has been a lower priority. Two “hotspots” identified in particular.	Keep in plan, but focus on education to allow plows to do their job.
3. Purchase a back-up generator for County Highway Department for fuel, doors, communications, etc.	Has the generator, but connections not made; provides fuel for Sheriff’s Dept also	Make connections a priority.
4. Polk County should continue to stress the need for additional electric power transmission to the area and express its support for additional electric transmission for the area to State of Wisconsin officials.	Construction of the Chisago-Apple River transmission line addressed this strategy.	Remove from plan.
5. Improve bridges and bridge abutments at CTH “G”, Atlas, and CTH “D” to reduce potential of damage during heavy stormwater events.	High water issues at CTH “G” remedied, though bridge replacement likely needed.	Keep in plan, but specify priorities.
6. In cooperation with the Village of Balsam Lake, upgrade the dam under CTH “I” for improved flood prevention and water level control.	Improvements completed and no issues noted.	Remove from plan.

2006 Plan Strategy	Progress	Recommendation for Plan Update
Planning & Policy Strategies		
7. Develop and adopt County driveway standards for width, grade, access, culvert sizing, and cul-de-sac length which may also serve as a model for cities, villages, and towns.	County had adopted for county highways; most towns have their own.	Remove, since largely covered.
8. Maintain close contact with WisDNR to expedite the FEMA mapping update and ensure local input is integrated.	Completed in Fall 2010	Remove; complete.
9. When FEMA map update complete and County land parcel database fully built, perform a full flood hazard assessment to identify floodplain development trends and risks.	Map update completed, but parcel database not fully completed.	Complete parcel mapping; LIDAR needed to fully address.
10. Every five years, County will update its orthophotography to allow tracking of land-use trends and anticipate potential hazards.	Flights flown in 2001, 2006, and 2010...on schedule	Keep in plan.
11. Continue to develop the County land parcel database and link to the 9-1-1 system for enhanced 9-1-1 which automatically provides can address and map for the caller's location.	Have Enhanced 9-1-1 based on addressing.	Combine parcel needs into #9 above. Make sure new addresses in system.
12. The County, cities, and villages will work cooperatively to establish and maintain common coordinates and benchmarks for mapping and engineering.	County has Public Land Information System (PLSS) and communities can use.	Not a significant issue; remove from plan.
13. Develop a County Stormwater Ordinance to require plans for both 25-year and 100-year storm events.	Ordinance adopted for 100-year events effective 2006.	Remove; complete.
14. Amend the County subdivision ordinance to require the installation of dry hydrants in subdivisions in rural areas without community water systems for fire protection.	No action.	Reword... discuss with citizen cmte on potential amendment
15. Adopt a County mobile home ordinance which requires mobile homes to be properly fastened to resist high winds; provide this ordinance as a model for other Polk County communities.	UDC covers new to be fastened, so not a priority issue. Could refocus on shelter and planning for manufactured home parks.	Discuss w/ citizen cmte on potential shelter and/or EOP requirement.
16. Establish a policy and procedure for requesting the use of County equipment (e.g., De-Con unit, heavy trucks) to include standard billing rates, required training, and liabilities/responsibilities.	Determined not to be a priority concern; good relationships exist.	Remove.
17. Dedicate fees from ordinance administration to ordinance enforcement to help increase enforcement of existing Polk County land-use and water quality ordinances.	No specific action. County has developed a strategic plan.	Remove; not directly related to mitigation.
18. Develop a formal, detailed response plan for the release of toxic or hazardous substances from point sources, especially for releases into water bodies. Exercise the plan.	Many of the older manure storage facilities abandoned. Ordinance requires NRCS specs for earthen facilities.	Remove; not directly related to natural hazards.

2006 Plan Strategy	Progress	Recommendation for Plan Update
19. Amend the County Floodplain Ordinance for consistency with the new State Model, and monitor the proposed changes to NR116 for potential impacts and comment.	Update is under review by WDNR	Remove.
20. Encourage State of Wisconsin officials and representatives to develop tax incentive programs which promote energy conservation.	County Renewable Energy Cmte established and related topics under discussion.	Remove; not directly related to plan scope.
21. Require standardized testing and use policies for weather sirens prior to providing grant funds for new siren equipment, if grant funding is identified.	Contingent on funding. No grant funding yet identified.	Keep in plan, but combine with #42 and #44.
Communication Strategies		
22. Every two years, conduct a conference of County emergency response providers, utilities, dam operators, local officials, and Tribe on hazard issues, new personnel, equipment, data, etc	Meetings are occurring individually given time limitations and scheduling conflicts.	Not feasible as a single, large meeting. Integrate intent into #33.
23. Continue to implement and support the County Skywarn Spotter Program.	Ongoing. Good cooperation from ARES/RACES in exercises.	Add ARES/RACES reference.
24. Improve the County communication systems to provide county-wide wireless communication for emergency service providers.	Previous gaps in coverage largely remedied.	Remove.
25. Coordinate with all municipalities for shared access to communication bands/channels for a coordinated response.	Has MARK repeaters and services has channels programmed.	Focus on narrow-banding for pagers; need to replace.
26. Maintain close contact with North American Hydro Inc to ensure scheduled improvements to Clam Falls Dam occur in a timely fashion.	Discussions ongoing, but limited progress. EOP being updated.	Keep in plan; emphasize need. Related to #1
27. Promote use of weather warnings systems by the largest employers and Tribal facilities in Polk County.	Many industries & schools have voice-activated recvrs or radios	Add a weather radio project; NOAA signal gap in center
Education Strategies		
28. Implement a driveway standards educational effort on access, grade, width/clearance, and turn-around, to include media packets, brochures, and driveway spot checks.	Concerns related to address signage have been addressed.	Keep in plan, but add long-dead end roads and strike methods at end.
29. Polk-Burnett Electric will hold bi-annual training for County and municipal officials and response providers using the high voltage emergency training unit.	Training is periodic and not on set schedule.	Change to "periodic" training.
30. Distribute educational brochures on the growing potential for power shortages in Polk County and identify ways that individuals can help decrease power demand and mitigate potential impacts.	New transmission line added along USH 8.	Remove.
31. Provide a workshop on capital improvements planning for County and municipal officials, to encourage the scope of such planning in many communities to include stormwater infrastructure and grants.	No formal efforts, though some County departmental level discussion. Each municipality takes an approach to capital projects suited to circumstances.	While could benefit mitigation, not strongly related. Remove.

2006 Plan Strategy	Progress	Recommendation for Plan Update
32. Polk Co. Emgcy Mgmt will track the status of mutual aid agreements in Polk County and encourage all agreements to be formally executed and up-to-date.	Not being centrally tracked currently.	Refocus to consider countywide fire agreement(s)
33. Emergency Management will provide annual presentations to the Towns' Association on available resources and hazard event reporting.	No significant progress as a large group. Could extend to other stakeholders.	Keep, but change to bi-annual and extend invites.
34. Develop and distribute educational literature to Polk County citizens (especially in western Polk) on the rare mussel habitat and the negative effects of stormwater run-off, silt loads, and erosion.	Information provided via signage and USGS website and primarily handled through WDNR and other regulations.	Not a direct relationship to hazard mitigation. Remove.
Multi-Jurisdictional Strategies		
35. ALL INCORPORATED AREAS Maintain up-to-date, written, and executed Mutual Aid agreements with applicable billing rates to help secure FEMA reimbursement if needed.	Agreements for fire, police, and EMS solid. Most have public works agreements based on Rural Water model.	Promote public works mutual aid and countywide fire.
36. ALL INCORPORATED AREAS Emergency response providers will conduct annual emergency response training at public housing apartment complexes.	Some exercises occurring, including at assisted living.	Being addressed by Fire Depts & housing owners; remove.
37. ALL INCORPORATED AREAS Review, and amend if deemed necessary, local ordinances to require mobile homes to be securely fastened or anchored.	Changes to State Uniform Dwelling Code since last plan has largely addressed this, and further local options limited.	Remove.
38. ALL INCORPORATED AREAS Review, and amend if deemed necessary, local ordinances to require storm shelters be provided for residents of new mobile home parks.	Limited progress.	Incorporate into a county-level strategy alternative.
39. ALL INCORPORATED AREAS As needed, identify storm shelters for residents, execute formal agreements for shelter use, and use local media to educate residents on availability.	Varies by community. A few communities have elected not to provide a public storm shelter.	Keep as strategy, but identify the communities.
40. ALL INCORPORATED AREAS For stormwater issues, perform hydraulic studies and implement necessary actions and management plans. Include adjacent jurisdictions as needed in the process.	Varies by community. Not a significant issue in many communities at this time.	Focus strategy for individual communities with needs/issues.
41. ALL INCORPORATED AREAS Update floodplain ordinances based on new State model and monitor proposed NR116 for potential impacts and comment.	Being addressed as part of the new D-FIRMs to be completed in 2011.	Remove.
42. ALL INCORPORATED AREAS Develop and approve a standardized testing, use, and maintenance policy for weather sirens.	Varies by community. Most have a policy, but not all are written.	Expand to a policy on maintaining Emgy Op. Plans
43. ALL INCORPORATED AREAS Review, and adopt as needed, driveway standards for width, grade, access, culvert sizing, and cul-de-sac length.	Varies by community. Often a more significant challenge in unincorporated towns.	Incorporate into a county-level educational strategy alternative.
44. VARIOUS -- The following communities have need for new or additional sirens: Round Lake (1), T. of Garfield (1), Amery (2), Centuria (1), Frederic (1), Luck (2), Osceola (1), Dresser (1).	Significant needs still exist due to aging equipment and growth. Should include concentrations of residential in rural towns.	Update list and combine with #21 and #44.

2006 Plan Strategy	Progress	Recommendation for Plan Update
45. BALSAM LAKE, CENTURIA, CLAYTON, LUCK -- Develop and/or amend local ordinances to include stormwater management planning as part of a formal site and plat review process.	State law changes since last interviews require planning for 1+ acre projects. Some local ordinance updates in interim.	Revisit, but perhaps more generalized policy statement.
46. BALSAM LAKE, MILLTOWN Acquire back-up generators for some utilities in case of power outages.	Milltown now has one generator and Balsam Lake two.	No longer a priority need. Remove.
47. DRESSER-OSCEOLA-GARFIELD FIRE DEPT. -- Construct a new Fire Hall in the Village of Dresser near Trollhaugen on County Highway F.	Completed.	Remove.
48. CLAYTON Acquire a battery back-up for the new warning siren.	No change.	Combine with a multi-jurisdictional siren strategy.
49. OSCEOLA Enact a local ordinance to require unattended and unsheltered airplanes be tied-down.	Adopted and now tied-down.	Remove.
50. OSCEOLA Maintain communications with WisDOT on STH "35" and lower Osceola Dam improvements to address concerns with impacts to Falls and Hwy 243.	Improvements completed.	Remove.
51. OSCEOLA As part of the recommended studies to address stormwater concerns, special attention should be given to erosion/bank stabilization on the St. Croix River.	Still an issue, including an area along Ridge Road (not on the river).	Keep in plan, but broaden to continue to address "hotspots"
52. ST. CROIX FALLS Work with WisDOT and MinnDOT to establish a warning or queuing system for east bound traffic attempting to ascend STH "8" under icy conditions.	No action. Still a concern.	Keep in plan.
53. ST. CROIX FALLS Working with Polk County, the hydraulic analysis for St. Croix Falls should give special attention to runoff from the fairgrounds impacting the nursing home.	Significant improvements in the area completed since previous plan which may have addressed the issue.	Remove.
54. ST. CROIX FALLS, CLEAR LAKE Pursue grant funding for water system improvements in order to maintain adequate fire protection.	No need in Clear Lake unless significant new development. Five wells now in St. Croix Falls.	Remove from plan.
55. ST. CROIX CHIPPEWA NATION Coordinate the development of an Emergency Operating and Response Plan for Round Lake, with the Tribe taking the lead.	Plan is completed.	Remove.
56. ST. CROIX CHIPPEWA NATION The County Emergency Management Director will participate on the Tribal Emergency Response Committee, once formed.	St. Croix Chippewa representative on the LEPC, so this strategy is not needed.	Remove.
57. ST. CROIX CHIPPEWA NATION Amend the cooperative agreement with Polk County to clearly encompass provision of emergency services to heirship lands.	After discussion with Nation, this is likely not needed.	Remove.

SECTION VI.

MITIGATION GOALS AND STRATEGIES

Polk County will continue to proactively protect the health, safety, and welfare of the community by mitigating the negative human, economic, and environmental impacts of natural hazard events. This vision will be accomplished through planning, evaluation, communicating with stakeholders, and maintaining a strong, reliable infrastructure. This plan reflects the County's past, current, and ongoing commitment to natural hazard mitigation.

A. MITIGATION GOALS

The mitigation goals are intended to provide direction to achieve the desired outcome and are to be used as guidelines by which mitigation activities are identified and impact is evaluated. The goals provide Polk County further direction for determining the future and reflect the needs of the County as identified through the assessment of hazard conditions and community profile.

The mitigation goals for this plan update reflect, and are consistent with, the vision statements and goals found in the Polk County Comprehensive Plan, including the following in particular:

Transportation Vision Statement: Safe, convenient transportation for residents and tourists; various transportation infrastructure modes to enhance the residential, commercial, industrial, agricultural, and recreational resources in Polk County.

Utilities and Community Facilities Vision Statement: To provide for future growth while protecting public health and natural resources by maximizing the use of existing infrastructure and distributing facilities to ensure a consistent level of services.

Land Use Vision Statement: Polk County will have the appropriate/minimal amount of restrictions to maintain land owners rights, and have high quality lakes, open spaces, parks, orderly growth with focus on commercial development within cities and villages and take into account the impacts to the environment, economy, agriculture, public use, health and commercial development.

Natural Resources Goal 1: Recognize the environment as an integrated system of land, water, and air resources.

Natural Resources Goal 2: Minimize the potential impacts on natural resources, environmental corridors water resources, and wildlife habitats when evaluating potential residence, communities, industrial/mining, and intensive agricultural uses

Intergovernmental Cooperation Vision: Nurture an environment of divergent viewpoints and responsibilities so that governmental units may work in harmony and cooperation to reduce conflict and duplication of services and increasing efficiencies.

Intergovernmental Cooperation Goal 4: Participate in effective intergovernmental agreements that deal with issues that cover more that one jurisdiction.

With consideration of these guiding themes, the steering committee amended the 2006 plan goals.

The following are the 2011 *Polk County Natural Hazards Mitigation Plan* goals:

Goal One: Physical Infrastructure

Maintain a safe, efficient physical infrastructure which is prepared for and mitigates the negative impacts of natural hazard events.

Goal Two: Planning and Policy

Anticipate natural hazard vulnerabilities and identify appropriate, reasonable mitigation plans and policies which can be implemented in a cooperative, efficient manner.

Goal Three: Communication and Coordination

Nurture cooperation and strategic partnerships to maintain efficient and effective emergency planning, response, and recovery systems.

Goal Four: Education and Outreach

Increase the awareness of our natural hazard risks and the alternatives to mitigate these hazards in our homes, businesses, and communities.

B. EVALUATION OF ALTERNATIVE MITIGATION STRATEGIES

A comprehensive range of alternatives was considered when developing strategies to meet the plan's vision and goals. A description of many of these alternative mitigation strategies is included in the Mitigation Toolbox in **Appendix K** which was used to help identify potential mitigation options.

The strategy alternatives in **Appendix L** were evaluated based on community acceptance, administrative feasibility, costs, benefits, and other considerations. The strategies in Appendix L are organized by topic and the following sub-sections:

- ***Potential Policies:*** Policies tend to be on-going, decision-making or programmatic guidance. Policies strategies can often be funded or performed as part of normal operating budgets and do not require the identification of new or special funding or other resources. However, policies can become projects due to changing conditions or if a policy necessitates action or additional resources.
- ***Potential Projects:*** Projects typically have a focused, action-oriented outcome which is achievable within a certain time period. Since special funding or other resources are often needed for the implementation of projects, additional attention is given to these recommendations later in this report.
- ***Potential Multi-Jurisdictional Strategies:*** These are policies or projects under consideration by the participating cities and villages. Recommended multi-jurisdictional projects receive additional attention later in this report.

Evaluating the alternatives and selecting the mitigation strategies for inclusion in this plan was a multi-step process:

- #1 Potential mitigation strategies to address the hazard risks and vulnerabilities analyzed in Section III were identified during the key stakeholder interview process, steering committee meetings, town surveys, and city and village meetings. The strategies with the most potential were integrated into Appendix L.
- #2 During stakeholder interviews, the 2006 plan strategies listed in Section V were reviewed, which yielded a recommendation for this plan update. These strategies were also integrated into Appendix L, and a column added which indicates whether the strategy appeared in the 2006 plan, was significantly revised, or if it is new to this update.
- #3 A survey with the alternative county-level strategies shown in Appendix L was distributed via mail to steering committee members. Committee members gave each strategy a priority of “high”, “medium”, “low”, or “exclude” based on costs vs. benefits, political acceptability, technical feasibility, etc. Average scores were then determined based on a 10-point scale to provide a relative priority and exclude the lowest scoring strategies. Members were also encouraged to write-in comments, such as barriers to implementation, which were incorporated into Appendix L. The survey results were analyzed further during the fourth steering committee meeting resulting in some additional changes.
- #4 For those strategies in Appendix L that are recommended for plan inclusion, key parties to be involved (or take a leadership role) in implementation were identified.
- #5 Recommended multi-jurisdictional strategy alternatives for cities and villages were also added to Appendix L and reflect the findings from the meetings with each participating community. These recommended strategies were mailed to the cities and villages for review in July 2011. The discussion of the multi-jurisdictional strategies in Appendix L were then modified and amended based on the comments received. The input from the meetings and follow-up mailing determined which multi-jurisdictional strategies should be recommended in the final plan.
- #6 For priority projects recommended for implementation within the next five years, additional analysis and guidance was included in Section VI.C, including estimated costs if available. The steering committee analysis and community input referenced in Steps #3 and #5 were used to help determine priority. This new section allowed for additional

Note:

The priorities for the strategies in Appendix L were made in the context of this plan and the natural hazards facing Polk County.

A low priority should not necessarily be interpreted as having a lesser importance to Polk County overall.

A low priority or strategy not included in this plan should not be deferred if the need exists and resources are available.

analysis of the costs vs. benefits for the steering committee and communities, and it was further modified based on the additional input received.

- #7 Additional changes and “fine-tuning” to the recommended strategies and draft plan were made based on review of the draft plan by communities, local officials, key stakeholders, and the general public as part of the public informational meeting and adoption process.

C. RECOMMENDED MITIGATION STRATEGIES (ACTION PLAN)

Strategies are specific mitigation policies and projects selected based on their feasibility to assist the Polk County in attaining the plan goals. Some strategies may also have a strong emergency preparedness emphasis, but have been included for their importance in helping to mitigate the negative impacts of natural hazard events when they do occur. The last section (multi-jurisdictional strategies) identifies those recommended actions for the participating cities and villages.

As mentioned previously, Appendix L includes implementation guidance for each strategy, including relative priority, key parties likely involved during implementation, and potential barriers. The relative priority (i.e., high, medium, low) is helpful in determining which projects to implement first from a mitigation perspective, but individual programs or communities may rate some of these strategies differently. As explained in Appendix L, the strategies were prioritized based on their importance to hazard mitigation, but some strategies have additional local benefits which may not have been considered. These priorities are also subject to change over time and new priorities may arise. To avoid too much emphasis on the prioritization, only the high priority strategies are denoted here.

i. Physical Infrastructure Strategies

Recommended Projects

1. Continue to address stormwater and flash flooding hotspots in the County. Two of the higher priorities are the re-building of the Atlas Bridge (CTH "B") and stormwater management activities in the growing area immediately east of St. Croix Falls. **(High Priority) related to continued NFIP compliance**
2. Pursue the installation of weather warning sirens in unincorporated areas of high residential growth. Coordinate with those cities and villages who are in need of siren replacement, battery back-up, or additional siren coverage. **(High Priority)**
3. Pursue grant funds for dry hydrants for fire protection in areas of concentrated development where other water sources are not readily available.
4. Pursue grant funding to make cost-sharing available for the installation of storm shelters at mobile home parks and campgrounds where no existing shelter alternatives exist.
5. Continue to work with local power providers to bury electrical lines in areas prone to outages due to falling trees/limbs or high winds.

6. Complete the connections of the County Highway fuel systems, garage doors, and communications systems to the back-up generator.
7. Work with the State of Wisconsin and Minnesota agencies to establish a warning or queuing system for east-bound traffic on U.S. Highway 8 approaching the "St. Croix Falls" hill under icy or dangerous conditions.

Recommended Policies

8. Work with the dam owner and the Town of Clam Falls to address the problems with over-the-road flooding on CTH "I" at the Clam Falls Dam.

ii. Planning & Policy Strategies

Recommended Projects

9. Conduct a survey of emergency power generator capability and needs for EOCs and other critical facilities. Identify alternatives to address identified needs. **(High Priority)**
10. Investigate the feasibility of centralized testing and triggering of sirens through County Dispatch.
11. Revisit and expand the Polk County Continuity of Government Plan.
12. Every five years, Polk County will update its orthophotography to allow tracking of land-use trends and anticipate potential hazards, unless alternative photography exists.
13. Continue to work with other county, regional, and state organizations to secure grant funding support for countywide LIDAR, then request an update to the D-FIRMS in the future. *related to continued NFIP compliance*
14. Continue to monitor river and lake overbank flooding on the two Sand Lakes and along the Apple River. If repetitive problems begin to occur, investigate mitigation alternatives as a potential project. *related to continued NFIP compliance*

Recommended Policies

15. Continue to maintain or advocate for up-to-date emergency operating plans and dam failure analysis for County dams, high hazard dams, and dams with critical infrastructure within their shadows. **(High Priority)**
16. Adopt County ordinance language which requires new mobile home parks to construct or identify per formal agreement a storm shelter for their residents. Provide model language to cities and villages for consideration. **(High Priority)**
17. Continue the development of geographic informational systems (GIS) data for hazard mitigation and emergency management purposes, including completion of parcel mapping. Consider additional GIS coverages in the future, such as mapping of siren coverage areas, emergency shelters, dam shadows, dry hydrants/water sources, and building point files. **(High Priority)**

18. Provide to municipalities a model agreement for use of non-municipal buildings as public storm shelters.
19. Encourage local communities in the Cooperative Fire Protection areas to administer burning permits in a manner consistent with WDNR approach for the Intensive Fire Protection areas.
20. Continue to work with communities and other service providers to expand awareness of and participation in the Polk County Special Needs Registry for times of emergency.
21. Encourage the County and municipalities to integrate hazard mitigation issues and strategies into their comprehensive plans.
22. Discuss with the County's citizen planning committee the potential amendment of the County subdivision ordinance to require installation of dry hydrants in rural subdivisions without community water systems.
23. Work with Town of Clam Falls to encourage dam shadow zoning for the Godfrey Lake Dam so that it may be re-classified from a HIGH hazard dam to a LOW hazard dam.

iii. Communication and Coordination Strategies

Recommended Projects

24. Implement a NOAA All Hazard Radio project to include addressing the current gap in coverage area and distributing radios (or discount vouchers) to mobile home residents and/or critical facilities. **(High Priority)**
25. Explore the feasibility of establishing a Reverse 9-1-1 system. *related to continued NFIP compliance*

Recommended Policies

26. Establish emergency procedures for contacting residents and facilities in the dam shadows of "HIGH" and "SIGNIFICANT" hazard dams. **(High Priority)**
27. Continue to involve electric providers, County Land Information/G.I.S., County health and aging services, hospitals, ARES/RACES, and local non-profits (e.g., housing authorities, long-term care facilities) in exercises and discussions on their relationships with the incident command system.
28. As resources allow, continue to support the County Skywarn Spotter Program and ARES/RACES group, including the installation of informational signage, their efforts to attract new members, and their further implementation of the Automatic Packet Reporting System (APRS).
29. Work with Fire Departments and municipalities to consider the development of a countywide fire mutual aid agreement.
30. As grant opportunities allow, continue to assist local fire departments and emergency services agencies with communications equipment and pager upgrades for narrowbanding.

iv. Education & Outreach Strategies

Recommended Projects

31. Increase preparedness of campgrounds and resorts to severe weather by promoting use of weather radios and educational outreach to encourage the identification of storm shelters.
32. Increase resident knowledge on flood insurance and the typical limitations of homeowner's policies to cover flood damage. *related to continued NFIP compliance*

Recommended Policies

33. Polk-Burnett Electric Cooperative will conduct periodic training for County and municipal officials and response providers using the high voltage emergency training unit. **(High Priority)**
34. Polk County should continue to support WDNR and local wildfire awareness in the Towns of Sterling and West Sweden, such as continued public service announcements and increased signage. Work with WDNR, local fire departments, and the communities to determine interest in additional community wildfire protection planning or Firewise-style programming. **(High Priority)**
35. Polk County Emergency Management will continue to provide bi-annual presentation(s) to the Towns' Association on available resources, hazard event reporting, and current issues (e.g., access for emergency vehicles). Encourage towns to bring key staff to the presentation and maintain their emergency operating plans. Extend invitations to cities and villages, or provide a similar presentation for incorporated areas.
36. Polk County Emergency Management will work with other pertinent county departments to host a meeting(s) with long-term care facilities and other health care service providers on emergency planning and roles during an event.
37. Continue to expand educational efforts and partnerships regarding alternatives to mitigate stormwater and flash flooding run-off, such erosion controls, rain gardens, natural vegetation buffers, permeable pavement, shoreland practices, and forest management in areas with steep slopes.
38. Polk County, municipalities, and fire departments in the Intensive Fire Protection areas should continue to advocate for and participate in WDNR wildland training exercises.
39. Work with local media on a concerted effort to increase public awareness of the volunteerism needs in the County for ARES/RACES, Red Cross, local fire departments, first responders, and other local emergency services.

v. Multi-Jurisdictional Strategies

The priorities for multi-jurisdictional strategies vary by community. **Implementation of these strategy recommendations are at the discretion of each community.** In some cases, Polk County Emergency Management may be able to provide guidance, but the responsibility for putting these strategies into action lies with each community.

Recommended Projects

1. **DRESSER, FREDERIC, LUCK, MILLTOWN, OSCEOLA, ST. CROIX FALLS** - Continue efforts to remedy the stormwater and flash flooding problems in each community, including any necessary studies and potential development of a community stormwater management plan. **(High Priority) related to continued NFIP compliance**
2. **BALSAM LAKE, DRESSER, FREDERIC, MILLTOWN, OSCEOLA** - Identify storm shelters (or a second storm shelter site) for residents, execute formal agreements for shelter use, and use local media to educate residents on availability. If a shelter is not readily available, pursue grant funding to construct a public storm shelter as opportunities allow. **(High Priority)**
3. **CLEAR LAKE, DRESSER, LUCK, MILLTOWN, OSCEOLA, AMERY** - Pursue additional sirens for replacement of aging equipment or added geographic coverage as funding opportunities allow. Potentially coordinate through a multi-jurisdictional or countywide project. **(Medium-to-High Priority)**
4. **ST. CROIX FALLS** - Work with the Polk County to encourage State of Wisconsin and Minnesota agencies establish a warning or queuing system for east-bound traffic on U.S. Highway 8 approaching the "St. Croix Falls" hill under icy or dangerous conditions (*see related County strategy*). **(Medium-to-High Priority)**
5. **BALSAM LAKE, CENTURIA, FREDERIC, MILLTOWN** – Should funding opportunities arise, acquire additional electric power generators for emergency use. **(Medium Priority)**
6. **LUCK** - Work with electric utilities to bury power lines along Highway 48 which is prone to falling trees and limbs. Coordinate such projects with municipal street and other utility improvements when opportunities arise. **(Low Priority)**
7. **CENTURIA, CLAYTON, LUCK, FREDERIC, MILLTOWN** - Pursue battery back-up or emergency generators for existing sirens as funding opportunities allow. Potentially coordinate through a multi-jurisdictional or countywide project. **(Low Priority)**

Recommended Policies

8. **ALL INCORPORATED AREAS** – If flooding or other emergency occurs, compile and document all damages and costs with pictures, testimony, invoices, etc., for potential future grant funding or reimbursement. **(High Priority) related to continued NFIP compliance**
9. **ALL INCORPORATED AREAS** - Update, as needed, and maintain local emergency operating plans and continue to participate in mock event exercises and training sessions when opportunities arise. Develop and maintain siren use and testing policies as part of these plans. Consider development of continuity of operations plans for critical government services and records management. **(High Priority)**
10. **ALL INCORPORATED AREAS** - Continue to work with Polk County Emergency Management to ensure communications interoperability and to pursue funding support to

replace and upgrade communications equipment for municipal utilities, street departments, and local emergency services providers in a cost-effective manner. **(High Priority)**

11. **CLEAR LAKE** – Address “sanctioned status” under the National Flood Insurance Program (NFIP) as of January 13, 2012. **(High Priority)** *related to continued NFIP compliance*
12. **ALL INCORPORATED AREAS** – Municipal staff and elected officials identified as having a first line, supervisory, or other key role during an emergency as identified in the community emergency operating plan should complete FEMA ICS 100, 200, and 700.A training which is available on-line. **(Medium-to-High Priority)**
13. **ALL INCORPORATED AREAS** – If the community has not to date, adopt Wisconsin Department of Transportation third-party billing rates for equipment use, or its own equipment rate schedule, by resolution or other administrative policy. **(Medium-to-High Priority)**
14. **ALL INCORPORATED AREAS** - Incorporate hazard mitigation and emergency preparedness activities into community comprehensive plans and land use procedures (e.g., site plan review) as opportunities allow. Other planning efforts potentially related to mitigation include: continuity of government plans, stormwater management plans, and capital improvements plans. Consider the use of official mapping and subdivision standards to avoid the creation of long, dead-end streets. **(Medium Priority)**
15. **CLAYON, LUCK, AMERY** - Consider development of a public storm shelter agreement and policy with those entities currently providing facilities as a public storm shelter. **(Medium Priority)**
16. **AMERY** – The City, response providers, housing authority, and other facilities should continue to cooperatively prepare for and exercise their emergency plans for multi-family housing complexes and long-term care facilities. **(Medium Priority)**
17. **ALL INCORPORATED AREAS** – As deemed necessary, develop or modify public works mutual aid agreements to cover all levels of potential support (e.g., utilities, debris clean-up, generators, administrative) during or following an emergency. **(Medium-to-Low Priority)**

D. IMPLEMENTATION OF PRIORITY PROJECTS

As discussed previously, Appendix L included implementation guidance for all recommended plan strategies, including relative priority, key parties, and potential barriers to implementation. This section focuses on the high-priority project recommendations. Projects typically have a focused, action-oriented outcome which is achievable within a certain time period. Since special funding or other resources are often needed for the implementation of projects, special attention to these strategies are provided here.

Implementing Priority Projects

The following provides guidance for the implementation of each of the priority projects and estimated costs if available. Many of these projects are eligible for FEMA Hazard Mitigation Grant Program or FEM Pre-Disaster Mitigation Grant Program dollars. These funding sources can be very competitive, so (unless a major storm event occurs in the County) it is unlikely that multiple projects tapping into these two grant programs would be funded within a short-time period. A full cost-benefits review should be performed prior to implementation.

Project	Logistics	Potential Funding Sources	Other Guidance and Estimated Costs
<i>physical infrastructure priority projects</i>			
1. Continue to address stormwater and flash flooding hotspots in the County. Two of the higher priorities are the re-building of the Atlas Bridge (CTH "B") and stormwater management activities in the growing area immediately east of St. Croix Falls.	<u>timeline:</u> on-going & varies by project; no firm deadlines <u>lead party:</u> municipalities and Highway Department	If significant history of damage or critical risks to safety, may be eligible for FEMA mitigation dollars. Otherwise, CDBG, transportation dollars, or funded locally.	Significant progress since 2006 plan. Costs will vary by project. Continue to integrate into Capital Improvement Plans and work schedules. Be certain to document all instances for flooding or flood damage.
2. Pursue the installation of weather warning sirens in unincorporated areas of high residential growth. Coordinate with those cities and villages who are in need of siren replacement, battery back-up, or additional siren coverage.	<u>timeline:</u> contingent on grant funding availability <u>lead party:</u> County Emgy Mgmt for general coordination	Grant funding for siren projects currently very limited. USDA Rural Dvlpmt Program is one potential source. Otherwise, may need to be funded locally. Some cost sharing would likely be required.	11 sirens and 4 battery back-ups may be needed. Tornado assessment summarizes needs, but may need to contact communities for additional needs. Sirens typically cost in \$18k-\$25k range. Policy for maintaining and triggering sirens should be in place prior to funding any new siren.

<i>planning and policy priority projects</i>			
3. Conduct a survey of emergency power generator capability and needs for EOCs and other critical facilities. Identify alternatives to address needs.	<u>timeline:</u> 2-5+ years	Inventory – Likely performed as part of normal operational budgets. Mitigation – Generators may be eligible for FEMA mitigation grant funding, as well as certain facility grant programs (e.g., CDBG, USDA-CF). Electric providers may also be able to provide funding or competitive pricing assistance.	Added as a project, since the survey would yield a list of needs. Funding for generators may require a mix of local, private sector, and grant funds. This is currently not a high priority project for many funding agencies. May need to target grants based on facility type. For instance, a Pennsylvania Fire Dept received \$162k from the AFG program in 2010 for emergency generators at 2 fire halls.
	<u>lead party:</u> County Emgy Mgmt with assistance of municipalities and perhaps electric providers. WCWRPC may be able to assist in grant proposal development.		
<i>communications and coordination priority projects</i>			
4. Implement a NOAA All Hazard Radio project to include addressing the current gap in coverage area and distributing radios (or discount vouchers) to mobile home residents and/or critical facilities.	<u>timeline:</u> 1-5 years; gap in service should be addressed prior to distribution of radios	This would be eligible for FEMA mitigation grant funding, in particular for the distribution of radios. Local maintenance funding would be needed, along with tower rent if required. Consider partnering with retailers on distribution at their places of business.	One NOAA frequency is available. Antennae and related equipment costs abt. \$30,000. Would need an appropriately located radio tower, preferably without rent; this is likely the largest barrier to implementation. Significant flexibility available for NOAA radio component. Could partner with non-profits in implementation if desired.
	<u>lead party:</u> County Emgy Management in coordination with NOAA. County ARES may be available to assist with programming.		

multi-jurisdictional priority projects (priority can vary by community)			
<p>5. DRESSER, FREDERIC, LUCK, MILLTOWN, OSCEOLA, ST. CROIX FALLS - Continue efforts to remedy the stormwater and flash flooding problems in each community, including any necessary studies and potential development of a community stormwater management plan.</p>	<p><u>timeline:</u> on-going & varies by project and flood events</p>	<p>If significant history of damage or critical risks to safety, may be eligible for FEMA mitigation dollars.</p>	<p>Continue to integrate into Capital Improvement Plans and work schedules. Document all flooding or flood damage. Other potential grant sources include: WDNR Urban Nonpoint Source Grant Program, USDA-Rural Development Loans and Grants, CDBG, and transportation dollars.</p>
	<p><u>lead party:</u> municipalities</p>		
<p>6. BALSAM LAKE, DRESSER, FREDERIC, MILLTOWN, OSCEOLA - Identify storm shelters (or a second storm shelter site) for residents, execute formal agreements for shelter use, and use local media to educate residents on availability. If a shelter is not readily available, pursue grant funding to construct a public storm shelter as opportunities allow.</p> <p><i>Note: Shelters can come in many sizes, varieties (e.g., above ground versus below ground), construction materials, and options (e.g., lighting, fire insulation, seating). All shelters should be designed in accordance with FEMA, ICC, and State minimum design, construction, and installation standards</i></p>	<p><u>timeline:</u> varies by community</p>	<p>In some cases, may be able to address through partnerships and agreements, not requiring grant dollars.</p> <p>If construction, FEMA Haz. Mit. Grant Program or Pre-Disaster Mit. Grant Program. Amounts available are dependent on population to be served and coverage area (normally 0.5 miles).</p>	<p>A 10-15 person pre-fab shelter costs about \$4,000-\$8,000 + installation. Larger shelters are available and pricing varies by design, size, and options. One above-ground shelter for up to 63 persons costs \$14,000 plus delivery and installation. <u>Must</u> be accompanied by policies and activities to alert visitors to storm conditions and shelter availability.</p>
	<p><u>lead party:</u> municipalities with possible assistance or coordination from Chippewa County Emgy Management</p> <p>WCWRPC may be able to assist with further grant research and proposal development.</p>		
<p>7. CLEAR LAKE, DRESSER, LUCK, MILLTOWN, OSCEOLA, AMERY - Pursue additional sirens for replacement of aging equipment or added geographic coverage as funding opportunities allow. Potentially coordinate through a multi-jurisdictional or countywide project.</p>	<p><u>timeline:</u> varies by community; contingent on grant and/or local funding availability</p>	<p>See #2 above.</p> <p>Could be part of a multi-community or countywide project with Emergency Management providing general coordination.</p>	<p>Sirens typically cost in \$18k-\$25k range. Policy for maintaining and triggering sirens should be in place prior to funding any new siren. Some communities also expressed a desire to be able to remotely activate their sirens, which could also be considered part of this strategy.</p>
	<p><u>lead party:</u> municipality and/or siren owner</p>		

E. ADDITIONAL IMPLEMENTATION GUIDANCE

Appendix M includes a synopsis of some of the more commonly used natural hazard mitigation grant funding sources. Additional information on Federal grant funding can be found at www.cfda.gov. Substantial infrastructure improvements may also be funded locally through the establishment of a stormwater utility district or ordinance fee system, tax incremental financing (TIF), general obligation bonds, and developer contributions or exactions. Capital improvements planning can be a valuable tool to assist communities in the planning and prioritizing of major infrastructure investments and identifying the best financing approach.

Additional sources of financial support are also often available following a disaster event, such as U.S. Small Business Administration (SBA) loans for the repair or replacement of property. The U.S. Department of Agriculture, through its local Farm Service Agencies, provides additional disaster assistance for crop losses and livestock emergency through programs such as the Disaster Reserve Assistance Program (CFDA #10.452) and Noninsured Crop Disaster Assistance (CFDA #10.451). Grant funding for additional emergency measures, such as the rehabilitation of flood control works, may be available through the U.S. Army Corps of Engineers. In the event of an impending or recent disaster, municipalities and the County emergency management director are encouraged to contact Wisconsin Emergency Management and the agencies identified in Appendix M for potential assistance, since available resources and related requirements frequently change and this list is not all inclusive.

The prioritization of the strategies in Appendix L offers guidance to departments and communities in the implementation of this plan based on available resources and changing conditions. And, as the implementation plan reflects, with such challenges also come opportunities to form or strengthen strategic partnerships to share and leverage existing resources which is a primary theme within the plan goals.

Most policy strategies can utilize existing program budgets for implementation, though funding would be required for many of the recommended projects. Some of these policy strategies may involve the amendment of an ordinance or the institution of new procedures. Examples and model language for some of these strategies were compiled by West Central Wisconsin Regional Planning Commission (WCWRPC) and are available from Polk County Emergency Management or WCWRPC. This reference information does not constitute legal advice, but provides insight into similar activities by other communities which can be used at the discretion of Polk County municipalities. Further, due to the involvement of key officials and County departments during the planning process, the strategy recommendations are known to these stakeholders and can be integrated into, or coordinated with, other work programs and planning efforts.

Like many municipalities, Polk County and its communities are facing fiscal challenges and resources are limited. **The recommended strategies will be implemented as resources (e.g., funding, staffing) and other priorities allow.** Further, because of such limitations, there is not an expectation that all strategy recommendations will be fully implemented between now and the next update of this plan.

SECTION VII.

PLAN ADOPTION & MAINTENANCE PROCESS

A. PLAN COORDINATION

Many of the strategy recommendations in the previous section have relationships to other plans and policies for which coordination and consistency is vital. These related plans tend to fall within the following general categories:

- Local capital improvements plans and other budget documents. Most notably are infrastructure projects, such as those related to stormwater systems, water supplies, weather sirens, and communications equipment, which must be considered as part of local budgets.
- Regulations, agreements, and related procedures (e.g., subdivision ordinances, official mapping, shelter agreements, burning permits). These strategies are primarily identified in the policy strategies. Amendments can often be performed in concert with other ordinance updates. Some related actions, such as consistent administration of burning permits, may be accomplished procedurally without an ordinance amendment.
- Existing emergency operating or response plans. Many local municipalities need to update their emergency operating plans and Polk County Emergency Management is taking the lead to encourage these updates. County Emergency Management and other county offices will also work cooperatively with stakeholders regarding plans, procedures, and grant applications related to long-term power outage, storm shelters and sirens, highway closures, communications systems, incident command, etc.

To date, integrating the strategies and recommendations found in the 2006 hazard mitigation plan into local comprehensive plans has been inconsistent. Some planning consultants working with local communities are unfamiliar with the details of the hazard mitigation plan and the state comprehensive planning law includes no specific reference to mitigation or resiliency planning. Further, mitigation planning is on a different schedule than comprehensive planning, with most comprehensive plans likely to be updated no more frequently than once per decade.

Even so, the 2006 hazard mitigation plan and strategies have been considered or integrated into the County plan and many local planning efforts. And during this mitigation plan update, comprehensive plans were considered by local participants for potential issues and other guidance.

The *Polk County Conditions & Trends Report (CTR)* completed in January 2009 makes numerous references to the *Polk County Natural Hazards Mitigation Plan*, with specific discussion on topics such as stormwater/flash flooding and dam hazard ratings. The CTR was used during the development of the *Polk County Comprehensive Plan* adopted in October 2009 which also included similar references. The CTR was also widely used by numerous cities, villages, and towns during their respective planning efforts as well.

While the mitigation plan was not specifically referenced in many participant comprehensive plans, many of the mitigation recommendations are included as comprehensive plan policies. Most communities with 100-year floodplains included strategies in their comprehensive plans to discourage or not allow any floodplain development. Stormwater management is another common theme in many local comprehensive plans. And some communities, such as Amery, included plan strategies on topics emergency vehicle access. Even so, greater effort is needed to ensure that the hazard mitigation plan is considered during other local planning efforts, and vice versa.

As the mitigation plan strategies reflect, WCWRPC and Polk County Emergency Management will continue to work with the Polk County Land Information (Planning) Department and local municipalities to encourage coordination and consistency between comprehensive planning and the hazard mitigation plan, and provide instruction on how to incorporate mitigation strategies into their comprehensive plans and other planning mechanisms. And when made aware of local comprehensive planning efforts and updates, WCWRPC will contact to municipalities to encourage them to consider the strategies found within the *Polk County Natural Hazards Mitigation Plan*, within periodic reminders through the WCWRPC newsletter e-mailed to every jurisdiction in the region.

Section V also showed that the hazard mitigation plan strategies have been integrated into additional local planning mechanisms. Many of the stormwater and flash flooding hotspots in the 2006 mitigation plan were addressed by including these projects in the transportation or capital improvement plans at the County or local level. As part of its work plan, Polk County Emergency Management continues to encourage and assist local jurisdictions in the update of their emergency operating plans; these plans often address mitigation policies or issues. And Section V demonstrated that many mitigation strategies were integrated into work plans, ordinances, and project budgets, such as the adoption of a County stormwater ordinance and requiring the tie-down of aircraft at the Osceola Airport.

Since key County staff was actively involved in the development and update of the County mitigation plan, many of the mitigation strategies are based on staff recommendations and gives confidence that a high level of coordination between these various planning efforts will continue.

Continued, active involvement of key county staff, local jurisdictions, and other stakeholders during hazard mitigation plan updates is critical to ensuring incorporation of mitigation strategies into other planning mechanisms.

B. PLAN MAINTENANCE

Since the adoption of the 2006 plan, reviews of the existing plan were primarily limited to a periodic internal review by the Emergency Management Director. No special plan reviews or plan amendments were needed.

i. Plan Monitoring and Annual Plan Reviews

The *Polk County Natural Hazards Mitigation Plan* will be monitored by the Emergency Management Coordinator, including a quarterly review of the progress on plan implementation. These reviews will be part of the County's semi-annual Plan of Work to be provided to the Wisconsin Emergency Management Regional Director.

Each year, starting in the first quarter of 2013, one quarterly review will be replaced by a more robust annual review to consider progress and determine if the plan has become obsolete, if conditions have changed within the County, or if new technologies/approaches to hazard mitigation have become available. Polk County, through its Emergency Management Coordinator, will complete this annual review unless a plan update is already in progress.

The annual plan review should consider the following:

1. Any changing conditions impacting hazard risk or vulnerability.
2. Review of any new mandates, rules, etc, as well as any input from Wisconsin Emergency Management (WEM) and The Department of Homeland Security--Federal Emergency Management Agency (FEMA) regarding plan implementation.
3. Review of the plan's recommended strategies, emphasizing completed priority projects and their effectiveness, as well as priority projects yet to be completed and funding sources.
4. Coordination of plan strategies with other County or local planning mechanisms.
5. Potential new projects.
6. Any public or community input received on the plan and activities.

After this review, the Emergency Management Coordinator will provide a brief report to the Hazard Mitigation Plan Steering Committee on the progress towards the plan's strategies, as well as any critical changes or amendments being proposed. These meetings will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment. The Emergency Management Coordinator will have primary responsibility for establishing meeting dates, distributing related materials, and facilitating the meetings.

After completion of each annual review, the Committee will recommend any revisions or amendments to the plan if necessary. The revisions will be forwarded to the County Board for their consideration and action. The Emergency Management Coordinator may also need to follow-up with participating jurisdictions and various County offices during this process.

ii. Special Plan Reviews (Post-Disaster or New Project)

Within six months following a significant natural disaster event as determined by the Emergency Management Coordinator, a special post-disaster review will occur. A municipality or the County may also request a special plan review for the consideration of a plan amendment to incorporate a new project which was not included in the original plan, perhaps due to unforeseen circumstances or an increased hazard risk.

Information regarding the recent disaster or new project will be collected by the Emergency Management Coordinator from local law enforcement personnel, fire department personnel, Polk County disaster response personnel, involved municipality(s), DNR, WEM and FEMA personnel, affected citizens, and any other relevant entity. This information will be provided to the Hazard Mitigation Plan Steering Committee for their review.

At a duly called and posted public meeting, the Committee will analyze factors which contributed to any impacts of the hazard risk, the likelihood of the event reoccurring, and any strategy alternatives. The Emergency Management Coordinator will have primary responsibility for establishing special plan review meeting dates, distributing related materials, and facilitating the meetings. The Emergency Management Coordinator will also advertise these special meetings to affected department heads, citizens, or community groups, so additional input and comment can be received. Special plan review meetings will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment.

The Committee may recommend to revise or amend the existing plan. As appropriate, recommended changes to the plan will be forwarded to the County Board and the municipal contacts of the participating incorporated municipalities for their action and consideration.

iii. Plan Updates

Every five years, the Hazards Mitigation Plan will be comprehensively reviewed, current data collected, and fully updated. The next full plan update should be completed and adopted no later than January 2017. This planning effort should be robust and incorporate opportunities for public involvement to meet all requirements of 44 CFR Part 201.6 and/or any applicable requirements or regulations developed in the interim.

At that time, the Emergency Management Coordinator will propose a plan update steering committee and process for County Board approval, and will include representation on behalf of participating jurisdictions. Plan update steering committee meetings will be subject to the Wisconsin Open Meeting Law and properly noticed to allow for public involvement and comment. In the interim, efforts should continue to be made to address data weaknesses in the vulnerability assessment, most notably for the flood assessment as described in **Appendix B**.

C. PLAN ADOPTION

Each participating municipality, including Polk County, considered and adopted this plan in a duly posted and held public meeting.

<u>Jurisdiction</u>	<u>Adoption Date</u>
Polk County (encompasses all unincorporated areas)	March 20, 2012
Village of Balsam Lake	May 7, 2012
Village of Centuria	April 9, 2012
Village of Clayton	August 6, 2012
Village of Clear Lake	July 10, 2012

Village of Dresser	May 7, 2012
Village of Frederic	May 14, 2012
Village of Luck	May 9, 2012
Village of Milltown	May 14, 2012
Village of Osceola	August 14, 2012
City of Amery	July 11, 2012
City of St. Croix Falls	May 14, 2012

Copies of the adopting resolutions are attached (see **Appendix A**). The approval process is described in detail in Section I.B at the beginning of this plan.

APPENDIX A.

ADOPTING RESOLUTIONS

RESOLUTION 06 -12

RESOLUTION TO APPROVE AN ALL HAZARDS MITIGATION PLAN FOR POLK COUNTY
TO THE HONORABLE SUPERVISORS OF THE COUNTY BOARD OF THE COUNTY OF POLK:

WHEREAS, 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; and,

WHEREAS, Polk County has worked through a multi-agency, multi-jurisdictional hazard mitigation planning steering committee to update the *Polk County Natural Hazards Mitigation Plan*, to assess the magnitude of hazard risks, and to develop strategies for minimizing or reducing these risks; and,

WHEREAS, Polk County Emergency Management provides emergency management planning, coordination, response, and recovery support on behalf of all communities of Polk County; and,

WHEREAS, Polk County towns, villages, and cities participated in the planning process through a presentation to the Town's Association, a Town hazard assessment survey, meetings, the review of the draft strategies, various meetings, and other communication; and,

WHEREAS, the planning meetings for this effort were open to the public, properly noticed in accordance with Wisconsin's Open Meetings Law, and included a special Public Informational Meeting held on August 29, 2011; and,

WHEREAS, adoption of the Plan by the County Board will make the County and its unincorporated towns eligible for federal grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Polk County Board of Supervisors adopts the *Polk County Natural Hazards Mitigation Plan*, which is attached hereto and incorporated herein, as the official all hazards mitigation plan for the County with the intent of implementing the plan recommendations as funding and resources allow.

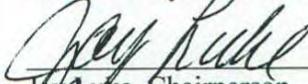
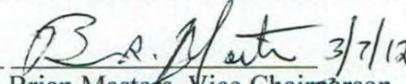
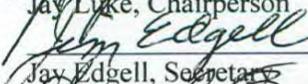
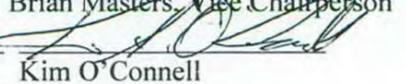
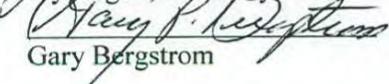
Funding Amount and Source: Authorized Pursuant to Resolution 72-09:
(Resolution To Authorize Polk County Hazard Mitigation Planning Grant)

Date Finance Committee Advised: Not Applicable

Finance Recommendation: Not Applicable

Effective Date: Upon Passage

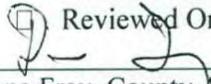
Submitted by the Polk County Public Protection and Judicial Committee:

	 3/7/12
Jay Luke, Chairperson	Brian Masters, Vice Chairperson
	
Jay Edgell, Secretary	Kim O'Connell
	
Gary Bergstrom	

Date Submitted to County Board: March 20, 2012

Review By County Administrator:

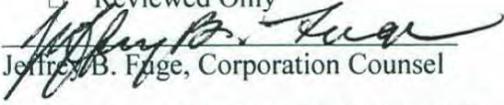
- Recommended
- Not Recommended
- Reviewed Only



Dana Frey, County Administrator

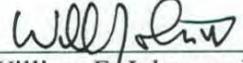
Review By Corporation Counsel:

- Approved as to Form
- Recommended
- Not Recommended
- Reviewed Only

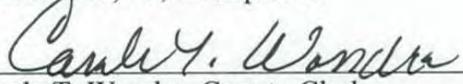


Jeffrey B. Fidge, Corporation Counsel

On March 20, 2012, the Polk County Board of Supervisors adopted Resolution No. ___-12: Resolution to Approve An All Hazards Mitigation Plan For Polk County, by a vote of ___ in favor and ___ against, in which said plan was incorporated and attached thereto. *by unanimous voice vote*



William F. Johnson, IV, Chairperson

Attest: 

Carole T. Wondra, County Clerk

Resolution #2012-07

**A Resolution approving a Natural Hazards Mitigation Plan
for the Village of Balsam Lake**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Balsam Lake participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

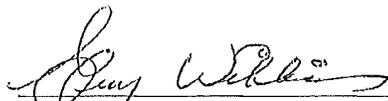
WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Balsam Lake to apply for FEMA grant dollars for hazard mitigation projects;

NOW THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazard Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Balsam Lake with the intent of implementing the plan recommendations as funding and resources allow.

Adopted this 7th day of May, 2012.

Approved:



Guy Williams, Village President

Attest: I hereby certify that the foregoing resolution was duly adopted by the Village Board of Balsam Lake at a legal meeting held on this 7th day of May, 2012.



Lori Duncan, Village Clerk-Treasurer

RESOLUTION # 1-12

A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE VILLAGE OF CENTURIA

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Centuria participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Centuria to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Centuria with the intent of implementing the plan recommendations as funding and resources allow.

Adopted, April 9, 2012

Dates and Signatures

David Markert
Village President
April 9, 2012

Judith A. Gypson
Village Clerk
April 9, 2012

RESOLUTION 2012-02

**A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE VILLAGE OF CLAYTON**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Clayton participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Clayton to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Clayton with the intent of implementing the plan recommendations as funding and resources allow.

Adopted, this 6th day of August, 2012



Jennifer Gabe, Village President

Attest: 

Cally Lauersdorf, Village Clerk

Ayes: 5 Nays: 0

RESOLUTION # 3 -2012

**A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE VILLAGE OF CLEAR LAKE**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Clear Lake participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Clear Lake to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Clear Lake with the intent of implementing the plan recommendations as funding and resources allow.

Adopted, this 10th day of July, 2012.

SIGNED:



Roger LaBlanc – Village President

ATTESTED:



Albert Bannink – Village Clerk

Village of Dresser

RESOLUTION #02-2012

**A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE VILLAGE OF DRESSER**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

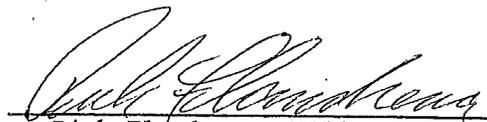
WHEREAS, the Village of Dresser participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

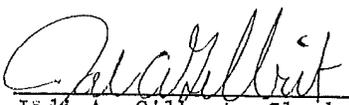
WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Dresser to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Dresser with the intent of implementing the plan recommendations as funding and resources allow.

Adopted at Dresser, Wisconsin, this 7th day of May 2012.


Rick Flandrena, Village President

ATTEST:


Jodi A. Gilbert, Clerk/Treasurer

BY ROLL CALL VOTE: 7 AYE 0 NO 0 ABSTAIN 0 ABSENT

CERTIFICATE OF CLERK

Motion by Jim Rochford Jr. and seconded by Kristi Scheet that Resolution No. 02-2012 is adopted. Passed with seven (7) votes in the affirmative, zero (0) votes abstained, zero (0) votes in the negative, zero (0) absent votes constituting at least a 2/3rds vote of the elected members of the governing body of the Village of Dresser, at the regular and duly called meeting of the Board of Trustees of the Village of Dresser held on the 7th day of May, 2012.

I further certify that the above is a true and correct copy of the original on file in the office of the Village Clerk of the Village of Dresser, Polk County, Wisconsin.

A handwritten signature in cursive script, reading "Jodi A. Gilbert", written over a horizontal line.

Jodi A. Gilbert
Village Clerk
Village of Dresser
Polk County, Wisconsin

Dated this 8th Day of May 2012.

VILLAGE OF FREDERIC

107 Hope Road West
P.O. Box 567
Frederic, WI 54837
715-327-4294

David Wondra, Village Administrator: administrator@fredericwi.com
Kristi Swanson, Clerk: treasurer@fredericwi.com

RESOLUTION

A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN FOR THE VILLAGE OF FREDERIC

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Frederic participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Frederic to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Frederic with the intent of implementing the plan recommendations as funding and resources allow.

Adopted,
5/14/2012

Village President
 05.14.2012
 5-14-12
Village Clerk

Dates and Signatures

**RESOLUTION 2-2012: A RESOLUTION APPROVING A NATURAL HAZARDS
MITIGATION PLAN FOR THE VILLAGE OF LUCK**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Luck participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Luck to apply for FEMA grant dollars for hazard mitigation projects;

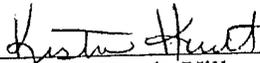
NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Luck with the intent of implementing the plan recommendations as funding and resources allow.

Adopted this 9th day of May, 2012.

I hereby certify that the foregoing Resolution was adopted by the Luck Village Board at a legal meeting on the 9th day of May, 2012.



Peter Demydowich
Village President

Attest: 

Kristina Handt, Village Administrator

VILLAGE OF MILLTOWN

RESOLUTION #5-14-12

**A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE VILLAGE OF MILLTOWN**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a National Hazards Mitigation Plan Steering Committee, with representatives from local municipalities, to develop the Polk County Natural Hazards Mitigation Plan, 2011-2016 to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Milltown participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 200 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Milltown to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the Polk County Natural Hazards Mitigation Plan, 2011 – 2016 as the official all hazards mitigation plan for the Village of Milltown with the intent of implementing the plan recommendations as funding and resources allow.

Adopted this 14th day of May, 2012

By the Milltown Village Board


Louise White, Village President


Joyce Stener, Village Clerk

Ayes 7

Nays 0

Resolution # 12 - 16
Village of Osceola
Polk County, Wisconsin

APPROVING A NATURAL HAZARDS MITIGATION PLAN

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

WHEREAS, the Village of Osceola participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the Village Board will meet prerequisite requirements which enables the Village of Osceola to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the Village Board adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the Village of Osceola with the intent of implementing the plan recommendations as funding and resources allow.

Approved the 14th day of August 2012.



Gary Beckmann, Village President

Attest: 

Joel B. West, Village Administrator

RESOLUTION 5-2012

**A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE CITY OF AMERY**

WHEREAS, hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effects; and,

WHEREAS, Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee, with representation from local municipalities, to develop the *Polk County Natural Hazards Mitigation Plan, 2011-2016* to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and,

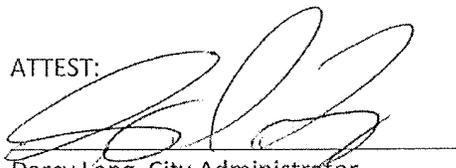
WHEREAS, the City of Amery participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and,

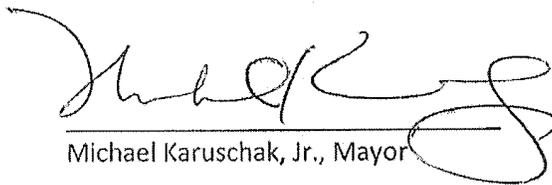
WHEREAS, the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS, adoption of the Plan by the City Council will meet prerequisite requirements which enables the City of Amery to apply for FEMA grant dollars for hazard mitigation projects;

NOW, THEREFORE BE IT RESOLVED, the City Council adopts the *Polk County Natural Hazards Mitigation Plan, 2011-2016* as the official all hazards mitigation plan for the City of Amery with the intent of implementing the plan recommendations as funding and resources allow.

Adopted this 11th day of July, 2012

ATTEST:

Darcy Long, City Administrator


Michael Karuschak, Jr., Mayor

A RESOLUTION APPROVING A NATURAL HAZARDS MITIGATION PLAN
FOR THE CITY OF ST CROIX FALLS

WHEREAS: hazard mitigation planning is the process of developing a set of actions designed to reduce or eliminate long-term risk to people, businesses, infrastructure, and property from hazards and their effect; and

WHEREAS: Polk County has worked through a Natural Hazards Mitigation Plan Steering Committee; with representation from local municipalities, to develop the Polk County Natural Hazards Mitigation Plan, 2011-2016 to assess the magnitude of hazard risks and develop strategies for minimizing or reducing these risks; and

WHEREAS: the City of St Croix Falls participated in the planning process through a meeting with community representatives to identify hazard risks, vulnerabilities, and strategies unique to the community, as well as through the review of draft plan materials; and

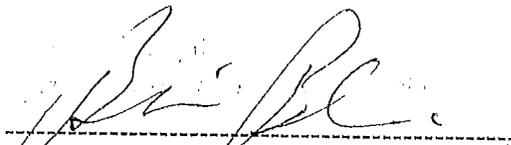
WHEREAS: the Plan was reviewed and preliminarily approved by Wisconsin Emergency Management as meeting the requirements of the Federal Disaster Mitigation Act of 2000 and applicable Code of Federal Regulations; and,

WHEREAS: adoption of the Plan by the City Council will meet prerequisite requirements which enables the City of St Croix Falls to apply for FEMA grant dollars for hazard mitigation projects;

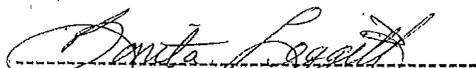
NOW THEREFORE BE IT RESOLVED: the City Council adopts the Polk County Natural Hazards Mitigation Plan, 2011-2016 as the official all hazards mitigation plan for the City of St Croix Falls with the intent of implementing the plan recommendations as funding and resources allow.

ADOPTED THIS 14 DAY OF May 2012

CITY OF SAINT CROIX FALLS



Brian Blesi, Mayor



Bonita Leggitt, City Clerk

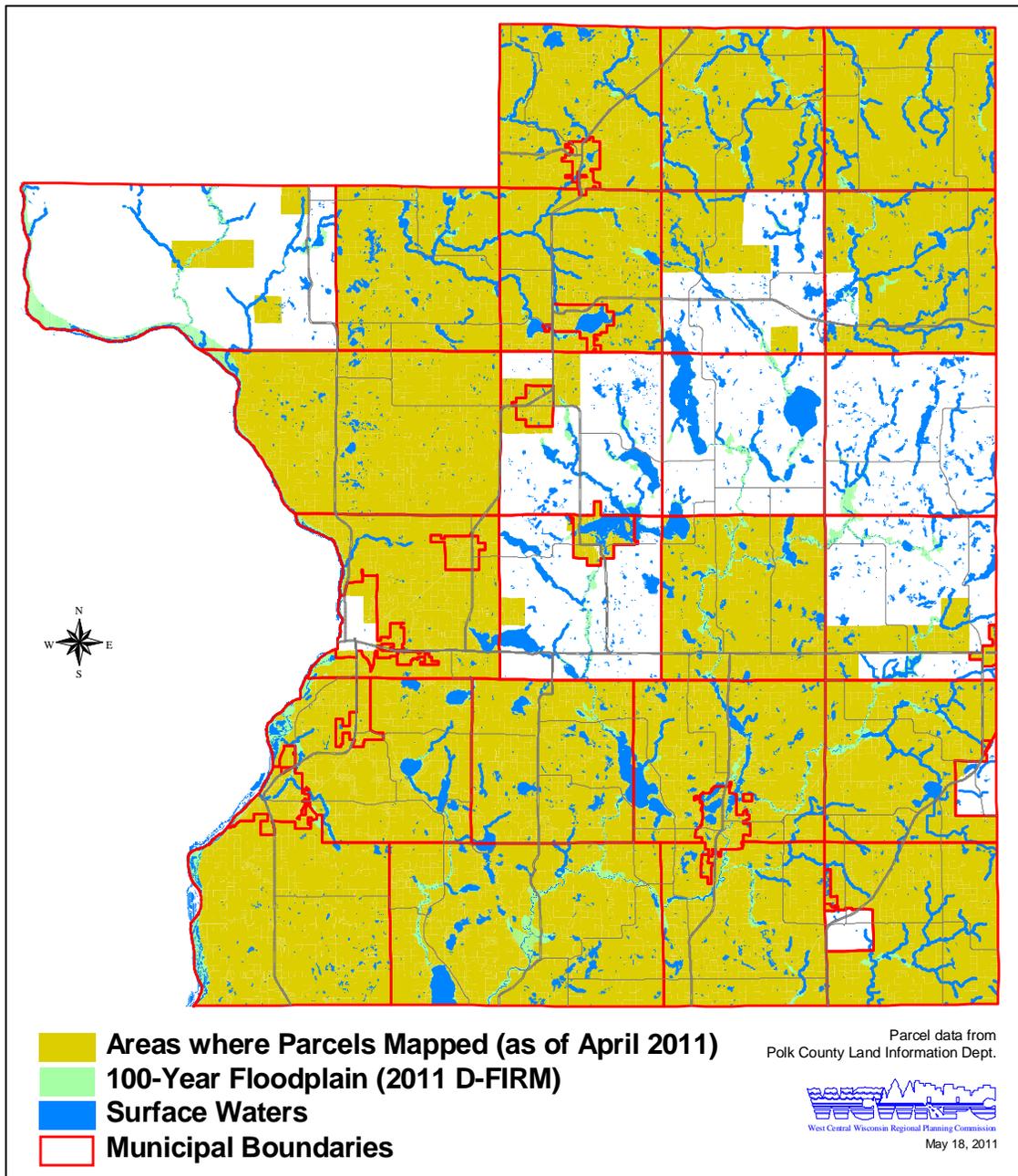
APPENDIX B.

**FLOOD ASSESSMENT
METHODOLOGY**

Polk County Flood Assessment Methodology

Significant Changes Since the 2006 Hazard Mitigation Plan

1. A G.I.S. parcel database linked to tax assessment data for the improvements was not available for the 2006 plan. Since then, significant progress has been made on the geographical information systems (G.I.S.) parcel database, though it is still incomplete as the map below shows. With some effort, WCWRPC (the planning consultant) was able to link tax assessment information to the available G.I.S. parcel data. The available data was integrated into the plan update.



2. The Flood Insurance Rate Maps (D-FIRM) for Polk County have been updated and are in digital format, thereby increasing accuracy and usability overall. As of May 2011, these D-FIRMs are being reviewed and adopted locally and are anticipated to be effective in Fall 2011.

Remaining Flood Assessment Data Challenges

1. G.I.S. data for individual structures is very limited in Polk County. Point data is available as part of the WDNR emergency mapping completed for the Intensive Fire Protection Area which encompasses all or parts of eight towns and the Village of Frederic. No geographic database exists which identifies the characteristics of individual improvements and structures (e.g., basements, number of stories, base flood elevation) in the county.

As a result, the flood assessment methodology uses a top-down, “birds-eye” perspective which doesn’t account for site-specific topographic variation. A structure might appear to be located within the 100-year floodplain on a map, but could it have been landscaped or otherwise elevated above the base flood elevation.

2. Assessed values for improvements and tax records are linked to the parcel database, but are not linked to the building point data. This allows us to see which buildings may potentially be located in a 100-year floodplain, but the use and value of each individual building are not available.
3. Tax assessment data for improvements is not available for all parcels. Tax data does not include a value of improvements for municipal buildings (e.g., town halls, fire stations), public infrastructure (e.g., wastewater treatment plants, water towers), and other non-taxable structures (e.g., churches, public housing, electric cooperatives, non-profits).
4. Polk County does not have county-wide LIDAR, so the accuracy of D-FIRMs is still questionable in some areas. However, it is important to keep in mind that a serious flood could exceed the estimated 100-year limits, as well as being impacted by other factors which may change over time, such as reduced flood storage or increased stormwater runoff.
5. Related to #4, most designated 100-year floodplain areas in Polk County fall within Zone A which have no base flood elevations (BFEs) established, making it much more difficult to determine the actual vulnerability to individual structures. BFEs were established for a large portion of St. Croix River from just north of St. Croix Falls to the south county line, though encroachment of development on these floodplains are limited by protective easements as a Scenic & Wild River and the steep adjacent slopes in many areas.

6. It is quite common for a single parcel to include multiple buildings, such as in the example below. And as the example shows, there are instances where not all of the buildings within a single parcel are within or intersect the 100-year floodplain.



Existing Conditions

Polk County has a large amount of river and lake shoreline and floodplain. Using available G.I.S. data, as of April 2011 there were 2,561 mapped parcels with assessed improvements which lie within or intersect the 100-year floodplain. However, based on the point data, there were only 570 principal structures (taxable and non-taxable) within the floodplain. Of these 570 structures, 143 structures were either tax exempt or were located on parcels which have not yet been mapped, so it was not possible to obtain an assessed value for their associated improvements.

Flood Assessment Methodology

It is cost prohibitive to perform the detailed survey work of structural characteristics and attaching tax assessment data to the individual structures (versus parcel) necessary to make definitive conclusions in many cases. And structural footprint data is not available at time. However, it is critical to remember that the purpose of this assessment is to identify potential flooding risks to structures during a 100-year flood event for general mitigation planning. The

assessment methodology used here is sufficient to identify those structures which may be most at risk of flood damage and those areas which may be a priority for flood mitigation activities.

For the assessment of riverine and lake flooding in Polk County the following methodology was used:

1. The D-FIRM G.I.S. shapefiles were used to identify the 100-year floodplain boundaries (shown as the green line on the previous map).
2. The G.I.S. parcel data provided by Polk County Land Information Department as of April 2011 was linked to the 2010 tax assessment data provided by Polk County Treasurer's Department, thus providing information on municipality, land use, and assessed values for those areas where parcel mapping was complete.
3. Those improved parcels which were within or intersected the 100-year were identified for guidance (shown as the purple line on the previous map).
4. Using the building point G.I.S. data provided by WDNR, those principal structures which were located within or intersected the 100-year floodplain were identified using G.I.S. technology. For all other areas of the county, the principal structures were identified by visual inspection of orthophotography overlaid with the 100-year floodplain; the improved parcels provided additional guidance. Accessory structures (e.g., garages, barns, boat houses) were excluded if they were not the principal structure on the parcel.

Together, these two data sources were used to create a G.I.S. data layer of all principal structures, taxable and exempt, which intersect or are contained within the 100-year floodplain (shown as the red dots on the previous map). As the previous maps demonstrate, it can be difficult to determine if a building intersects the floodplain or if a building is the principal structure. It was also difficult to estimate where parcel lines were likely located in a few of the more developed areas where parcel mapping has not yet been completed. WCWRPC staff used their best judgment and buildings were marked if in doubt.

5. By overlaying the parcel and building point G.I.S. data, an estimated value of improvements for buildings potentially in the floodplain was identified. However, situations with multiple structures on a single parcel can be a challenge as noted previously. In such cases, the assessed value of all improvements was used, rather than attempting to further assign values to individual structures. In many cases, those ancillary structures on a parcel which are likely outside the 100-year floodplain boundary are still close enough to the boundary to potentially be vulnerable to flooding should a large event occur. For non-taxable parcels, improvement estimates are not available, such as in the case of the Luck School.

For those municipalities where parcel mapping has not been completed, individual land uses were not identified and the assessed value of improvements is based on the municipality's 2010 average for assessed residential improvements.

Though it has its weaknesses, this approach provides a good picture of which principal structures may fall within the 100-year floodplain areas of Polk County. However, this should not be relied upon as an accurate indicator of flood depth or damages during flood events since elevation, flood depth, and assessed value for each individual structure is not currently valued. Many of the structures shown have no flood history and may not have a significant vulnerability to a flood event.

6. For comparison, the Polk County HAZUS Risk Assessment distributed by Wisconsin Emergency Management in February 2009 is summarized in the plan.
7. Utilizing key informant interviews, discussions with local officials, a survey to each Town Board, and available records (e.g., NFIP flood insurance claims), floodprone areas and hotspots were also identified where infrastructure or improvements may be vulnerable to riverine or lake flooding.

Taken together, this approach provides an understanding of the overall flooding risks and vulnerabilities in Polk County, while providing insight into the distribution of potentially vulnerable structures within the county and the location of past flooding events.

APPENDIX C.

STAKEHOLDER INTERVIEW LIST

Polk County Natural Hazards Mitigation Plan Key Stakeholder Interview List

The following constitute the key stakeholders who were interviewed and provided input during the development of the draft plan. Municipalities, the steering committee, and other stakeholders also provided additional input during the review of the draft plan strategies and plan adoption process.

Interviewee	Title/Notes	Date	Approx. Time
Village of Balsam Lake	2 village attendees	4/27/11	1 hour
Village of Centuria	3 village attendees	4/20/11	1 hour
Village of Clayton	3 village attendees	5/12/11	1 hour
Village of Clear Lake	3 village attendees	4/20/11	1 hour
Village of Dresser	3 village attendees	4/20/11	1 hour
Village of Frederic	6 village attendees	4/27/11	1.5 hours
Village of Luck	4 village attendees	4/19/11	1 hour
Village of Milltown	4 village attendees	4/27/11	1 hour
Village of Osceola	4 village attendees	4/27/11	1.5 hours
Village of Turtle Lake	3 village attendees	8/15/10	15 min
City of Amery	3 city attendees	5/3/11	1 hour
City of St. Croix Falls	2 city attendees	7/20/11	1 hour
Town's Association	presentation & seven returned surveys	4/28/10	7 surveys
Fire Department Survey	8 surveys received from Fire Chiefs	5/10-6/10	8 surveys
Kathy Poirier	Director, Polk Co. Emergency Management	8/9/10	3hr 15 min
Sara McCurdy	Director, Polk County Land Information	8/9/10	1hr 15 min
Gary Spanel	Zoning Administrator, Polk Co. Zoning	8/9/10	1hr 15 min
Tim Anderson	Planner, Polk County	8/9/10	1hr 15 min
Brad Runeberg	GIS Coordinator, Polk County Land Information	8/9/10	1hr 15 min
Jim Pankonien	Polk County Highways	8/9/10	1 hour
Tim Ritten	Director, Polk Co. Land & Water Resources	9/9/10	30 min
Debra Peterson	Director, Polk Co. Buildings, Solid Waste, & Parks	8/9/10	45 min
Jeremy Koslowski	Forest Administrator, Polk County	8/9/10	45 min
Kari Flom	Director, Polk Co. Aging Programs	8/9/10	30 min
Steve Moe	Polk Co. Sheriff's Department	8/9/10	1 hour
Adjacent County Emrgy Management Depts	all adjacent County Emergency Management Directors were contacted for input	fall 2010	varies
William Schmidt	Polk-Burnett Electric Cooperative + follow-up data from Steve Stroshane, Operations Manager	9/9/10 + Emails	30 min + data
Aaron Moore	USDA-Farm Services Agency	8/31/10	45 min
Frank Dallam	Water Reg. & Zoning Engineer, WisDNR (phone)	7/13/10	40 min
Steve Runstrom	WDNR – St. Croix Area Forestry Leader (phone)	10/13/10	30 min + email
Marty Kasinskis	WDNR – WUI Specialist, Gordon Station (phone)	10/13/10	30 min
Ross Larson	WDNR – Webster Office	10/15/10	15 min

Renee Paulson	WDNR – Webster Office	10/15/10	15 min
Kurt Dreger	Super., Interstate Park, WisDNR (phone)	8/30/10	15 min
Michael LaPointe	St. Croix Chippewa Tribe	9/9/10	30 min
Brian Admundson	Xcel Energy	9/1/10	15 min
Todd Krause	National Weather Service, Chanhassen MN	5/8/11	email
Terri Anderson	American Red Cross (phone)	3/4/11	15 min
Chris Keezer, Richard Radke	Polk County ARES/RACES	June/July 2011	email

Additional Documentation

The following additional documentation is attached for reference:

- sign-in sheets for meetings with the municipalities
- agendas and sign-in sheets for Plan Steering Committee meetings

Most of the above meetings were informal and did not include a quorum of elected officials. As such, official minutes were typically not maintained or later approved. This was also a cost-savings measure since keeping official notes or detailed minutes for every meeting is time consuming.

Instead, the planning consultant would write-in notes and needed corrections directly onto materials used during the meetings. This approach was very effective and efficient because this was a plan update. For instance, during the community meetings, key sections from the previous plan (i.e., list of strategies, current mitigation activities table, hazard risk table, meeting notes) were printed, along with a map of the community with key features shown. Then during the community meetings, the consultant and community discussed the community’s risks, activities, and strategies noted in the previous plan, then made corrections and additions directly to these documents.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Conferencia
 Date & Time: 9-10 AM 4/20/11

NAME	TITLE	*HRLY WAGE/SCALE RATE	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/SCALE RATE	TIME	TOTAL IN-KIND MATCH
Judith A. Jepsen	Clerk/Treasurer						
Anthony H. Weinzirl	Director of Works						
Bribery E. Weinzirl	Student						
Karen C. Edgerly	Deputy Clerk						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of (i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Clayton
 Date & Time: 9 AM - 10 AM

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Grant R Pickard	Police Chief						
SHELDON DONATH	Department of Public Works						
Frances Duncanson	Clerk-Treasurer						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of(i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Frederic
 Date & Time: 4/27/11 3 PM - 4 PM

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Chris Bartlett	Public works						
Mike baron	Public works						
Kenny Hackett	Public works						
Brian Daeffler	Fire Department						
Dave Wenger	Village Finance Admin						
RS Sereyve	Frederic Police						
Kristi Swanson	Clerk						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
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 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Village of Luck
 Date & Time: 3:00-4:10

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Kristina Hendt	Village Administrator						
Kristina Hanson	Clerk / Treasurer						
David Lass	Chief of Police						
Seth Petersen	Director						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of (i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Mill town

Date & Time: _____

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Mike Nutter	Lead man						
Joyce Steiner	Village Clerk						
Ludana White	Village Pres						
Chad Hansen	Crew member						

*Please enter wage/salary (Pay range for position if wage not available)

**Dollar amount or percentage for benefits paid

***Benefits consist of(i.e. health insurance, social security, retirement)

In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: Osceola - Village Hall
 Date & Time: 5/27/11 9:00 AM - 10AM

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Jim Schmidt	Public Works Director						
New Soars	Village Administrator						
Don Pedrys	Lt-Osceola P.D.						
TIM HARRISON	POLICE CHIEF						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of (i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Activity: St. Croix Falls
 Date & Time: 7/20 8:30-10:00 AM

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
<u>Bonita Beggitt</u>	<u>City Clerk</u>						
<u>Gail Brian</u>	<u>Treasurer</u>						
<u>Jack Rydeen</u>	<u>Chief of Police</u>						

*Please enter wage/salary (pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of (i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisory/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

POLK COUNTY TOWNS ASSOCIATION MEETING

APRIL 28, 2010 - 7:00 P.M.

POLK COUNTY JUSTICE CENTER

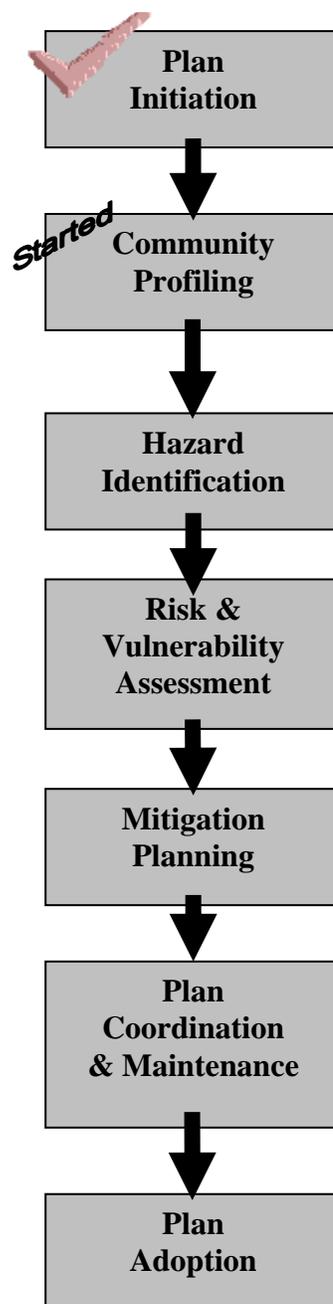
NAME	TOWNSHIP	ELECTED POSITION
Ed Bergmann	Clear Lake	Chairman
Larry Saindahl	Clear Lake	Supervisor
Bob Wright	Osceola	Supervisor
Dean Johnson	LUCK	Chair
WILLIAM F. JOHNSON	V. OF FREDERIC	POLK CO BOARD CHAIR
Steve Warndant	Polk County	Highway Commissioner
Herzkel Brown	Polk County	Supervisor Dist 5
Curtis Schmitt	LUCK	CONSTABLE
E R Lindholm	OSCEOLA	Supervisor
Ann Hraychuck	State Reg (Balsam Lk Twp)	Rep.
Don Mook	Starfield	Supervisor
Dan King	Laketown	Chairman
Dave Boulton	Black Brook	Side Ed

**Polk County
Natural Hazards Mitigation Plan Steering Committee**

**Meeting #1 – Plan Update
2:00 PM January 26, 2010
Polk County Justice Center Multi-Purpose Room**

AGENDA

- I. Call to Order**
- II. Roll Call/Introductions**
- III. Review Project Brochure**
 - a. What is a Hazard Mitigation Plan?
 - b. Why create and adopt a Hazard Mitigation Plan?
- V. Planning Process for Polk County**
 - a. the general planning process & Committee’s role
 - b. approval and adoption process (local, state, & federal)
 - c. discuss multi-jurisdictional involvement
 - d. discuss public involvement
- VI. Plan Scope**
- VII. Next Steps in the Process**
- VIII. Adjournment**



**POLK COUNTY
NATURAL HAZARDS MITIGATION PLAN STEERING COMMITTEE**

**TUESDAY, JANUARY 26, 2010
2:00 P.M.
POLK COUNTY JUSTICE CENTER
MULTI-PURPOSE ROOM**

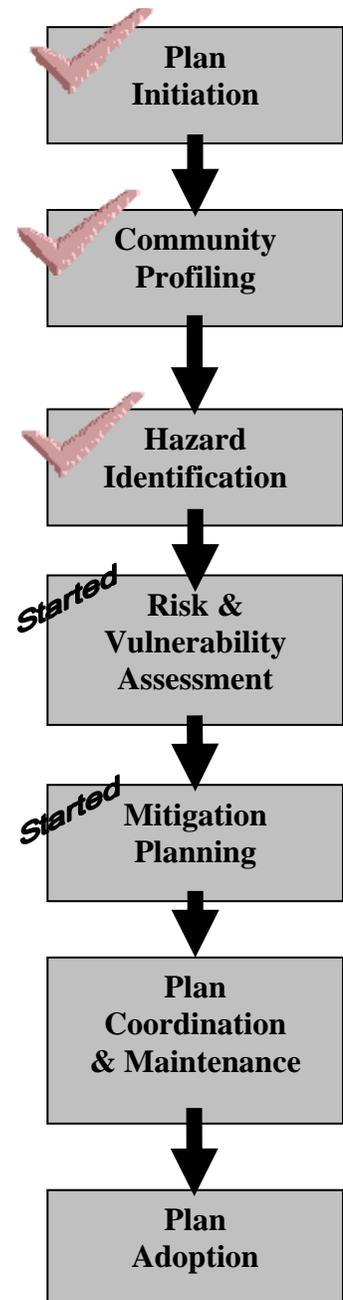
NAME	REPRESENTING
Kathy Lurier	Emerg. Mgmt.
✓ Neil Lohs	Univ. of Osceola
✓ Kristina Handt	village of Luck
✓ James H. Beistle	Polk County ^{Chairman} Board
✓ Jim Kitten	Polk Co LWRD
✓ Steve Warndahl	Polk Co Highway
Chris Straight	WCWRPC
Sara McCurdy	Polk Co LAND INFO
Meeting adjourned at 3:30	

**Polk County
Natural Hazards Mitigation Plan Steering Committee**

**Meeting #2 – Plan Update & Progress Since 2005 Plan
2:00 PM August 31, 2010
Polk County Justice Center Multi-Purpose Room**

AGENDA

- I. Call to Order**
- II. Roll Call/Introductions**
- III. Update on Planning Process for Polk County**
 - a. review scope per 1/27/10 meeting
 - b. general update
- IV. Stakeholder/Key Informant Interviews (to date)**
 - a. progress on recommendations from 2006 Plan
 - b. new issues & opportunities identified
- V. Next Steps in the Process**
 - a. continue interviews
 - b. D-FIRMs → City & Village meetings
 - c. obtaining Fire Department input
 - d. next Steering Committee meeting – Late 2010
(*issues & strategy prioritization homework*)
- VI. Adjournment**



Polk County Natural Hazards Mitigation Plan Steering Committee

Meeting #3 – Natural Hazards Trends & Issues
2:00 PM June 7, 2011
Polk County Justice Center Multi-Purpose Room

AGENDA

- I. Call to Order
- II. Roll Call/Introductions
- III. Update on Planning Process
- IV. Review & Discussion of Planning Trends & Issues
- V. Discussion on Strategy Alternatives Survey
- VI. Next Steps in the Process
 - a. return strategy surveys
 - b. draft plan to Steering Cmte by 7/1/11; also send draft issues/strategies to cities, villages, & towns
 - c. Final Committee meeting in July on draft plan
 - d. Public Informational Meeting in August
 - e. Draft plan to WEM for pre-review by 9/1/11
- VII. Adjournment



POLK COUNTY NATURAL HAZARDS MITIGATION PLAN UPDATE

Activity/Location: Steering Committee Meeting, Polk County Justice Center
 Date and Time: June 7, 2011 2:00 p.m.

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
Christina Hunt	Village Administrator						
Emil Norby	Technical Support Manager Hwy						
LARRY BEISTLE	TOWNS ASSEN REP.						
Deborah Stern	Polk County Park Bldg SW						
Nels, Scott	Village Administrator						
Kathy Linder	Polk County Emergency Mgmt.						

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of(i.e. health insurance, social security, retirement)

Polk County Natural Hazards Mitigation Plan Steering Committee

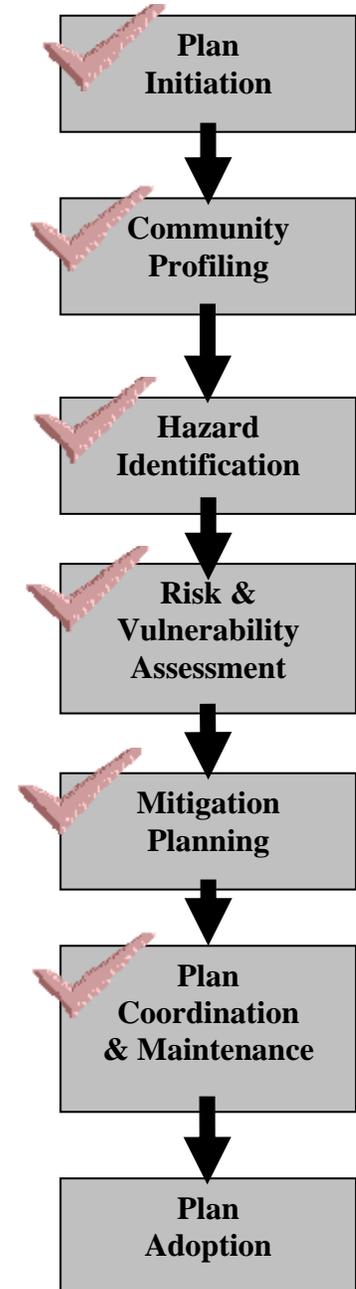
Meeting #4 – Natural Hazards Trends & Issues
2:00 PM July 19, 2011
Polk County Justice Center Multi-Purpose Room

AGENDA

- I. Call to Order
- II. Roll Call/Introductions
- III. Update on Planning Process
- IV. Review & Discussion of Initial Draft Plan
- V. Next Steps in the Process
 - a. C&V comments due 8/15/11
 - b. Public Informational Meeting – 8/29/11 @ 6:30 PM
 - c. Send notice to towns; draft plan on web?
 - d. Draft plan to WEM for pre-review by 9/1/11
- VI. Adjournment

Unless the input from the municipalities, public informational meeting, or WEM pre-review warrant otherwise, 7/19/11 is the final meeting of the Plan Steering Committee for this plan update.

THANK YOU!



Polk County Natural Hazards Mitigation Plan Update - Documentation of In-Kind Contribution

Review
Plan

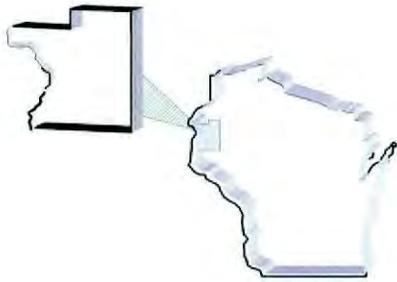
Activity: Steering Committee Meeting
 Date & Time: July 19, 2011 2:00pm-

NAME	TITLE	*HRLY WAGE/SALARY	**BENEFITS	***LIST ELIGIBLE BENEFITS	TOTAL WAGE/BENEFITS	TIME	TOTAL IN-KIND MATCH
James Buxton	Polk & Tammen rep					1 1/2	
Dustin Burton	Polk Co.					.5	
Kristina Handt	Village Administrator					1.5	
Steve Warndahl	Polk Co					1.5	
Kathy Forrier	Energ. Mgmt.					1.25	
Jim Ruffen	LWRD					1.5	

*Please enter wage/salary (Pay range for position if wage not available)
 **Dollar amount or percentage for benefits paid
 ***Benefits consist of (i.e. health insurance, social security, retirement)
 In lieu of specific wages or benefits, the following can be applied: \$10 for Clerks, \$12.50 for Supervisors/Trustees/Board, \$15 for Chairs/Presidents/Mayor, or a documented rate for similar work.

APPENDIX D.

PUBLIC INFORMATIONAL MEETING NOTICE



POLK COUNTY SHERIFF'S DEPARTMENT
EMERGENCY MANAGEMENT OFFICE
1005 W. MAIN ST. SUITE 900
BALSAM LAKE, WI 54810
TELEPHONE: 715-485-9280
FAX: 715-485-8315

August 4, 2011

PUBLIC NOTICE

PLEASE TAKE NOTICE that there will be a public informational meeting on Monday, August 29, 2011, at 6:30 P.M. in the Community Room, Polk County Justice Center, 1005 W. Main Street, Balsam Lake, Wisconsin, to discuss natural hazard mitigation efforts.

Polk County is in the process of updating the County's Natural Hazard Mitigation Plan which is a pre-requisite for certain FEMA grant funding. As part of the plan development process, the County is seeking input regarding the use of various activities to reduce or eliminate natural hazard risks to residents and property. A copy of the draft plan is available for review at the County Emergency Management Office at 1005 W. Main Street in Balsam Lake.

County residents are encouraged to attend. If you have any questions or need any additional information, please contact Kathy Poirier, Polk County Emergency Management Coordinator at 715-485-9280.

Notice is hereby given that members of the County Board may be present at the foregoing meeting to gather information about a subject over which they have decision-making responsibility. This may constitute a meeting of the County Board, pursuant to State ex rel. Badke v. Greendale Village Bd., 173 Wis.2d.553,494 N.W.2d408 (1993), and must be noticed as such, although these governmental bodies will not take any formal action at this meeting.

A handwritten signature in cursive script that reads "Kathy Poirier".

Kathy Poirier
Polk County Emergency Management Coordinator

cc: News Media
Public Bulletin Board/County Clerk's Office

APPENDIX E.

INVENTORY OF CRITICAL FACILITIES

Facility Name	Address	Community
Government Buildings		
Alden Town Hall	183 155th St	Star Prairie
Apple River Town Hall	792 Mains Crossing Ave	Amery
Black Brook Town Hall	99 75th St	Clear Lake
Clam Falls Town Hall	3174 80th St	Frederic
Clayton Town Hall	462 105th Ave County Rd D	Amery
Georgetown Town Hall	1847 100th St County Rd H	Balsam Lake
Laketown Town Hall	2153 270th Ave	Cushing
McKinley Town Hall	2527 15th St	Cumberland
Polk County Government Center	100 Polk County Plaza	Balsam Lake
Saint Croix Falls Town Hall	1303 200th St	St Croix Falls
Sterling Town Hall	2663 Evergreen Ave	St Croix Falls
Clear Lake Town Hall	375 46th St	Clear Lake
Polk County Justice Center	1005 W Main	Balsam Lake
Polk County Adult Development		
Polk County Highway Department	518 Main	Balsam Lake
Federal Building		
Beaver Town Hall	1541 10th St County Rd T	Turtle Lake
Eureka Town Hall	2111 State Hwy 87	St Croix Falls
Farmington Town Hall	2647 30th Ave	Osceola
Garfield Town Hall	690 Minneapolis St	Amery
Lincoln Town Hall	661 85th St	Amery
Lorain Town Hall	252 345th Ave County Rd E	Frederic
Osceola Town Hall	516 East Ave N	Dresser
Luck Town Hall	135 W 1st Ave	Luck
West Sweden Town Hall	3147 3rd Ave N	Frederic
Balsam Lake Municipal Building	404 Main	Balsam Lake
Clear Lake Municipal Building	350 4th Ave	Clear Lake
Clayton Municipal Building	133 Clayton Ave E	Clayton
Clayton Village Hall		
Frederic Village Hall	107 Hope Rd W	Frederic
Luck Village Hall	401 S Main St	Luck
Centuria Village Hall	305 Wisconsin Ave	Centuria
Amery City Hall		
Milltown Village Hall		
Osceola Village Hall		
Dresser Village Hall	102 E Main st	Dresser
Balsam Lake Town Hall	1494 150th Ave	Balsam Lake
Bone Lake Town Hall	954 280th Ave	Frederic
Johnstown Town Hall	2181 20th St County Rd G	Comstock
Milltown Town Hall		
Polk County Information Center	710 State Hwy 35	St Croix Falls
Saint Croix Falls City Hall	710 State Hwy 35	St Croix Falls
Polk County Recycling Center	1302 208th St	St Croix Falls
Amery Police Department	675 Hariman Ave S	Amery

Facility Name	Address	Community	
Nursing Homes			Beds
Frederic Nursing & Rehabilitation Community	205 United Way	Frederic	50
Golden Age Manor	220 Scholl Ct	Amery	114
Willow Ridge Healthcare	400 Deronda St	Amery	83
United Pioneer Home	210 Park Ave	Luck	65
Good Samaritan Society - St Croix Valley	750 E Louisiana St	St Croix Falls	85
Other Long-Term Care (not mapped)		Facility Type	Beds
Riverbend	CBRF	Amery	11
Amery Assisted Living-Riverbend	Resid. Care Apt. Complex	Amery	26
Evergreen Village	Resid. Care Apt. Complex	Amery	8
Aurora Residential Alternatives Inc (Bals Lake)	CBRF	Balsam Lake	4
Aurora Residential Alternatives Inc (Centuria)	Adult Family Home	Centuria	4
Sophies Manor Assisted Living II Inc	CBRF	Centuria	20
Rosewood Adult Family Home	Adult Family Home	Clear Lake	4
Clear Lake Manor	CBRF	Clear Lake	8
Vaughan/Sorensen Adult Family Home	Adult Family Home	Frederic	4
Comforts of Home-Frederic	CBRF	Frederic	20
Patricia's	Adult Family Home	Luck	6
Angels in Waiting	Adult Family Home	Milltown	4
Our Sweet Home	Adult Family Home	Milltown	4
Seventh Child Adult Family & Respite	Adult Family Home	Milltown	4
Morning Glory-Community Homestead	Adult Family Home	Osceola	4
Pine View LLC	Adult Family Home	Osceola	3
Royal Oaks Inc.	Resid. Care Apt. Complex	Osceola	10
Comforts of Home-St. Croix Falls I	CBRF	St Croix Falls	15
Comforts of Home-St. Croix Falls II	CBRF	St Croix Falls	16
St. Croix Valley Good Sam. Apt. Complex	Resid. Care Apt. Complex	St Croix Falls	8
Hospitals			Beds
Amery Regional Medical Center	265 Griffin St East	Amery	25
ARMC Behavioral Health Center	230 Deronda St	Amery	10
Osceola Medical Center	2600 65th Ave	Osceola	23
St Croix Regional Medical Center	204 S Adams St	St Croix Falls	25
Clinics (not mapped)			
Big Round Lake Clinic (St. Croix Chippewa Nation)		Big Round Lake	
Clear Lake Clinic		Clear Lake	
Frederic Regional Medical Clinic		Frederic	
Luck Medical Clinic		Luck	
Unity Clinic		Balsam Lake	

Facility Name	Address	Community
Schools		District
St Croix Falls High School	740 Maple Dr	5019
St Croix Falls Elementary School	631 Louisiana St	5019
Unity Elementary School	1908 State Hwy 46	0238
Osceola Middle School	1029 Oak Ridge Dr	4165
Osceola High School	1111 Oak Ridge Dr	4165
Osceola Intermediate School	949 Education Ave	4165
Mustard Seed Faith Academy	647 113th St	private
Clear Lake High School	1101 3rd St SW	1127
Clear Lake Elementary	135 8th Ave	1127
Frederic High School	1437 Clam Falls Dr	1939
Frederic Elementary	305 Birch St E	1939
Luck Elementary School	810 7th St S	3213
Luck High School	810 7th St S	3213
St Croix Falls Middle School	740 Maple Dr	5019
Unity Middle School	1908 State Hwy 46	0238
Unity High School	1908 State Hwy 46	0238
Valley Christian School	1263 State Hwy 35	private
Osceola Elementary School	250 10th Ave	4165
SDA School	176 10th St	private
Lien Elementary School	543 Minneapolis Ave	0119
Amery Middle School	501 Minneapolis Ave	0119
Amery High School	555 Minneapolis Ave	0119
Amery Intermediate School	501 Minneapolis Ave	0119
Clayton High School	221 Prentice St S	1120
Clayton Elementary School	221 Prentice St S	1120
Clayton Middle School	221 Prentice St S	1120
Dresser Elementary School	131 2nd Ave W	5019
Seventh-Day Adventists School	2955 140th St	private

Licensed Child Care Facilities (as of July 2008, not mapped)

City	Day Care Name	Capacity
AMERY	COZY CARE DAY CARE	8
	GROWING YEARS	8
	MARIANN'S LITTLE LAMBS	8
	SHERRY'S DAY CARE	8
	TENDER TIMES CHILD CARE	8
BALSAM LAKE	BALSAM LAKE CESA #11 HEAD START	34
	KIDS QUEST	8
	STACY'S LICENSED DAY CARE	8
CENTURIA	CUDDLE BUGS CHILD CARE	8
	LIGHTHOUSE FAMILY CHILD CARE	8
	SANDY'S FAMILY DAY CARE	8
CLEAR LAKE	LITTLE LAMBS CHRISTIAN DC CTR LLC	30
CUSHING	BECKY'S HOUSE FAMILY DAY CARE	8
	GENE'S JUMPSTART PROGRAM	8
	KID'S CORNER CHILDCARE	8
DRESSER	COUNTRY CARE	8
	QUALLE BEAR DAYCARE	42
FREDERIC	CHRISTY JENSEN'S DAYCARE	8
	COUNTRY WONDERLAND FAMILY DAY CARE	8
	LINDAS FAM CHILD CARE	8
LUCK	ABC EXPRESS PRESCHOOL	24
	BRENDA'S KIDDIE KARE	8
	TAMMY'S FAMILY DAY CARE	8
MILLTOWN	LIL' RASCALS PLAYHOUSE	8
OSCEOLA	ABOVE ALL BEGINNINGS CHILD CARE INC	91
	BUSY BEE'S CHILD CARE CTR	29
	CORINNE'S DAY CARE	8
	GRACE FOR KIDS	8
	HILLTOP DAY CARE	8
ST CROIX FALLS	BETHIE'S BUSY BEES	8
	BIG HUGS CHILD CARE CENTER	32
	KIDS VIEW DAY CARE	44
	THE LITTLE SCHOOL	8
TURTLE LAKE	DAR'S BUSY BODIES DAY CARE	8
	ROCHELLE'S LITTLE TYKES DAYCARE	8

APPENDIX F.

VULNERABILITY ASSESSMENT
FOR
CRITICAL FACILITIES

Polk County Natural Hazards Vulnerability Assessment for Critical Facilities

SCORE: 1 = Low, 2 = Medium, 3 = High

Critical Facility Type	Quantity (if avail)	Riverine/Lake Flooding			Stormwater Flooding			Tornadoes			Thunderstorms/ High Winds			Winter Storms and Extreme Cold			Drought			Wildfire			Total Score
		score	impacts/ potential vulnerabilities		score	impacts/ potential vulnerabilities		score	impacts/ potential vulnerabilities		score	impacts/ potential vulnerabilities		score	impacts/ potential vulnerabilities		score	impacts/ potential vulnerabilities					
Government Buildings (includes emergency response)	6 county + 11 city/village halls + 24 town halls + misc. other	1	No history of overbank flooding problems at any government building, except for some parks. No critical governmental buildings were identified as potentially being located w/in 100-year floodplain.		1.5	No government buildings were identified as experiencing significant damage from stormwater flooding, though this is a higher risk than overbank flooding. The Milltown Village Hall may be the most at-risk due to past flooding on Main Street.		2	All vulnerable to varying degrees depending on construction type. Performs important emergency response and recovery roles, many buildings are EOCs and some function as storm shelters.		1	Some vulnerability to pole buildings. Many of these facilities do not have storm shelters or emergency power generation.		1.5	A number of key municipal buildings lack emergency power generators or electrical hook-ups.		1	None Known. Good water quantity reported by all communities.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified. A few municipal buildings are located in or adjacent to forested areas (e.g., Bone Lake Town Hall).		9
Utilities & Infrastructure (sewer, water, transportation, electric, telephone, etc.)	linear & site-specific	2	Overall, the overbank flooding vulnerability to utilities and infrastructure is low. Some roadways may occasionally be flooded and some bridges fall within the shadows of dams or immediately adjacent to dams.		3	During heavy rains, some communities have problems with stormwater entering the wastewater system through manholes, liftstations, or basements. Roads, culverts, bridge abutments, etc., have also washed out and roads closed.		2	Above ground utilities are all potentially vulnerable, but typically not widespread or long-term.		2	Loss of power due to high winds toppling trees is the greatest risk frequently mentioned during the planning effort. Lightning strikes and related power surges also pose threats to utilities, liftstations, communications equipment, and airport runway lights.		3	Above ground infrastructure is very vulnerable. Ice and heavy snow can topple trees and take down power lines. Ice and snow can result in accidents and restrict travel. Ice/snow on USH 8 in St. Croix Falls is of particular concern.		1	Current vulnerability is low. Water quality and quantity can be impacted during prolonged droughts. Communities currently have adequate supply to meet demand.		1.5	Utilities, such as above ground transmission lines, may run through areas particularly at-risk of wildfire. A number of electric substations are also located in forested areas. Travel can also be impacted and access is an issue in some forested areas.		14.5
Schools, Head Starts, and Day Cares	28 schools + 35 Day Cares	1	None problems reported. Of the principal structures associated with a school, Head Start, or day care it is believed that only a portion of Luck School is located in a 100-year floodplain.		1	No stormwater flooding problems at schools, head starts, or day cares noted. Past problems near Dresser School have been addressed and, hopefully, remedied.		3	Vulnerable, especially those buildings with large spans. Contains a large concentration of vulnerable population during school hours. Schools are also sometimes used as storm shelters.		1	Large span structures may be vulnerable to high winds.		1	Potential vulnerable population to extreme cold.		1	None Known.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified.		9
Hospitals & Clinics	4 Hospitals & 5 Clinics	1	None Known.		1	None Known.		3	Vulnerable. Often high value facilities in terms of monetary value and importance to the community. Important to disaster response efforts. Hospitals contain a large concentration of a potentially vulnerable population.		1	Vulnerability to potential loss of power mitigated through the availability of on-site generators.		1	Potential vulnerable population to extreme cold.		1	None Known.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified.		9
Long-Term Care Facilities (CBRFs, assisted living, nursing care)	58 facilities	1	None Known.		1	Limited. Stormwater from County Fairgrounds flows towards nursing home in St. Croix Falls which has caused some issues.		2	Vulnerable. Performs an important community function. Like hospitals, such facilities contain potentially vulnerable populations, some with limited mobility.		1	Some facilities may be vulnerable to power loss should the event occur during periods of cold or heat.		2.5	Potential vulnerable population. Uncertain if all facilities has emergency power generation and emergency fuel supply agreements if long-term outage.		1	None Known.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified.		9.5
Historic Buildings	12 historic properties & 1 historic district	1	None Known.		1	None Known.		2	Vulnerable. Important social value to the community.		1	High winds and heavy rains may cause damage to older structures.		1	None Known.		1	None Known.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified.		8
Hazardous Chemical Use & Storage Facilities	50 Tier 2 & 10 EHS facilities	1	No EHS planning facility was identified as being located in the 100-year floodplain. In fact, for those areas with parcel mapping completed, no manufacturing uses were identified as being within the floodplain.		1	None Known.		2	Vulnerable. A tornado event could potentially result in a release.		1	None Known.		1	None Known.		1	None Known.		1	All structures are potentially vulnerable to wildfire, though no unique or critical wildfire risks involving these facilities were identified.		8
Total Scores by Hazard		8			9.5			16			8			11			7			7.5			

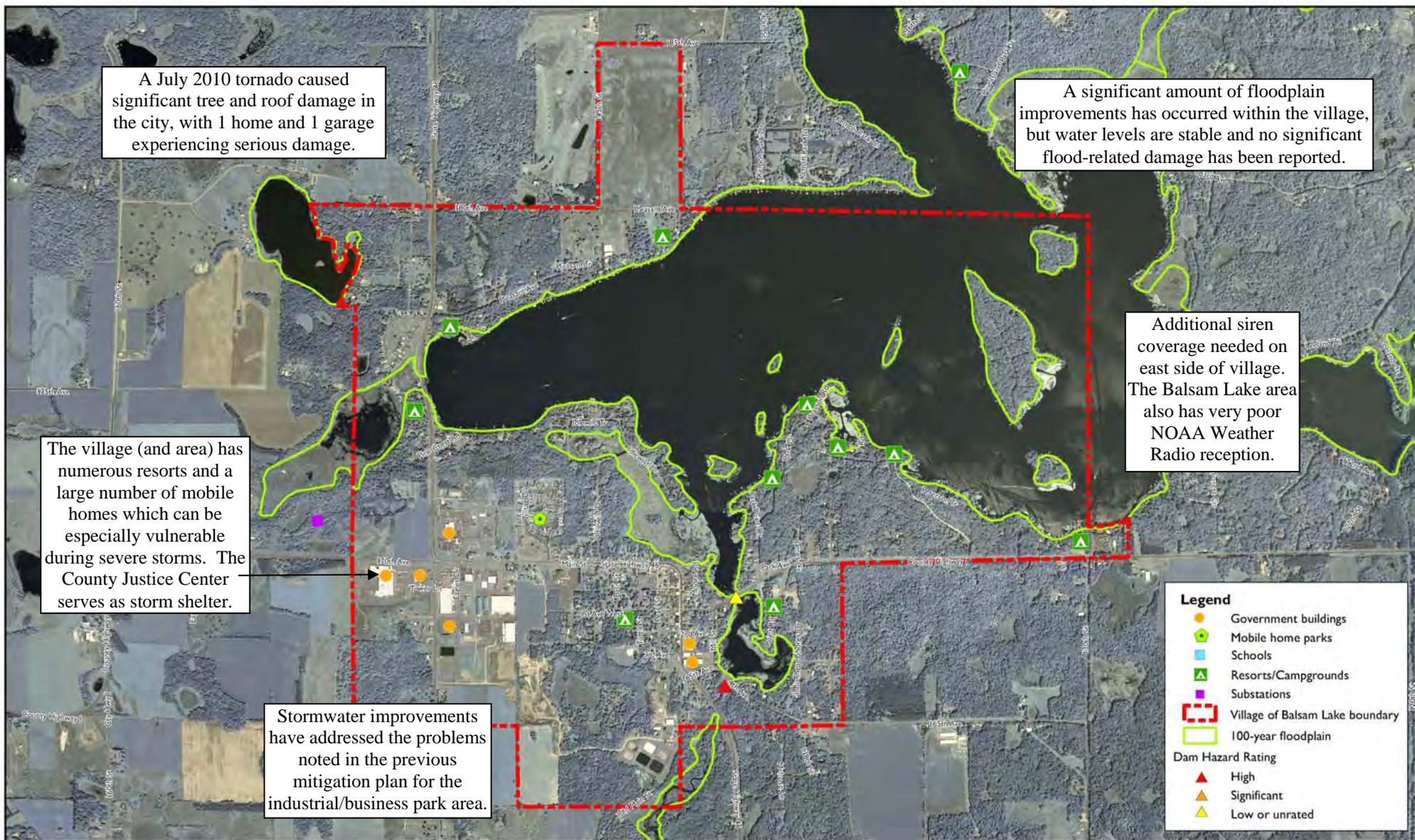
Scoring Factors
Historic Impacts: Has facilities of this classification within Polk County been impacted by this hazard type in the past?
Unique Vulnerabilities: Does a facility of this classification have unique vulnerabilities or risks associated with it in respect to the hazard type?
Relative Value: Relative to other facilities in the community, what is the value of a facility of this type?
Disruption of Critical Services: If a facility of this type was disabled due to a hazard, what would be the relative level of disruption to services most needed for disaster response and recovery?

APPENDIX G.

UNIQUE RISKS AND VULNERABILITIES BY INCORPORATED COMMUNITY

Municipality	2010 Population	Tornadoes	est. # mobile homes	Thunderstorms and High Winds	Winter Storms and Extreme Cold	Riverine or Lake Flooding	Stormwater or Flash Flooding	Drought or Wildfire	Other Notes
Village of Balsam Lake	1,009	July 27, 2010 tornado downed trees and caused roof damage. 1 house & 1 garage w/ significant damage. \$12,000 clean-up.	100	Tree damage from high straight-line winds. Have had property damage from baseball-sized hail.	None noted.	Minimal fluctuation of river and lake levels; no issues. Dams in good repair. Lower Dam down-rated to "SIGNIFICANT"	No significant issues identified. System design and improvements completed in business/industrial park area and for Park Point Drive area.	None noted.	Lack of NOAA weather radio coverage. May need additional storm shelter in future. Additional generator also would be convenient in case of extended power loss.
Village of Centuria	948	No recent event history. No public storm shelter. 24-unit subsidized housing complex.	72	Nothing uncommon; tree damage from high winds.	No hotspots. Occasional power line breaks due to heavy snow on trees and water main breaks 3-4x per year.	No floodplains; well drained.	No significant issues. Past problems areas largely addressed.	None noted.	Long cul-de-sac length for one development. May need a new siren on south side if significant development occur in that direction.
Village of Clayton	571	No recent event history.	29	Tree damage worst along Clayton St. East, but no power lines impacted. May 2011 lightning strike to well.	None noted.	No floodplains.	Stormwater into sewer system on north side, but much improved. Ditch on private land east of 10th St needs clearing, but flood damage limited to adjacent farm fields to date.	None noted.	Foremost Farms has substantial amounts of anhydrous ammonia, which is a special concern due to high groundwater table in area.
Village of Clear Lake	1,070	Recent touchdown on far south side of village with limited damage. Has public storm shelter.	55	Nothing unique noted. Periodic lightning strikes at wwtp or liftstations.	None noted.	Very minimal floodplain which is in conservancy.	Past stormwater infiltration thru basements being addressed through maintenance and inspections.	None noted. Additional water storage capacity may be needed in future, if significant new development.	
Village of Dresser	895	No recent event history. Trollhaugen is a significant risk during large events; village uncertain of their plans.	24	Nothing unique noted.	None noted. No longer have to "drip" to keep water lines from freezing.	No floodplains. Stormwater a concern due to hill to north and east.	Significant improvements completed near school, but not 100% certain if area fully addressed. Stormwater improvements needed in Peterson Dr neighborhood.	None noted.	Stormwater flows from NE to SW thru the community; some significant improvements made, but additional study on west side or around pond may be needed in future.
Village of Frederic	1,137	No recent event history. 3 retirement homes + 2 m.h. parks. "Handshake" agreement on shelter; new site needed?	58	Nothing unique noted; some straight-line winds. #4 well has been hit by lightning.	Nothing unique. Occasional waterline freeze-ups. Need generator for sewer plant.	No significant lake or overbank flooding concerns noted by Village. Electric company is in a low area, but no recent history at the site.	Stormwater flooding concerns in industrial park. 3-4x in 2010 and up to 12" deep on Industrial Way. Second area of concern downtown behind library.	None noted; good water quantity	Need formal agreement for shelter use or explore construction of new shelter(s).
Village of Luck	1,119	No recent event history. School used as storm shelter, but no formal agreement. Voice-Activated Radios are aging; newer radios needed, perhaps NOAA radios.	40	High straight-line winds resulting in tree and roof damage. Lightning strikes at water tower & wwtp (2). Summer 2010 bad.	Using rip-rap along lakeshore to help control erosion from wind and ice. Some ongoing lakeshore erosion concern along west shore.	No significant lake flooding, though some structures in 100-yr floodplain. LOMAs have removed some structures from official maps. Some resident concern that outlet from lake is not of sufficient size.	Run-off problems on north side may have been exacerbated by re-designed STH 48 and new curb & gutter; no outlet to lake causing in some basement flooding. Silt build-up and beaver dams some concern elsewhere.	Good water quantity. Forest areas on east ends of lake could be of concern given long, dead end roads for access.	Stormwater is a more significant concern than overbank flooding per local officials. Related damage to date have not been great, but a remedy is needed, especially for the north side of the lake. Currently, no large-scale stormwater management studies or plans exist.
Village of Milltown	917	No recent event history w/in village, but has been tornadoes in area. Church is storm shelter, but alternative needed.	80	High straight-line winds cause tree damage and heavy rains get into basements of older homes.	Occasional water pipe freezing for trailer homes. Electric hook-up and/or generator needed for community center.	No floodplains.	Past stormwater problems between Main St and Bank St may have been addressed, but Main St floods 1-2x per decade with 6"-8" of water and has caused damage.	Elderly can be vulnerable to heat	Stormwater issues top the list of past problems. Remedies have been made and issued being monitored. No overall stormwater mgmt planning to accommodate new growth.
Village of Osceola	2,568	No recent event history w/in village, but has been tornadoes in area. Old Medical Center used as shelter, but no agreement.	103	Damage in past mostly limited to tree damage and minor roof damage.	Some water line freezing every winter, mostly under trailer homes.	Minimal floodplain development and no riverine flooding impacts from the 2002 historic flood.	Stormwater is primary issue and a complete system study/plan is needed.	None noted.	Bank stabilization (washouts) along St. Croix River, especially near 2nd Ave. Also along Ridge Road. Water comes out of hills then comes out of rock along banks.
City of Amery	2,902	Last occurred about 1953, resulting in 1 death and building damage. Golden Age Manor is public shelter; no formal agreement.	200	Nothing unique noted. Downburst in 2005 on south side damaged hangars, feed mill, 1 home.	Nothing unique. Some waterline freeze-ups handled by residents dripping water in prone areas.	No history of riverine flooding; stays within banks. Amery Dam managed for flood control.	Only significant concern is creek through middle of city. Culvert under highway constricts flow, but no structural damage reported to date.	None noted. New well & tower since 2003 added to fire protection.	Four senior housing complexes and three low-income complexes owned by Housing Authority, plus Catholic Charities structure (6-8 units). 5-story structure could be difficult to evacuate if elevator not available.
City of St. Croix Falls	2,133	No recent event history. No public storm shelter. School used as shelter for fairgrounds.	35	Have had to evacuate fairgrounds on occasion due to severe weather. Structures atop of the hill more vulnerable to high winds.	East-bound traffic on USH 8 during slippery conditions cannot ascend hill resulting in accidents and back-ups. Also steep on Louisiana and Kentucky Streets.	No impacts from the 2002 historical flood. Periodic ice damming, but no significant structural damage. Dam is well maintained with very active monitoring.	Steep topography causes stormwater concerns. North side of community of most significant concern at this time. Fairgrounds/nursing home area addressed in 2007.	None noted.	River flooding has been primarily limited to park areas. Dam break would take out USH 8 bridge. Good communication w/ Interstate Park and Taylor Falls. Some neighborhoods more prone to water problems in winter.
St. Croix Band of Lake Superior Chippewa	abt. 250 (scattered locations)	No history. Most homes have crawlspaces.	0	Frequently occurs; high winds can cause debris, but no unique impacts.	None noted.	No issues; elevations of structures at Round Lake community prevents flood damage.	None noted.	Good well capacity; concern for Elders during extreme heat.	

The Village of Turtle Lake is addressed as part of the Barron County Natural Hazards Mitigation Plan. The above text incorporates comments received during interviews with each community in 2003 and 2011.



A July 2010 tornado caused significant tree and roof damage in the city, with 1 home and 1 garage experiencing serious damage.

A significant amount of floodplain improvements has occurred within the village, but water levels are stable and no significant flood-related damage has been reported.

Additional siren coverage needed on east side of village. The Balsam Lake area also has very poor NOAA Weather Radio reception.

The village (and area) has numerous resorts and a large number of mobile homes which can be especially vulnerable during severe storms. The County Justice Center serves as storm shelter.

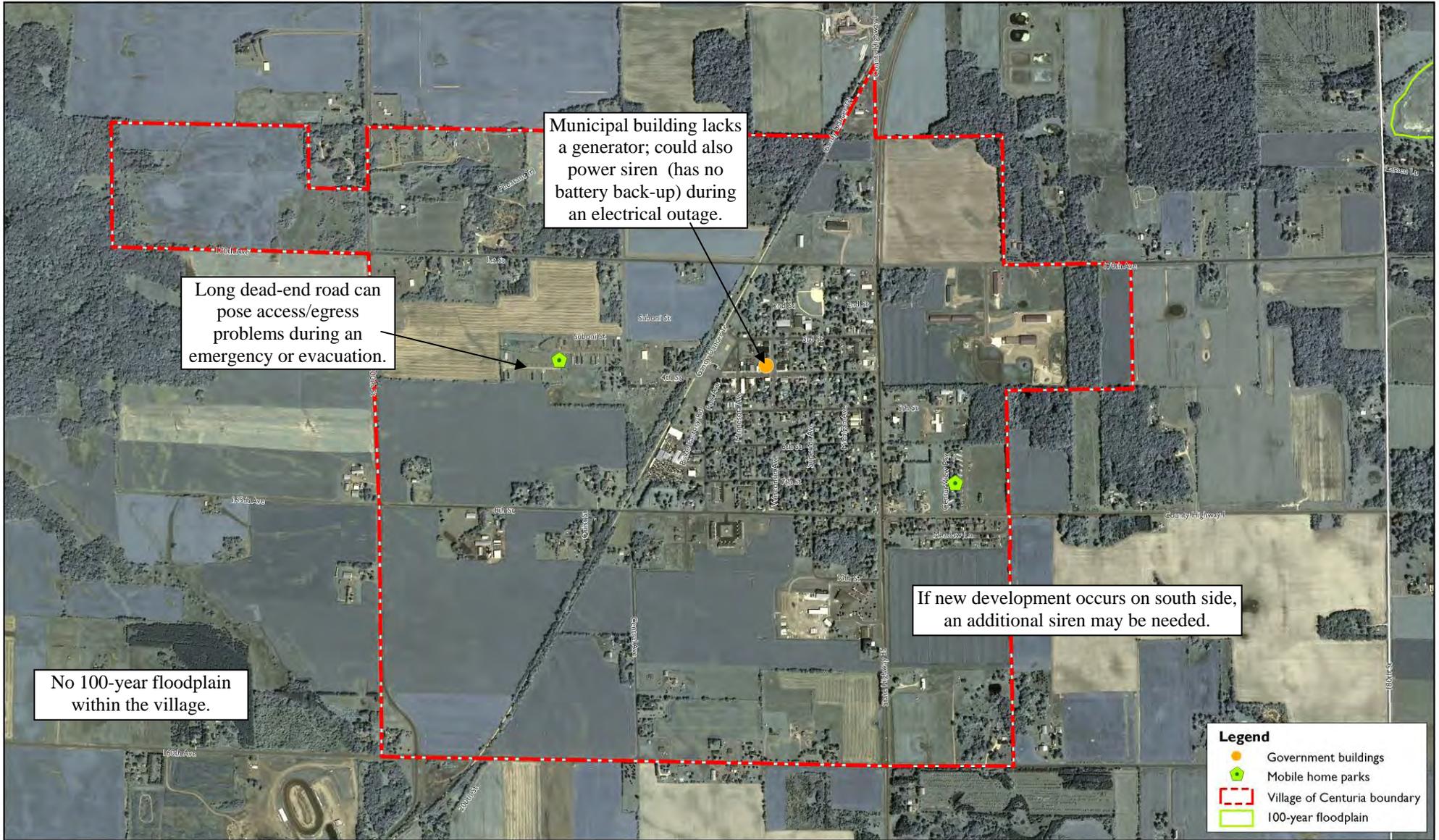
Stormwater improvements have addressed the problems noted in the previous mitigation plan for the industrial/business park area.

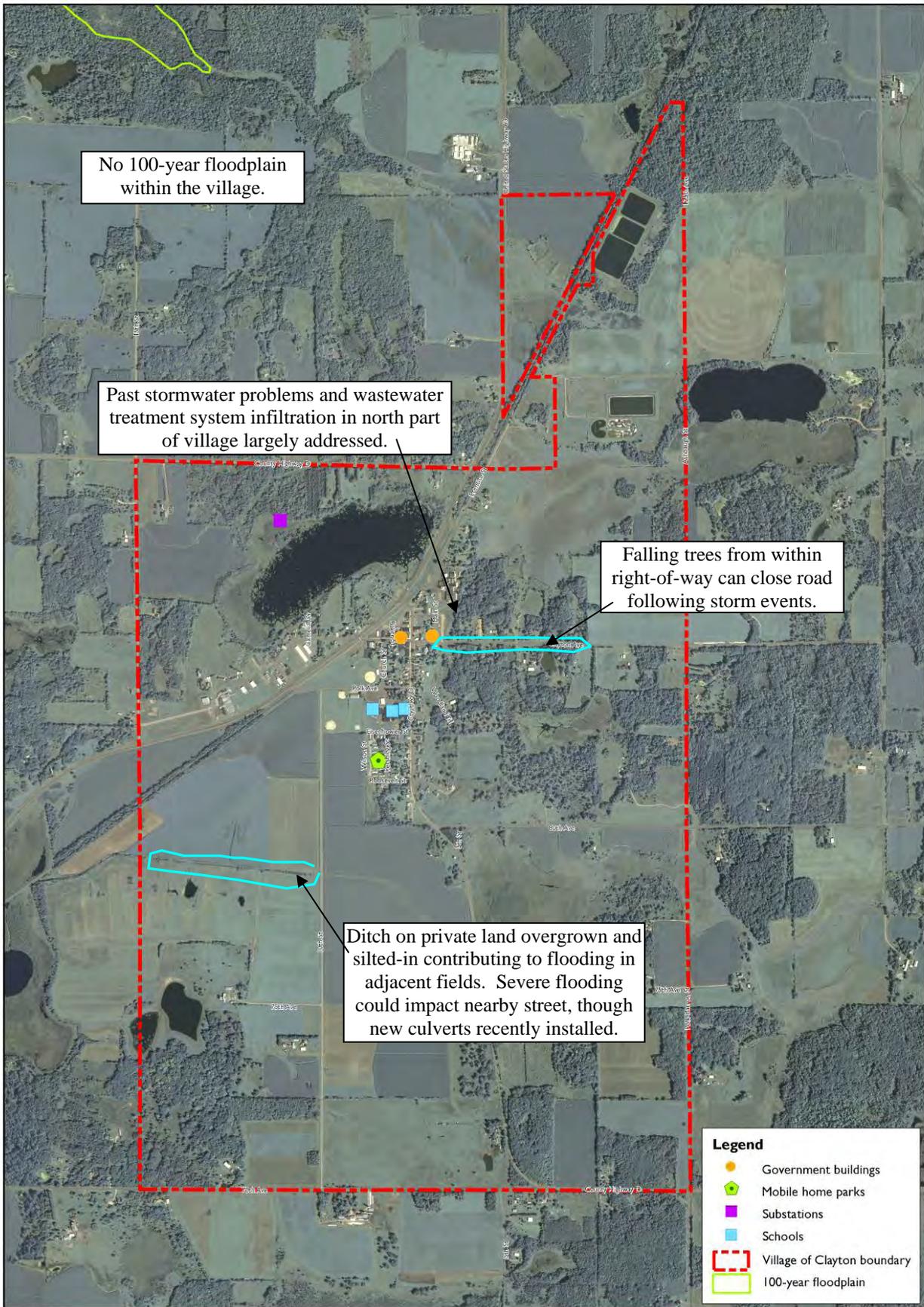
Legend

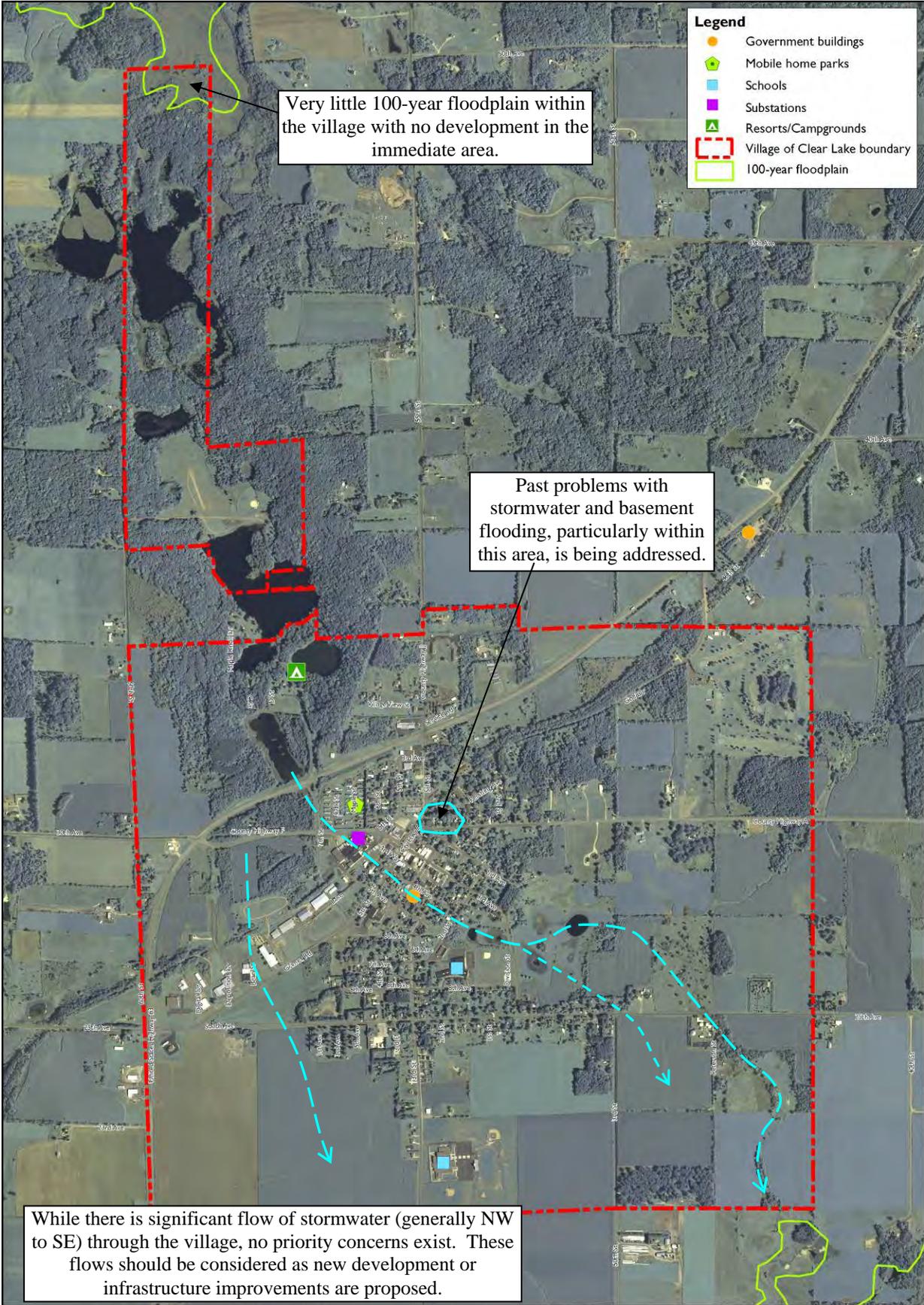
- Government buildings
- Mobile home parks
- Schools
- ▲ Resorts/Campgrounds
- Substations
- Village of Balsam Lake boundary
- 100-year floodplain

Dam Hazard Rating

- ▲ High
- ▲ Significant
- ▲ Low or unrated







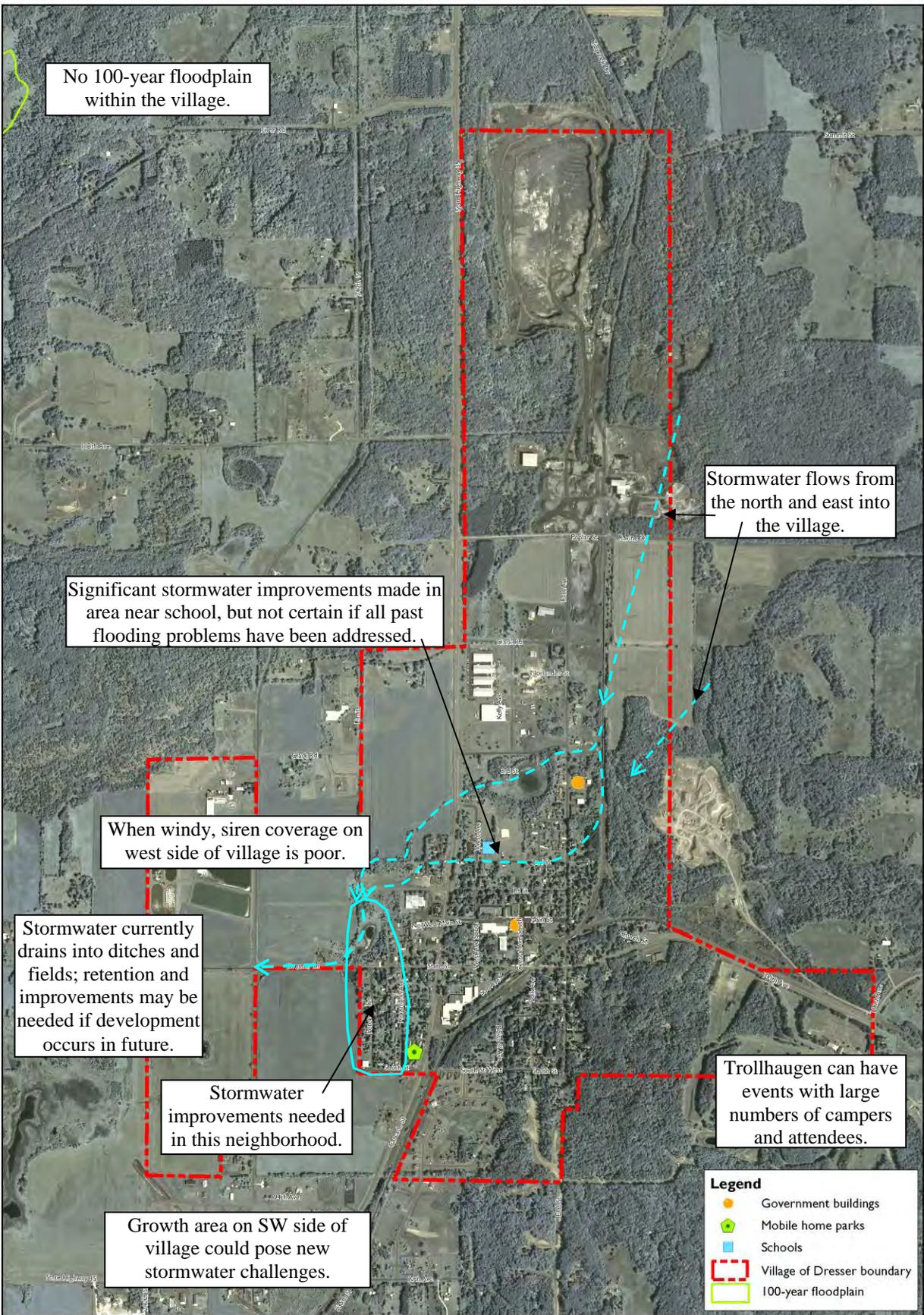
West Central Wisconsin Regional Planning Commission

Village of Clear Lake
Polk County, WI

Note: This Map should be used for general mitigation planning purposes only. Floodplain boundaries may not have been adopted; this map does not constitute a legal survey and should not be used for flood determinations.

Data Sources:
Polk County Land Information Department
<http://www.co.polk.wi.us/landinfo/index.asp>
Wisconsin Department of Natural Resources
<http://dnr.wisconsin.gov/maps/gis/geolibrary.html>
FEMA Map Service Center
<http://www.msc.fema.gov>
USDA Farm Service Agency
<http://www.fsa.usda.gov>





West Central Wisconsin
Regional Planning Commission

Village of Dresser Polk County, WI

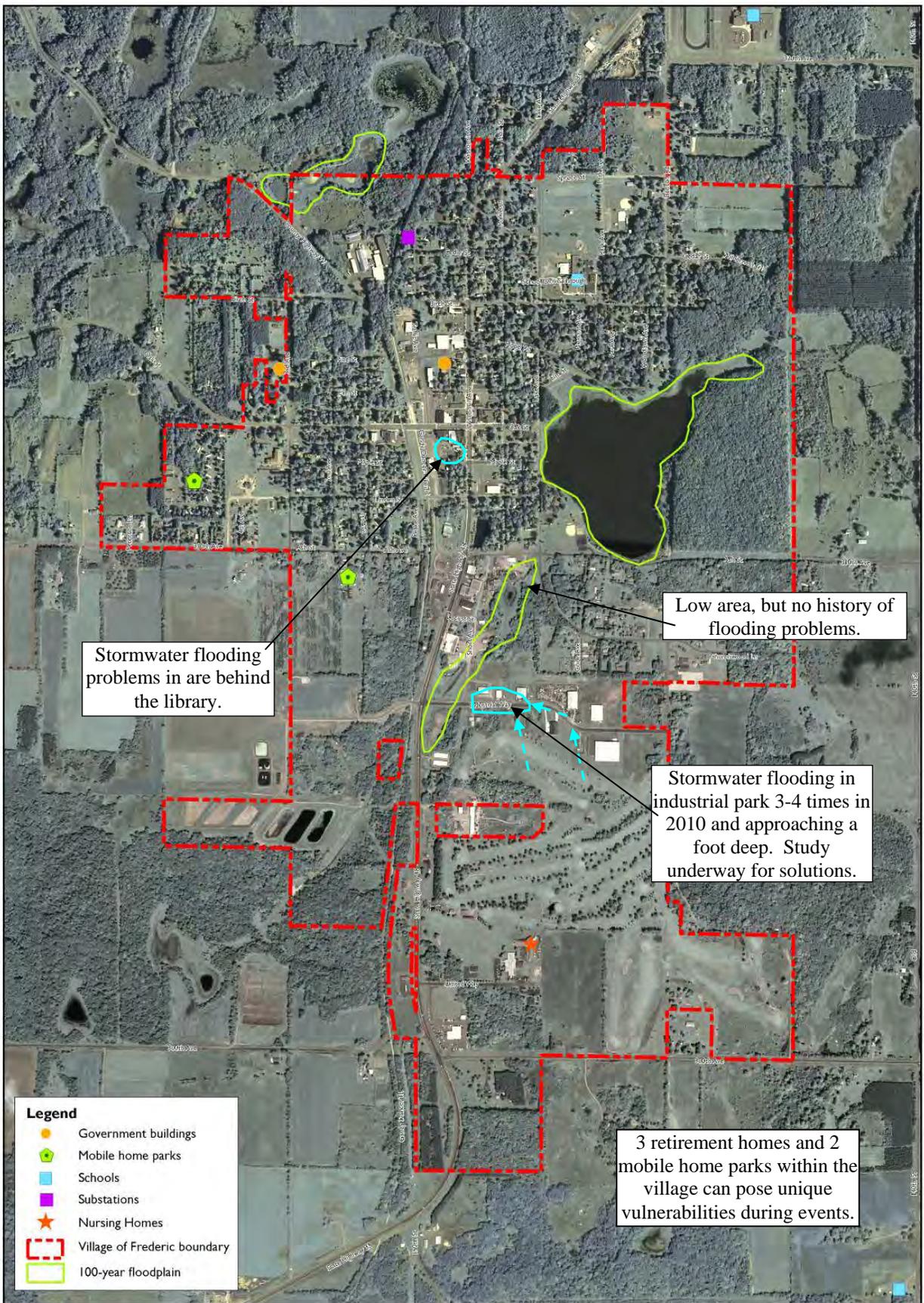
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Data Sources:
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Wisconsin Department of Natural Resources
<http://dnr.wi.gov/maps/gis/geolibary.html>
FEMA Map Service Center
<http://www.msc.fema.gov>
USDA Farm Service Agency
<http://www.fsa.usda.gov>

April 18, 2011





- Legend**
- Government buildings
 - Mobile home parks
 - Schools
 - Substations
 - ★ Nursing Homes
 - Village of Frederic boundary
 - 100-year floodplain

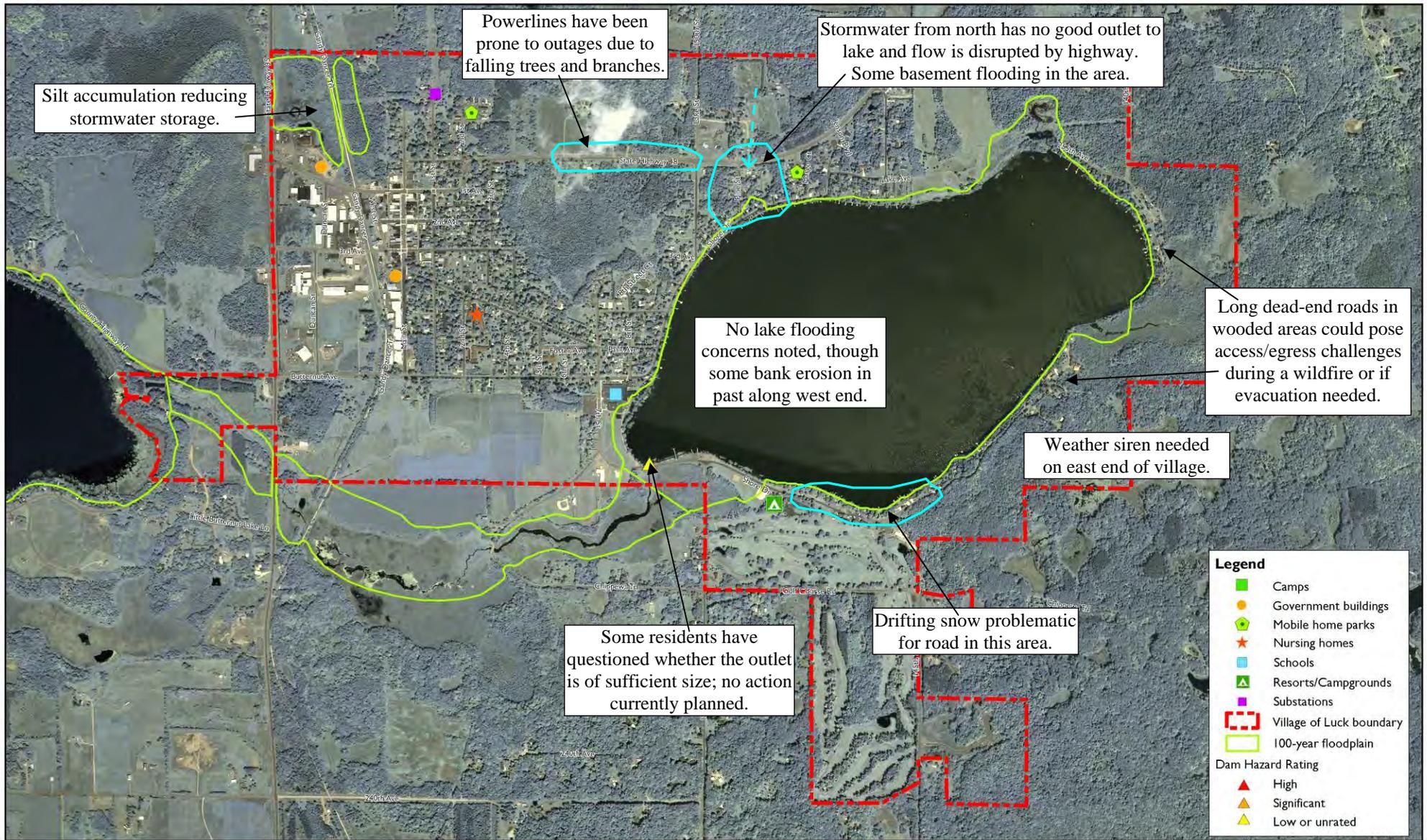
WCVRPC
 An innovative leader in responsible planning and development for over 45 years
 coordinate, partner, advocate, serve.
**West Central Wisconsin
 Regional Planning Commission**

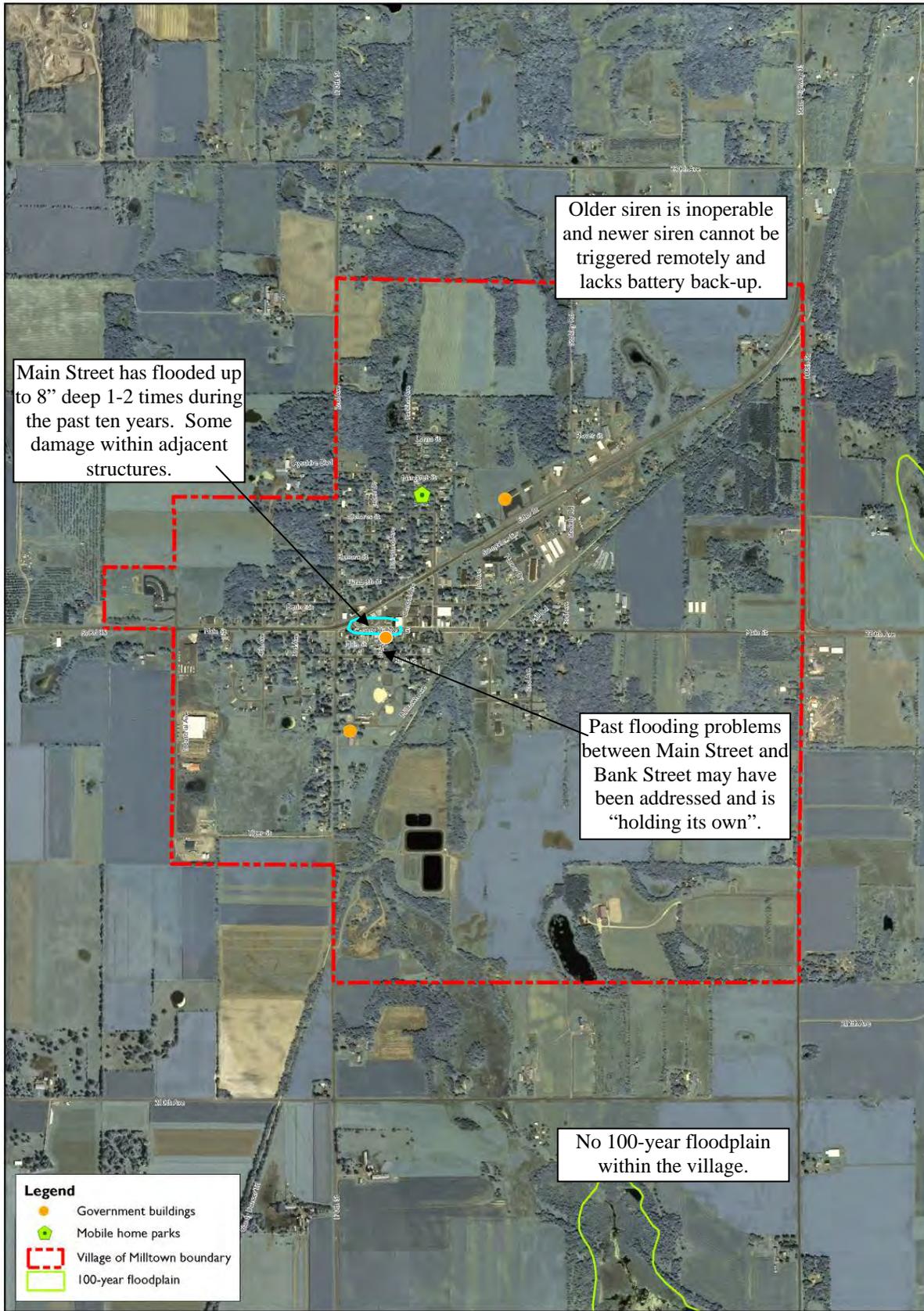
Village of Frederic
 Polk County, WI

Note: This Map should be used for general mitigation planning purposes only. Roadplain boundaries may not have been adopted; this map does not constitute a legal survey and should not be used for flood determinations.

Data Sources:
 Polk County Land Information Department: <http://www.co.polk.wi.us/landinfo/index.asp>
 Wisconsin Department of Natural Resources: <http://dnr.wisconsin.gov/maps/gis/geolibrary.html>
 FEMA Map Service Center: <http://www.msc.fema.gov/>
 USDA Farm Service Agency: <http://www.fsa.usda.gov>

0 400 800 1,600 Feet
 April 18, 2011

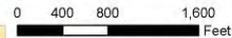




West Central Wisconsin
Regional Planning Commission

Village of Milltown
Polk County, WI

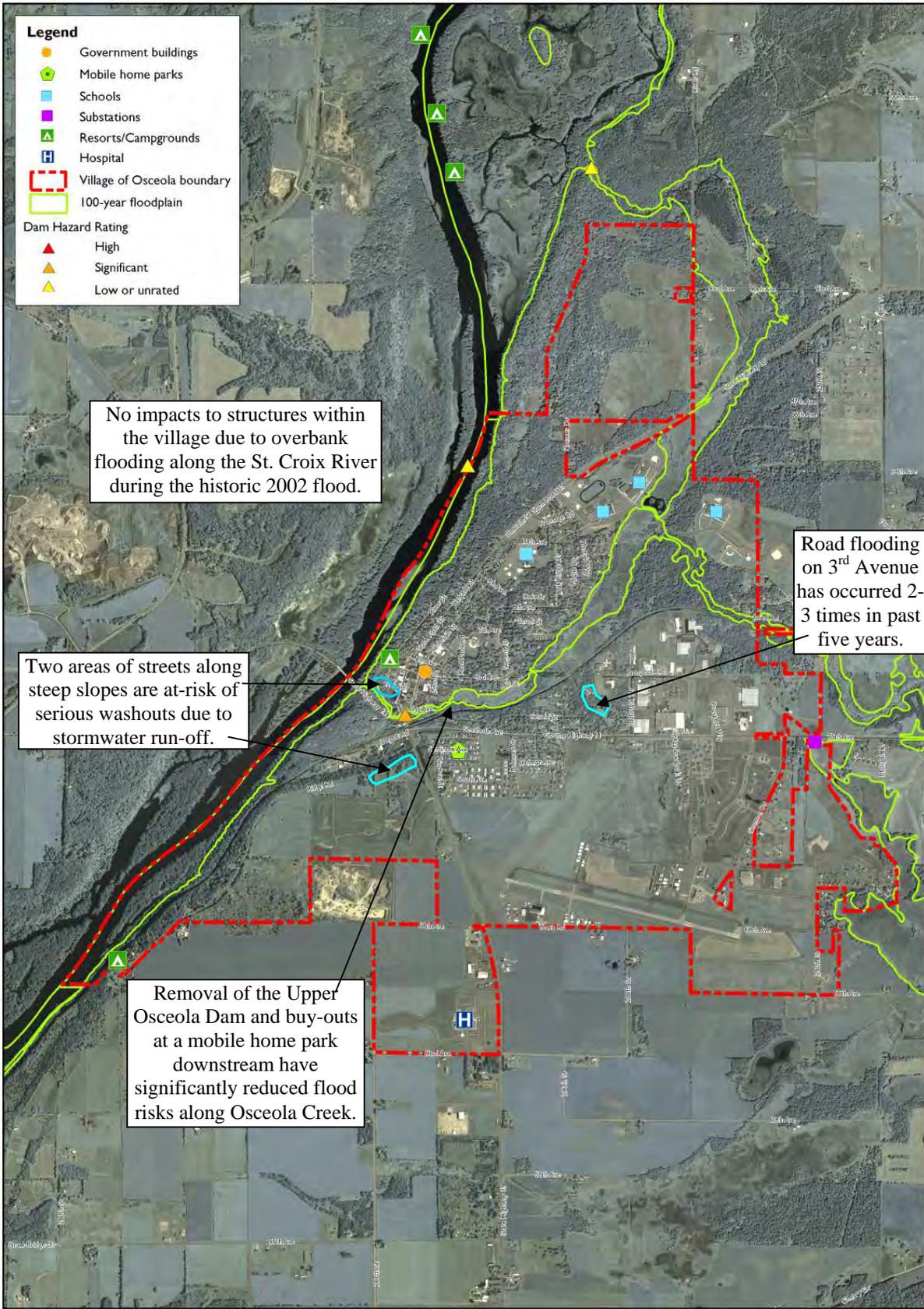
Note: This map should be used for general mitigation planning purposes only. Floodplain boundaries may not have been adopted; this map does not constitute a legal survey and should not be used for flood determinations.



April 18, 2011



Data Sources:
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<http://dnr.wis.gov/maps/gis/galibrary.html>
FEMA Map Service Center
<http://www.msc.fema.gov>
USDA Farm Service Agency
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West Central Wisconsin Regional Planning Commission

Village of Osceola

Polk County, WI

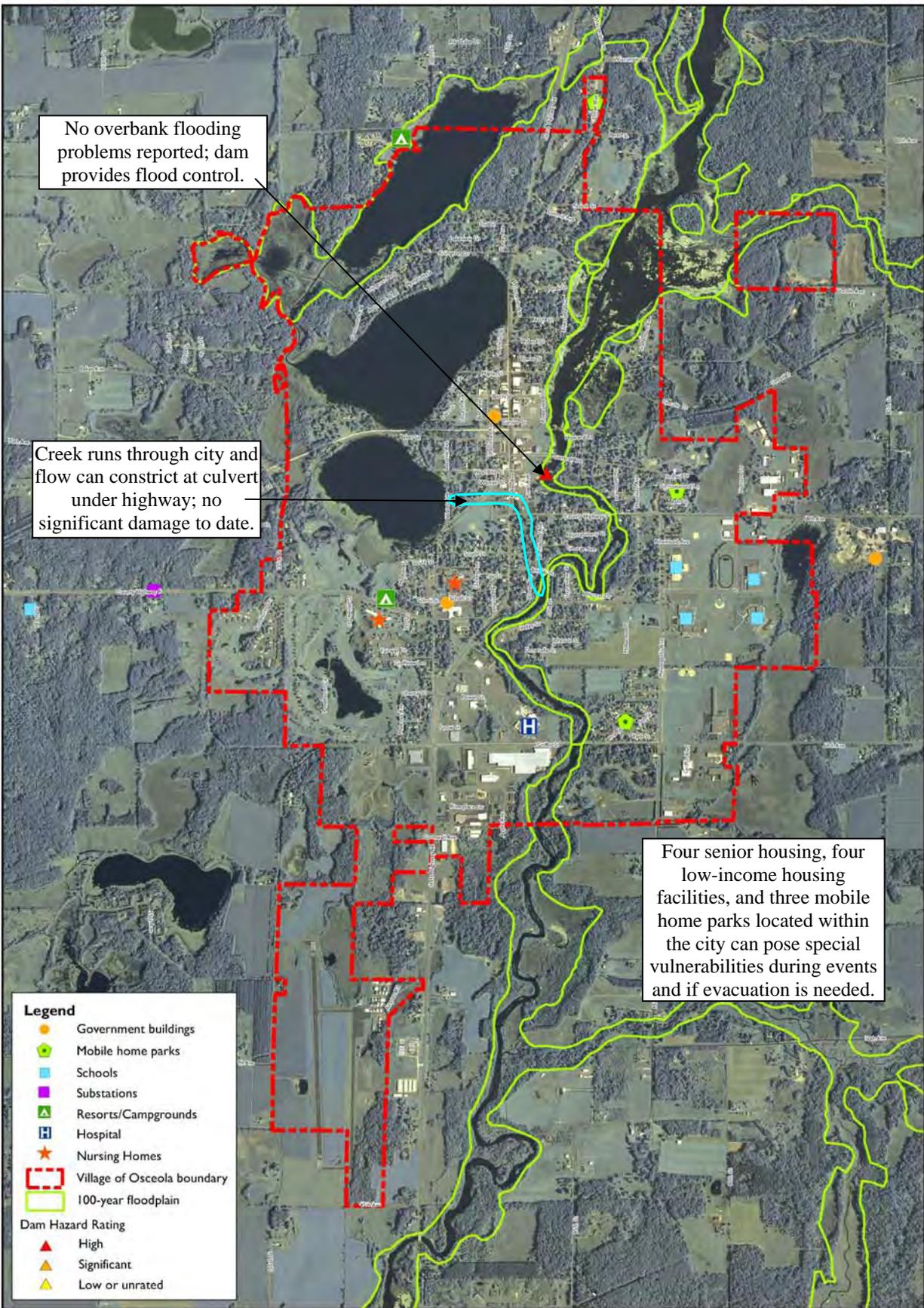
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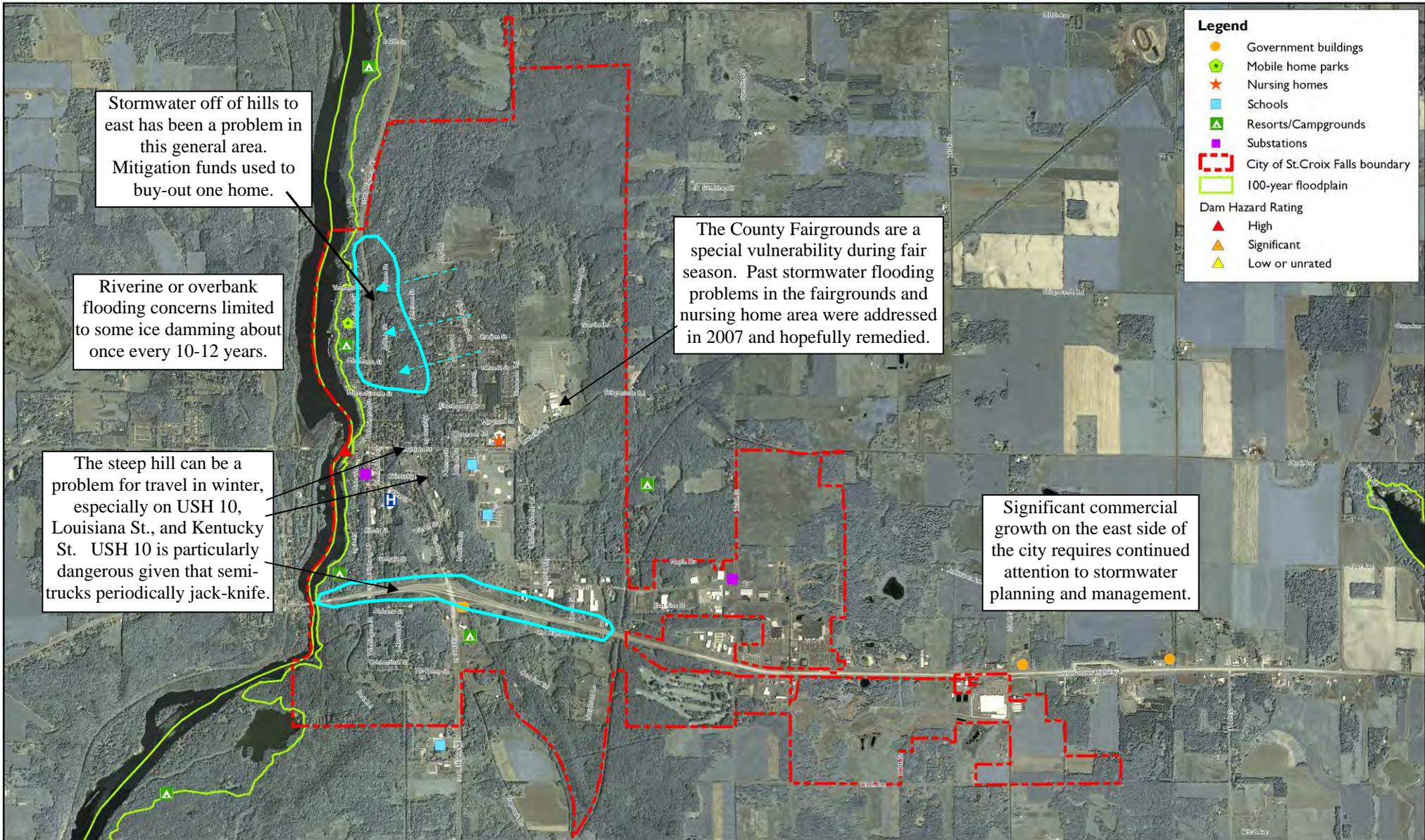
April 18, 2011



Note: This Map should be used for general mitigation planning purposes only. Floodplain boundaries may not have been adopted; this map does not constitute a legal survey and should not be used for flood determinations.

Data Sources:
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 USDA Farm Service Agency
<http://www.fsa.usda.gov>





Stormwater off of hills to east has been a problem in this general area. Mitigation funds used to buy-out one home.

Riverine or overbank flooding concerns limited to some ice damming about once every 10-12 years.

The steep hill can be a problem for travel in winter, especially on USH 10, Louisiana St., and Kentucky St. USH 10 is particularly dangerous given that semi-trucks periodically jack-knife.

The County Fairgrounds are a special vulnerability during fair season. Past stormwater flooding problems in the fairgrounds and nursing home area were addressed in 2007 and hopefully remedied.

Significant commercial growth on the east side of the city requires continued attention to stormwater planning and management.

Legend

- Government buildings
- ⬠ Mobile home parks
- ★ Nursing homes
- Schools
- ▲ Resorts/Campgrounds
- Substations
- ⋯ City of St. Croix Falls boundary
- ▭ 100-year floodplain

Dam Hazard Rating

- ▲ High
- ▲ Significant
- ▲ Low or unrated

APPENDIX H.

**HAZARD MITIGATION
ACTIVITIES BY INCORPORATED
JURISDICTION**

Municipality	Land-Use Controls (zoning, subdiv.)	Floodplain	Flood Mitigation Activities	Stormwater Management Activities	Emergency Response Plans	Communication & Notification Systems/Sirens	Incident Response Exercises	Strategic Partnerships and Mutual Aid	Other Activities or Notes
Village of Balsam Lake	Yes; including site plan review.	yes	agreement w/ Cnty to use 2nd dam for control if needed	Ongoing improvements with street repairs or new development.	Emergency Operations Plan plus dam response	Siren + police/fire P.A.	no specific needs identified	Emgy Op Plan w/ Milltown. Public Works with Dresser & SCF.	Polk Co Justice Center as storm shelter.
Village of Centuria	yes; somewhat formal site plan review process	n.a.	No floodplain.	Significant improvements have addressed the most significant concerns	Emergency Operations Plan being updated.	Siren	w/ Polk-Burnett Elect Coop	"handshake" working well; public works w/ Milltown	tree-trimming by municipal utility
Village of Clayton	Yes; including site plan review. Recent updates.	n.a.	No floodplain.	Significant improvement since last plan, plus additional review as part of village permitting.	Emergency Operations Plan needs updating.	Pretty new siren, police/fire P.A., and weather spotters	In good shape and most ICS/NIMS covered.	School as shelter, but no written policy. No written agreements for fire or public works.	Most power lines buried. Driveway ordinance to ensure emergency vehicle access for new drives.
Village of Clear Lake	Yes; including site plan review.	Very minimal floodplain	floodplain is in a conservancy area	Maintenance & inspection of system	EOP recently updated	Siren, police/fire P.A., and cable TV cut in.	Good overall. Need multi-juris TTX w/ mutual aid channels.	Good. Rural Water mutual aid agreement.	New siren w/ battery back-up and remote "trigger" needed. Village hall is storm shelter.
Village of Dresser	Yes	n.a.	No floodplain.	Substantial work completed near school which remedied some of the major concerns in that area	Emergency Operations Plan needs updating.	No formal siren policy.		Shared fire services; public works with Osceola	Tree-trimming as part of Tree City USA. Special emergency plans for specific events.
Village of Frederic	Yes; updating including mobile home ordinance	yes		Regular system maintenance	Emergency Operations Plan needs updating.	siren; VAR police/fire P.A. in mobile home park	Regular exercises.	Written fire assoc. mutual aid. Rural Water Agreement w/ Luck	Generator for water and electric, but generator needed for wwtp.
Village of Luck	Yes; including some site plan review.	yes	No significant overbank flooding, so no actions taken. Some LOMAs.	Some curb & gutter, plus retention areas and ditching. Considered during site plan review.	EOP updated abt 2 years ago; being reviewed.	2 sirens; 1 with battery back-up. Lack coverage on east side of lake (NE & SE)	No specific needs identified	Good, including a mutual aid for public works	Excel good on tree-trimming. Need formal agreement with school for use as shelter. Emgy mobile communications can be disrupted when indoors.
Village of Milltown	Yes; including site plan review.	n.a.	n.a.	Balltraps and stormwater improvements remedied some of past problems.	Emergency Operations Plan needs updating.	2 sirens; older is currently inoperable. No battery-backup.	Additional ICS or NIMS needed for some officials.	Emgy Op Plan w/ Balsam Lake. Rural Water public works agreement w/ Luck.	Remote/radio control for siren needed.; cannot hear siren in some areas if wind blowing hard.
Village of Osceola	Yes; including site plan review.	yes	thru zoning + 19 manuf homes removed via buyout	Efforts made to address stormwater/bank erosion concerns, esp. along 2nd Ave.	Emergency Operations Plan needs updating.	Siren can be activated from vehicle. Need 2nd?	Additional ICS/NIMS training recommended	In good shape. Rural Water public works agreement in place.	2006 plan strategies regarding airplane tie-downs, new fire hall, and lower dam improvements completed.
City of Amery	Yes; including site plan review.	yes	dam managed for flood control; well maintained w/ emergency plan	Significant improvements made since previous plan. 2009 stormwater ordinance.	Emergency Operations Plan needs updating.	3 sirens; cable TV cut-in for announcements + P.A. system	Good. Most have ICS 300.	Good. "Handshake" mutual aid for public works w/ New Rich'd.	No trash burning. Downtown siren inoperable/unreliable, but good coverage. Per City Housing Authority, city and responders have "been fantastic".
City of St. Croix Falls	Yes; including site plan review.	yes; development not allowed in floodplain	Through zoning and public parkland.	Significant improvements made since previous plan. Also buy-out of floodprone structure.	Emergency Operations Plan needs updating.	3 sirens; Police drive thru m.h. park	Various.	Coordinates with county, hospital, Taylor Falls, Interstate Park. No issues noted.	School used as shelter for fairgrounds.

The Village of Turtle Lake is covered and discussed as part of the Barron County Natural Hazards Mitigation Plan. The above text incorporates comments received during interviews with each community in 2003 and 2011.

APPENDIX I.

**2000-2002
FEMA PROJECT
APPLICATIONS
FOR POLK COUNTY**

2000-2002 FEMA Project Applications for Polk County

Location (not applicant)	Year	Disaster #	Scope of Work	Funding Request
T. of Alden	2002	1432	culvert replacement	\$49,922.62
	2002	1432	road repair/recovery	\$12,629.62
	2002	1432	road repair/recovery	\$17,436.47
	2002	1432	shoulder repair	\$6,402.43
C. of Amery	2001	1369	debris removal	\$8,267.19
T. of Apple River	2002	1432	shoulder repair	\$2,886.35
	2001	1369	debris removal	\$258,969.00
	2001	1369	road and culvert repair	\$24,445.00
V. of Balsam Lake	2001	1369	debris removal	\$37,138.32
	2001	1369	park repairs/replacement	\$4,955.00
T. of Beaver	2001	1369	road and culvert repair	\$11,292.00
	2001	1369	debris removal	\$125,226.00
T. of Black Brook	2002	1432	ditch repair	\$3,644.00
	2002	1432	shoulder repair	\$5,837.00
	2001	1369	road and shoulder repair	\$2,849.35
	2001	1369	debris removal	\$1,662.20
T. of Bone Lake	2000	1332	road and culvert repair	\$3,693.00
V. of Centuria	2001	1369	park repairs	\$3,583.67
	2001	1369	debris removal	\$14,789.88
	2001	1369	electrical line repair	\$7,005.21
T. of Clam Falls	2001	1369	road, shoulder, & culvert repair	\$62,319.02
	2000	1332	road repair & clearing	\$130,023.00
T. of Clayton	2002	1432	road/shoulder work	\$2,886.50
	2002	1432	road/shoulder work	\$3,246.00
	2002	1432	road/shoulder work	\$3,126.00
	2002	1432	road/shoulder work	\$3,286.20
	2001	1369	debris removal	\$1,500.00
	2001	1369	road and culvert repair	\$9,230.00
V. of Dresser	2002	1432	emergency measures	\$3,240.30
	2002	1432	pumping water from intersection	\$1,526.36
	2002	1432	repair nature jogging trail	\$2,017.80
	2002	1432	volunteer labor (pumping)	\$335.04
T. of Eureka	2001	1369	debris removal	\$2,091.10
T. of Farmington	2002	1432	road repair	\$4,702.07
T. of Garfield	2001	1369	Kennedy Dam work & repair	\$583,808.84
T. of Georgetown	2002	1432	shoulder repair	\$5,096.00
T. of Johnstown	2001	1369	road, signage, & culvert repair	\$9,869.57
	2000	1332	road repair & tree cutting	\$4,972.00
T. of Lorain	2001	1369	road and culvert repair	\$8,655.00
	2000	1332	road repair	\$241,525.00
	2000	1332	debris removal	\$1,509.00
	2000	1332	emergency measures	\$1,013.00

Location (not applicant)	Year	Disaster #	Scope of Work	Funding Request
T. of Lincoln	2002	1432	shoulder repair	\$12,516.33
	2001	1369	road, shoulder, & ditch repair	\$1,370.47
	2001	1369	debris removal	\$6,149.80
T. of Luck	2001	1369	road, shoulder, & culvert repair	\$21,721.59
T. of McKinley	2001	1369	road, shoulder, & culvert repair	\$41,519.57
	2001	1369	debris removal	\$3,114.24
	2001	1369	spillway repair	\$1,070.18
	2000	1332	road and culvert repair	\$76,563.00
	2000	1332	debris removal	\$1,287.00
T. of Osceola	2002	1432	road & shoulder repair	\$3,989.23
	2002	1432	culvert replacement	\$1,170.80
	2002	1432	shoulder repair	\$1,957.65
	2002	1432	shoulder repair	\$10,374.69
V. of Osceola	2002	1432	replace stairs & embankment	\$37,258.00
	2002	1432	bank erosion	\$13,254.00
	2002	1432	debris removal	\$71,771.57
	2002	1432	emergency measures	\$20,911.04
	2002	1432	road repair	\$5,977.20
	2002	1432	library repair	\$500.00
	2002	1432	foot bridge & board walk	\$75,520.00
	2002	1432	misc park repairs	\$13,123.35
	2002	1432	shoulder/sidewalk repair	\$71,739.56
C. of St. Croix Falls	2002	1432	debris/silt removal	\$2,756.23
	2002	1432	pumping operations	\$11,209.35
	2002	1432	berm construction	\$2,859.34
	2002	1432	road repair	\$1,094.00
	2002	1432	replace retaining wall	\$14,246.72
	2002	1432	replace electric monitoring system	\$1,300.00
T. of St. Croix Falls	2002	1432	culvert & shoulder washout	\$11,350.18
General or County-Wide	2001	1369	electrical line r-o-w debris clearing	\$229,701.09
	2001	1369	power line/system repair	\$375,649.63
	2001	1359	Sherrif's Office safety measures	\$2,397.92
	2001	1359	County Park debris removal	\$3,392.79
	2001	1359	debris removal	\$13,696.14
	2001	1359	road, shoulder, and culvert repair	\$61,230.36
	2000	1332	road and culvert repair	\$85,077
	2000	1332	misc dam repair/debris removal	\$25,129
	2000	1332	trail system repair	\$6,428.00
Total				\$3,028,989.13
Summary				
road, culvert & shoulder repair			\$1,037,625.80	
power line & associated right-of-way repair			\$612,355.93	
Kennedy Dam work & repair			\$583,808.84	
debris removal			\$549,927.67	
park & trail clean-up/repair			\$146,278.61	
other (e.g., emergency measures)			\$98,992.25	

APPENDIX J.

POLK COUNTY DAM INVENTORY

Dam Official/Popular Name	Stream Name	Impoundment Name	Owner or Contact Name	Owner Type	Dam Size	Status	Hazard Rating	Normal Storage (acre feet)	Maximum Storage (acre feet)
SAINT CROIX FALLS	SAINT CROIX RIVER	INDIAN HEAD FLOWAGE	XCEL ENERGY	UTILITY	LARGE		H	8900	14400
AMERY	APPLE RIVER	APPLE RIVER FLOWAGE	CITY OF AMERY / TOWN OF LINCOLN	CITY	LARGE		H	3500	4800
BIG ROCK CREEK FARM/ST. CROIX FALLS	BIG ROCK CR		BLAIR KLEIN	PRIVATE	LARGE		H		50
GODFREY LAKE	KNAPP CREEK	GODFREY LAKE	TOWN OF CLAM FALLS	TOWN	LARGE		H (est. L)	80	170
LOWER BALSAM LAKE	BALSAM BRANCH	BALSAM LAKE	VILLAGEAGE OF BALSAM LAKE	VILLAGE	LARGE		S	12000	22300
ATLAS FEED MILL/LONG TRADE LAKE	LONG TRADE LAKE	LONG TRADE LAKE	POLK COUNTY	COUNTY	LARGE		S	1100	1610
LOWER OSCEOLA/VILLAGEAGE OF SUCKER LAKE/WAPOGASSET LAKE	OSCEOLA CREEK	OSCEOLA WEST 27 8	VILLAGEAGE OF OSCEOLA	VILLAGE	SMALL		S	3	10
	WAPOGASSET BROOK	WAPOGASSET & BEAR TRAP	WAPOGASSET LAKE ASSOC.	LAKE ASSOC.	SMALL		S	4300	7200
CLAM FALLS	CLAM RIVER	CLAM FALLS FLOWAGE	NORTHWESTERN WI ELECT CO	UTILITY	LARGE		L	701	950
BLACK BROOK	APPLE RIVER	BLACK BROOK FLOWAGE	NORTHWEST WIS.ELEC.CO.	UTILITY	LARGE		L	727	1400
LEWIS	KNAPP CREEK	KNAPP FLOWAGE	SCOTT NELSON - OWNER	PRIVATE	LARGE		L	130	300
BEAVER BROOK (JOEL FLOWAGE)	NORTH BRANCH BEAVER BROOK	JOEL FLOWAGE	WI DNR - WILDLIFE BIOLOGIST	DNR	LARGE		L	170	370
SKINAWAY LAKE	TR NORTH BRANCH BEAVER BROOK	SKINAWAY LAKE	VILLAGEAGE OF TURTLE LAKE	VILLAGE	LARGE		L	375	690
BOHN	OUTLET OF FOUNTAIN LAKE	FOUNTAIN LAKE	ROY BOHN	PRIVATE	LARGE		L	40	130
JENSEN	MAPLE VALLEY CREEK		DEWEY JENSEN	PRIVATE	LARGE		L	12	72
DON DOSCH WILDLIFE FLOWAGE	TR BLACK BROOK		KAREN BOOTH	PRIVATE	SMALL		L	30	45
STRAIGHT LAKE #3	TR-STRAIGHT RIVER	LAKE 18-1	DNR	DNR	SMALL		L	44	108
GUIDERA	NON-NAV TRIB BONE LAKE		PETE GUIDERA	PRIVATE	LARGE		L	153	168
KENNEDY/POLK COUNTY	BALSAM BROOK	GARFIELD 3-8	POLK CO.	COUNTY	SMALL		L	30	40
BIG LAKE MILL	TRIB TO HORSE CREEK	BIG LAKE MILLPOND	CHURCH PINE, ROUND, BIG LAKE IMPRV. DIST.	LAKE ASSOC.	SMALL		L	4	17
BIG BUTTERNUT LAKE/POLK COUNTY	OUTLET BIG BUTTERNUT LAKE	BIG BUTTERNUT LAKE	POLK COUNTY	COUNTY	SMALL		L	77	851
HALF MOON LAKE/TOWN OFMILLTOWN	OUTLET HALF MOON LAKE	HALF MOON LAKE	TOWN OF MILLTOWN	TOWN	SMALL		L	1125	2250
BIG BASS LAKE/TILTON BROTHERS	BIG BASS LAKE OUTLET	LOVELESS LAKE	TILTON BROTHERS	PRIVATE	SMALL		L	310	430
LARGON LAKE/ PFLUGER	OUTLET LARGON LAKE	LARGON LAKE	E J PFLUGER	PRIVATE	SMALL		L	260	650
DEER LAKE	OUTLET DEER LAKE	DEER LAKE	DEER LAKE IMPROVEMENT AS	PRIVATE	SMALL		L	1580	3160
BIG LAKE/POLK CO. SPORTSMAN CLUB	HORSE CREEK	BIG LAKE	POLK CO SPORTSMAN CLUB	PRIVATE	SMALL		L	245	735
HORSESHOE LAKE CANAL	APPLE RIVER DIVERSION CANAL	BIG HORSESHOE LAKE	POLK AND BARRON COUNTIES	COUNTY	SMALL		L		
HANSON, BYRON/WETLAND RESTORATION	WOLF CR - TRIB	WETLAND	BYRON HANSON	PRIVATE	SMALL		L	2.2	3.2
RICHEY	UN-NAMED		WALTER RICHEY	PRIVATE	SMALL		L	3.5	6.3
JOHNSON	TRIB. TO TARBERT LAKE		GARY JOHNSON	PRIVATE	SMALL		L	4.2	9
JOEL MARSH WLA	N. BRANCH OF BEAVER BROOK		WI DNR - WILDLIFE BIOLOGIST	DNR	LARGE		L	1479	3586
STRAIGHT RIVER FLOWAGE/SCHILLING/WHALE	STRAIGHT R		BILL SCHILLING	PRIVATE	SMALL				
JENSEN,RAYMOND	NO WATERWAY		JENSEN,RAYMOND	PRIVATE	SMALL			4	25
STRAIGHT LAKE #2/CRAGWOOD INC.	TR-STRAIGHT RIVER				SMALL			123	245
ANDERSEN, ELMER POND NO 1	TR-DEER LAKE				SMALL			2	5
ANDERSEN, ELMER POND NO 2	TR-DEER LAKE				SMALL			2	6
PEER, ARNOLD	OULET MILLET CAMP LAKE	MILLER CAMP LAKE	ARNOLD PEER	PRIVATE	SMALL			16	50
REYNOLDS,NEAL	TR-APPLE RIVER				SMALL			2	4
HORSESHOE LAKE DIVERSION	APPLE RIVER		HORSESHOE LAKE IMPROV. ASSOC.	PRIVATE	SMALL				
HORSESHOE LAKE CONTROL	HORSESHOE-ECHO LAKES CHANNEL	HORSESHOE LAKE	HORSESHOE LAKE CONTROL	PRIVATE	SMALL				
BLAKE LAKE		BIG BLAKE LAKE	PERCY SHERRARD						
VILSTRUP	TRIBUTARY TO BONE LAKE		ROBERT VILSTRUP		SMALL			24	38

Dam Official/Popular Name	Stream Name	Impoundment Name	Owner or Contact Name	Owner Type	Dam Size	Status	Hazard Rating	Normal Storage (acre feet)	Maximum Storage (acre feet)
FOERST	TRIB TO LITTLE MIRROR LAKE		JACOB FOERST	PRIVATE	LARGE	NEGL	L		80
WILLIAMSON/BENGSTON DAM	HARDER CREEK		STEVEN WILLIAMSON TRUST	PRIVATE		UNATH			
CLAUSEN POND 1	TRIB TO LARGON LAKE		DAVE CLAUSEN	PRIVATE	SMALL	UNBLT	L	4.8	7.1
CLAUSEN POND 2	TRIB TO LARGON LAKE		DAVE CLAUSEN	PRIVATE	SMALL	UNBLT	L	3.6	6.3
AVEDA CORP	TRIB TO ST. CROIX RIVER		AVEDA CORPORATION	PRIVATE	SMALL	PLAND	L	0.3	0.5
CHENAL POND 1	UN-NAMED		DAVID CHENAL	PRIVATE	SMALL	PLAND	L	1.2	2
CHENAL POND 2	UN-NAMED		DAVID CHENAL	PRIVATE	SMALL	PLAND	L	4.4	9.8
FELLAND	UN-NAMED		MAYNARD FELLAND	PRIVATE	SMALL	PLAND	L	45	70
KEMIS	TRIB. TO HALF MOON LAKE		RICK KEMIS	PRIVATE	SMALL	PLAND	L	0.3	0.8
KING POND 1	TRIB. TO APPLE RIVER		JAMES KING	PRIVATE	SMALL	PLAND	L	1.1	5.5
KING POND 2	TRIB. TO APPLE RIVER		JAMES KING	PRIVATE	SMALL	PLAND	L	1.3	3.5
KING POND 4	TRIB. TO APPLE RIVER		JAMES KING	PRIVATE	SMALL	PLAND	L	1.3	4.6
KING POND 6	TRIB. TO APPLE RIVER		JAMES KING	PRIVATE	SMALL	PLAND	L	3.1	6.4
KING POND 7	TRIB. TO APPLE RIVER		JAMES KING	PRIVATE	SMALL	PLAND	L	1.3	4.5
TIM WILSON DAM	UNNAMED	TIM WILSON POND	TIM WILSON	PRIVATE	SMALL	PLAND			49
STRAIGHT LAKE #1					SMALL	PLAND		62	123
BRANDON OLSON	UNNAMED TRIB TO BEAR LAKE		OLSON	PRIVATE	SMALL	PLAND			38
Risvold Dam					SMALL	PLAND			47.3
DeRosier #1			DAVE DEROSIER		SMALL	PLAND			29
DeRosier 2			DAVE DEROSIER	PRIVATE	SMALL	PLAND			9.1
Cain #1			DAN CAIN		SMALL	PLAND			0.8
Cain #2			DAN CAIN	PRIVATE	SMALL	PLAND			0.7
Scott Jensen #1			SCOTT JENSEN		SMALL	PLAND			3.2
Scott Jensen #2			SCOTT JENSEN	PRIVATE	SMALL	PLAND			5.3
Scott Jensen #3			SCOTT JENSEN	PRIVATE	SMALL	PLAND			1.3
Scott Jensen #4			SCOTT JENSEN	PRIVATE	SMALL	PLAND			14.1
Morel/Gould 1			MIKE MOREL	PRIVATE	SMALL	PLAND			10
Morel/Gould 2			MIKE MOREL	PRIVATE	SMALL	PLAND			10
Morel/Gould 3			MIKE MOREL	PRIVATE	SMALL	PLAND			0.8
John Property Wetlands			DNR WILDLIFE	DNR	SMALL	PLAND			2.2
John Property Wetlands			DNR WILDLIFE	DNR	SMALL	PLAND			1.4
Straight Lake SWA - Middle			DNR WILDLIFE	DNR	SMALL	PLAND			0.8
Dietz Wetland			CRAIG DIETZ	PRIVATE	SMALL	PLAND			8
Paul Sokol			PAUL SOKOL	PRIVATE	SMALL	PLAND			4.2
Michael Mumm			MICHAEL MUMM	PRIVATE	SMALL	PLAND			1.1
Randy Caudy			RANDY CAUDY	PRIVATE	SMALL	PLAND			0.8
Straight Lake-SWA-Horsebarn 1			WI DNR	DNR	SMALL	PLAND			1.5
Straight Lake SWA-Horsebarn 2			DNR WILDLIFE	DNR	SMALL	PLAND			3.2
Straight Lake SWA-Horsebarn 3			DNR WILDLIFE	DNR	SMALL	PLAND			0.6
Straight Lk.-SWA-Horsebarn P1			DNR WILDLIFE	DNR	SMALL	PLAND			0.9
Straight Lk.-SWA-Horsebarn P2			DNR WILDLIFE	DNR	SMALL	PLAND			0.9
Straight Lk.-SWA-Horsebarn P3			DNR WILDLIFE	DNR	SMALL	PLAND			0.8
Straight Lk.-SWA-Horsebarn P4			DNR WILDLIFE	DNR	SMALL	PLAND			1
Straight Lk.-SWA-Woodland 1			DNR WILDLIFE	DNR	SMALL	PLAND			3
Straight Lk.-SWA-Woodland 2			DNR WILDLIFE	DNR	SMALL	PLAND			3
Straight Lk.-SWA-Sheep Barn			WI DNR	DNR	SMALL	PLAND			1.5

APPENDIX K

HAZARD MITIGATION TOOLBOX

MITIGATION TOOLBOX – ALTERNATIVE STRATEGIES

A wide variety of possible mitigation tools exist to address natural hazards. The most common of these mitigation strategies fall within six basic categories:

- I. Administrative and Regulatory Activities
- II. Structural Projects
- III. Education and Awareness Strategies
- IV. Natural Resources Protection
- V. Emergency Response and Recovery Services
- VI. Implementation Strategies

This appendix provides an overview of the alternative mitigation activities available to communities and community members for the typical weather-related natural hazards experienced in west-central Wisconsin, though many of these activities can also be used to mitigate the impacts of additional types of hazards (e.g., pests & infestation, forest fire). No such list of activities is complete, and new strategies are evolving as technology, laws, and impacts change. Many excellent bibliographies of mitigation guides and resource materials exist which provide additional detail on these alternative strategies. For additional information, three excellent starting points are:

Wisconsin Emergency Management. State of Wisconsin Hazard Mitigation Plan. July 2001.

Federal Emergency Management Agency. FEMA Web Site. <<http://www.fema.gov>>. In particular, see “Mitigation Ideas”, FEMA-R5, 9/02.

Schwab, Jim, et.al. Planning for Post-Disaster Recovery and Reconstruction. American Planning Association. Planning Advisory Service Report #483/484. December 1998.

I. ADMINISTRATIVE & REGULATORY ACTIVITIES

These type of activities can be implemented by local governments to protect new construction and expanding development from hazard risks. They fall within the five basic sub-categories listed below, along with the hazard types they would primarily address.

	Hazards Addressed				
	Tornado	Winter Storms	Thunderstorms	Flooding	Heat and Drought
Planning Activities	✓	✓	✓	✓✓	✓
Land-Use Controls	✓	✓	✓	✓✓	✓
Building Codes	✓✓	✓✓	✓✓	✓	✓
Special Plans & Studies	✓	✓	✓	✓✓	✓
Strategic Partnerships	✓	✓	✓	✓	✓

A. Planning Activities

Comprehensive and land-use planning can be important hazard mitigation tools, though natural hazard mitigation is often not a primary goal of such plans. In west-central Wisconsin, flooding and floodplain management typically receives the greatest attention in local land-use plans. Such plans often indicate areas appropriate for open space preservation or for low density development.

Other planning efforts which may incorporate hazard mitigation recommendations include:

- storm water management plans
- growth management plans
- policies regarding concurrency of infrastructure and development
- capital improvement planning
- floodplain management plans

- shoreland protection plans
- watershed district plans
- historic preservation plans
- wellhead protection plans
- farmland preservation plans
- various hazard analyses and emergency response plans

B. Land-Use Controls

Land-use controls are used to implement the plans and vision of a community. Of the land-use controls, zoning regulations are the most common. Zoning identifies appropriate uses for different areas of a municipality and regulates those uses. Again, within the region, flooding issues receive the most attention among the natural hazards, with regulations often discouraging development or high-density development within floodplains.

A wide-variety of land-use controls besides zoning are available to assist in mitigating hazards or their impacts, though some can require technical studies to administer. Some of these include:

- overlay zoning for high-hazard or hazard prone areas
- bonus or incentive zoning, allowing for the transfer of development credits
- performance zoning
- floating zones for areas recently impacted by a hazard
- density controls/down-zoning
- subdivision ordinances
- design review standards
- cul-de-sac & rights-of-way standards for snow removal and emergency vehicle access
- soil conservation and steep slope/hillside ordinances
- stormwater ordinance & impervious surface limits
- development moratorium or interim zoning to allow additional time to plan
- shoreland, floodplain, and wetland zoning, ordinances, or management regulations
- regulate fill, possibly performance based
- compensatory floodland storage (banking) to offset the effects of fill in flood-prone areas
- setback regulations, including vegetation setbacks in wildfire prone areas
- freeboard requirements in special flood hazard areas
- regulations for solid waste, landfills, and hazardous materials
- regulations for agricultural waste and septic systems

C. Building Codes

Building codes are one of the most important hazard mitigation tools, and can be used to address all natural hazards. When properly designed and constructed in an appropriate location, the average structure should rarely be seriously damaged by most of these natural forces.

Building codes can be created and modified to promote mitigation measures such as:

- fire-resistant building materials
- permanent foundations
- anchoring or tie-downs for mobile homes
- wind-resistant construction
- design standards of roofing systems for snow loads and high winds
- overhead sewers or ball-traps for basements to prevent sewer back-up
- stormwater gutters
- storm-shelters or safe-rooms for large capacity buildings
- special containment or monitoring for hazardous materials
- include insulation standards to help protect from extreme heat and cold, as well as improve energy efficiency

In addition to the adoption of such codes, methods of administration and enforcement may be modified to promote compliance. In lieu of regulatory action, educational efforts may also be undertaken to promote these hazard mitigating standards into new construction and existing buildings in the community. The Federal Emergency

Management Agency and Institute for Business and Home Safety have many such standards and recommendations available at their respective websites.¹

D. Special Plans and Studies

Once a problem or potential problem is identified, additional studies, surveys, or plans may be needed for a special planning area or for a specific issue. These can vary in both geographic scope and engineering requirements. A regional watershed or flood management plan may be required to address flooding issues which cross many different governmental boundaries. A neighborhood or industrial park may require stormwater or hydraulic studies to address localized flash flooding. A new home near a river may require a survey of elevations for a floodplain determination. Cost-benefits analysis could be performed before a local government agrees to a new project. Or, a special analysis of a school can be made to determine safe spots in case of a tornado warning.

II. Structural Projects

Structural projects are commonly the most expensive mitigation activities to undertake, and often have on-going maintenance costs. There are two basic types of structural projects—infrastructure improvements and building modifications.

	Hazards Addressed				
	Tornado	Winter Storms	Thunder-storms	Flooding	Heat and Drought
Infrastructure Improvement	✓	✓	✓	✓✓	✓
Modification of Buildings & Structures	✓✓	✓✓	✓✓	✓✓	✓

A. Infrastructure Improvements & Maintenance

The largest and most common structural projects are infrastructure improvements typically funded by public agencies, often with the assistance of federal or state grant funding. In west-central Wisconsin, the majority of these projects are undertaken to address flooding and stormwater concerns, though there are other improvements and maintenance efforts which address other natural hazards. The following are example infrastructure improvement and maintenance efforts:

- flood control works (construction, restoration/maintenance, or removal), such as:
 - dams, dam gates, and reservoirs
 - remote dam sensors
 - water level strategies for peak runoff events
 - levees, berms, floodwalls, & retaining walls
 - revetments & rip-rap
 - channel maintenance & dredging
 - agricultural dikes & drain tiles
 - diversions, surface channels, overflow weirs, tunnels
 - stormwater retention ponds/basins

- engineering, retrofitting, relocation, or new construction of roads, bridges & utilities, such as:
 - alternative routes of access and evacuation
 - sufficient access/egress for emergency vehicles
 - wells and wastewater plants relocated or protected, including associated monitoring wells
 - separation of stormwater and wastewater
 - assess and improve, as needed, electrical service reliability during winter or storm events (e.g., encourage back-up power generation or bury power lines)
 - evaluate and design water systems and wells to be less vulnerable to drought
 - road height or hill cuts to prevent flooding or drifting of snow

¹ FEMA Website--<http://www.fema.gov> and IBHS Website--<http://www.ibhs.org/>

- pruning of trees from power lines or clearing rights-of-way (prevent accidents, better snow removal)
- planting of trees to prevent drifting of snow
- improved road systems & signage/signalization to reduce accidents, including rail crossings, bridges, etc
- separation of transportation types (pedestrian, bicycle, truck routes)
- slope stabilization projects (compacting, vegetation, debris anchoring)
- fire breaks and debris clearing
- various monitoring systems (e.g., fire towers, weather stations, communication systems)

B. Modification of Buildings or Structures

Typically less expensive are modifications to individual structures and buildings. These changes are commonly made in response to building codes or other local regulations. Often, these projects are often funded by individual owners, though governmental agencies or insurance companies may have loan or grant programs available to assist. Some typically mentioned modification activities include:

- elevate structures above flood elevations
- structural retrofits for flood-proofing, such as defined wet areas)
- wind-proofing (bracing, storm shutters, shatter-resistant glass, etc)
- sewer back-up protection
- construction of flood barriers around structures
- security measures and escape routes
- identification or construction of a safe room or shelter (especially for public facilities and large complexes)
- electric generator for heating and cooling when normal power supply is not available

A more costly strategy is the acquisition, demolition, and/or relocation of flood-prone buildings, facilities, or entire neighborhoods. Typically, such a buy-out program is implemented by the local government, with the assistance of grant funds, and the resulting open space becomes parkland or an environmental corridor.

III. Education & Awareness Strategies

Education and awareness efforts aimed at community members, the private sector, and public officials can be some of those most effective mitigation strategies available. These efforts span all hazard types, even those hazards where other mitigation options may be limited. Some education and awareness strategies are relatively low cost to implement, with little or no new funding required.

	Hazards Addressed				
	Tornado	Winter Storms	Thunderstorms	Flooding	Heat and Drought
Public Education & Awareness Activities	✓✓	✓✓	✓✓	✓✓	✓✓

Education and awareness strategies can cover a variety of issues and topics, such as:

- hazard risks for the community and potential hazard impacts
- warning systems and terminology
- hazard insurance to protect belongings
- evacuation or location of shelters
- appropriate reaction to hazard events
- safety supplies or kits
- health and safety issues, such West Nile Virus
- agricultural educational efforts on drought, winter kill, and water quality issues
- how domestic practices may contribute to hazards
- permitting processes, including building and development regulations for realtors, builders, engineers, architects

- available technical assistance sources
- mitigation for business & industry leaders
- National Flood Insure Program participation
- required real estate disclosure of hazards
- formation of technical advisory committees
- drills or mock events
- modifying your home to be hazard resistant
- neighborhood or volunteer programs
- assisting with emergency
- driver safety programs
- household hazardous waste disposal

The implementation and delivery methods for these strategies can also vary greatly, including:

- face-to-face meetings
- direct mailings
- local media (television, radio, newspaper)
- informational flyers and self-help guides
- multi-media materials (CD-ROMs)
- World Wide Web
- identify a hazard information center
- information booths at events, fairs, etc
- presentations to schools, groups, etc
- pilot projects and demonstrations

Some of these activities may be required by law, such as the public noticing of government meetings or public participation during comprehensive planning efforts.

IV. Natural Resource Protection

Protecting a community's natural resources yields many positive social, environmental, health, and economic impacts, of which hazard mitigation is one. These protection strategies include the preservation of open space, the restoration of natural ecosystems, and the on-going management of a community's natural resources.

FEMA Insurance Program Activities

Communities must adopt & enforce a floodplain management ordinance to qualify for the NFIP.

CRS credited activities for rate reduction encompass a wide variety of mitigation activities, including:

Public Information Activities
 Elevation Certificate
 Map Determinations
 Outreach Projects
 Hazard Disclosure
 Flood Protection Library
 Flood Protection Assistance

Mapping & Regulatory Activities
 Additional Flood Data
 Open Space Preservation
 Higher Regulatory Standards
 Flood Data Maintenance
 Stormwater Management

Flood Damage Reduction Activities
 Repetitive Loss Projects
 Floodplain Management Planning
 Acquisition & Relocation
 Retrofitting
 Drainage System Maintenance

Flood Preparedness Activities
 Flood Warning Program
 Levee Safety
 Dam Safety

	Hazards Addressed				
	Tornado	Winter Storms	Thunderstorms	Flooding	Heat and Drought
Open Space Preservation			✓	✓✓	
Restoration Project			✓	✓✓	
Management Practices	✓	✓	✓	✓	✓

A. Open Space and Environmental Corridor Preservation

By limiting development in floodprone or hazard-prone areas, certain hazard impacts can be avoided before they occur. Open space can be maintained in agricultural uses, parks, environmental corridors, and often golf courses. Open space and environmental corridor preservation can also have other multiple benefits, such as protecting unique natural or cultural resources, maintaining or improving water quality, preserving productive farmland, and providing stormwater detention areas.

The most common tool to promote open space or to preserve an environmental corridor is through zoning regulations. However, there are additional tools available to promote open space:

- open space/environmental corridor preservation in local or regional planning efforts
- property acquisition
- transfer or purchase of development rights
- purchase options, such as right-of-first refusal or purchase & leaseback arrangements
- use of eminent domain for condemnation
- private or cooperative land trusts
- farmland preservation programs, including use or differential taxation and tax credits
- sediment or erosion controls

B. Restoration Projects

Similar to open space preservation, the restoration of natural areas can also help mitigate the impacts of flooding and stormwater. To address severely flood-prone areas with many repetitive loss properties, some communities have acquired the land and returned it to its natural form. Restorations project with potential positive hazard mitigation components include:

- stream corridor restoration
- shoreland, dune and beach restoration
- watershed management
- prairie restoration
- wetland restoration, preservation, & development regulations
- wetlands mitigation or “banking”
- environmental impact & carrying capacity review & ordinances

Often, these restoration projects occur in conjunction with a larger development project under the guidance of existing local or state regulations. For instance a community may identify an under-developed flood-prone area for restoration and stormwater detention. As development occurs in other areas of the community, the developers help share the financial burden of the restoration based on wetland impacts and stormwater created at the developing locations.

C. Management Practices

Community members and government officials utilize numerous natural resources management tools and best practices which have positive hazard mitigation impacts. Some examples are:

- forest and wild fire fuel reduction
- farmland preservation planning and soil conservation practices
- forest & vegetation management & projects
- urban forestry & landscape management

These management practices can impact most natural hazards to varying degrees. For instance, urban forestry and landscape management can be used to reduce stormwater run-off, improve water quality, reduce the impacts of the urban heat island effect, and help reduce local air and sound pollution. In rural areas, forest and vegetation management can help reduce the potential of large forest and wild fires, improve water quality, reduce the drifting of snow, and be an important soil conservation tool. Some of these practices may also be incorporated into local regulations.

V. Emergency Response & Recovery Services

Many of the tools & activities listed in this section may more appropriately fit within the scope of a post-disaster recovery & reconstruction plan, rather than a hazard mitigation plan. However, a prompt and organized response to a hazard warning or event can lessen the negative impacts associated with the event, and speed up the recovery process. The majority of these response strategies apply to multiple or all hazards.

	Hazards Addressed				
	Tornado	Winter Storms	Thunderstorms	Flooding	Heat and Drought
Planning Activities	✓✓	✓✓	✓✓	✓✓	✓✓
Communication Systems	✓✓	✓✓	✓✓	✓✓	✓
Resources	✓✓	✓✓	✓	✓✓	✓

A. Planning Activities

Emergency response and operations plans and policies can be comprehensive, specific to a hazard-type, or focus on addressing a particular impact. Most importantly, plans should be in place which identify roles, responsibilities, and authority when an event occurs, including any policies regarding emergency legislation. Such planning activities may include:

- evacuation procedures
- animal control
- general clearing, clean-up & refuse disposal
- disaster recovery plans
- security & protection against looting
- health issues (e.g., vaccinations for tetanus)
- emergency government plans

Additional planning and regulatory efforts may be required after an event occurs, and to help guide the redevelopment process, such as:

- development moratorium or interim zoning
- planning solutions for impacted historic buildings & sites
- re-occupancy permits
- emergency or temporary permitting for repairs
- emergency demolition
- evacuation procedures
- post-disaster evaluation & mitigation (lessons learned)
- post-disaster reconstruction land-use plans and priorities (opportunities)

B. Communication and Warning Systems

Hazard threat recognition & reporting is critical for effective hazard mitigation. Such warning systems may be electronic (e.g., dam monitors, weather radar, road ice sensors) or require human action (e.g., volunteer weather-watchers).

Once a potential or existing hazard is identified, it needs to be communicated effectively to those who may be impacted and to those who need to respond. Such warning systems may include sirens, television/radio, NOAA weather radios, automatic dialing systems, voice-activate radio, or public address systems.

If an event should occur, additional effective communication is needed between emergency response services in the field and the emergency operation center. Additional communication policies for post-disaster response may address media & public interaction and a point-of-contact with state emergency management officials.

C. Resources (Personnel, Financial, and Equipment)

Foremost, personnel need the training to identify a potential hazard, utilities the existing communication systems, and take appropriate action. A well-prepared community will have adopt emergency response procedures and plans

such as those previously discussed, and emergency personnel will be knowledgeable of these plans. As such, training is a very important hazard mitigation tool.

The following are some additional resource-related hazard mitigation strategies:

- purchase equipment or special vehicles (or related maintenance)
- maintenance or improvement to utilities & infrastructure to increase response effectiveness
- general clearing, clean-up & refuse disposal
- provide relief services for community members, such as:
 - special arrangements for payment of heating bills during severe winter storms
 - transportation to heating or cooling centers
 - emergency housing or shelters
 - public mortgage lending subsidies
 - damage assessment & accounting systems
 - restoration of utility services
 - business support
 - other specialists (e.g., environmental, agricultural, hazardous materials)

Related to strategic partnerships, some communities have established various agreement with other municipalities or the private sector for mutual support if a disaster should occur, in order to expedite the recovery process.

VI. Implementation Strategies

Implementation strategies are often not direct means of mitigating a hazard, but are important tools for assisting with the implementation of the various mitigation activities previously discussed. Implementation strategies call apply to all hazard types, and are equally important for pre-disaster mitigation and post-disaster response and recovery. This section overviews strategic partnerships and project financing as important implementation tools.

A. Strategic Partnerships

Strategic partnerships are very important in hazard preparedness, disaster response, and post-disaster recovery. Such partnerships may be between adjacent governmental entities, the private and public sectors, or even between community members themselves. These partnerships may involve formal contracts, mutual aid agreements, and memoranda of understanding, or may be a less formal sharing of information and training. Most common is the formation of partnerships for the sharing of resources, including technical skills, financial resources, equipment, and personnel. Some example strategic partnerships are:

- partnerships with universities and colleges for training programs or special studies
- establishment of public-private ad hoc task forces to address a critical issue
- sharing of data & information (e.g., GIS, maps, plans, ordinances, procedures)
- identification of community buildings to use a public storm, cooling, and heating shelters
- monitoring for potential hazards & related communication
- multi-agency training, drills, or mock events
- intergovernmental agreements for snow removal, fire, police, or other emergency services
- form a cooperative to increase buying power for special insurance
- intergovernmental agreements for regulatory oversight, inspections, monitoring, assessment, etc
- agreements to perform comprehensive planning or regional studies
- agreement regarding the provision and maintenance of infrastructure, dams, equipment, etc
- agreements covering disaster response and recovery services and resources (e.g., Red Cross)

Many of the existing strategic partnerships for hazard mitigation in Polk County are identified in **Section IV. Current Mitigation Activities** of the plan.

B. Project Financing & Fiscal Mechanisms

There are optional means of funding hazard mitigation measures, outside of the standard annual municipal or county budget cycle. Many communities are beginning to take a longer-term perspective on project financing and adopting capital improvements plans for all types of infrastructure improvements and heavy equipment purchases. This

approach allows a better perspective of the long-term needs and financial resources a community has available, enabling the exploration of alternative fiscal mechanisms such as:

- identification & procurement of grant funds (revenue)
- special assessment districts for special services or benefits (revenues, guide development)
- developer exactions, impact fees, development improvement taxes (revenue)
- user-fees (revenue)
- land dedications/exactions & TDRs (land)
- tax incentives--marginal cost pricing & differential assessment (primarily to guide development)
- tax increment financing (TIF) for infrastructure improvements (revenue)
- land transfer, development, gains taxes (versus speculation & profits for projects, create a land bank, etc)
- tax abatement, low-interest loans, subsidies, etc (incentives for mitigation or guide development)
- loans or tax-exempt bond financing
- special redevelopment funds
- strategic partnerships with non-profit groups for fund-raising activities (revenues, awareness)
- strategic partnerships to pool financial resources, possibly leveraging additional grant or private funds

APPENDIX L.

FEASIBILITY ANALYSIS OF ALTERNATIVE MITIGATION STRATEGIES

Analysis of Strategy Alternatives

Note: The alternative strategies were analyzed based on their importance and feasibility for the mitigation of natural hazard risks. Some strategies may be rated differently by the county or communities based on other criteria. As such, a strategy may be excluded or ranked low in this plan, but could be a high priority for the county overall.

2011 Plan Strategy	2006, revised, or new	Prioritization/Score				If recommended, likely key parties to be involved.	Comments or Proposed Changes
		High (8-10)	Med (6-7.9)	Low (4-5.9)	Exclude		
Physical Infrastructure Strategies							
1. Continue to address stormwater and flash flooding hotspots in the county. Two of the higher priorities are the re-building of the Atlas Bridge (CTH "B") and stormwater management activities in the growing area immediately east of St. Croix Falls.	2006; slightly revised	8.9				Towns, Highway Dept., other municipalities	Strategy is generalized to allow flexibility in implementation. If specific actions are known/desired, add as a new strategy below. If significant damages incurred, especially to structures, Emergency Management would become involved.
2. Work with the dam owner and the Town of Clam Falls to address the problems with over-the-road flooding on CTH "I" at the Clam Falls Dam.	2006	8.3				Town of Clam Falls, WDNR, Highway Dept.	Owner has discussed potential solutions in past, but no action taken. Priority concern by Highway Department.
3. Improve the CTH "B" bridge at Atlas which is in a dam shadow and is in a low area vulnerable to flooding.	revised				X	Exclude from plan.	Adequately covered and redundant with Strategy #1. Exclude as a separate strategy.
4. Maintain communication with the Town of Bone Lake on the "Schilling Dam" issue and encourage any pertinent planning and action to prevent future washouts of adjacent roads.	new				1.7	Exclude from plan.	No specific project identified, but the status of the structure needs to be addressed. Has been some disagreement on appropriate solution (i.e., improve or remove). Likely not eligible for hazard mitigation grant dollars. Deemed by Steering Cmte to be a local matter without strong mitigation implications at this time, so exclude from plan.
5. Work with the State of Wisconsin and Minnesota agencies to establish a warning or queuing system for east-bound traffic on U.S. Highway 8 approaching the "St. Croix Falls" hill under icy or dangerous conditions.	2006			4.4		Wisconsin & Minnesota DOT, area communities, Highway Dept.	Would require signage with blinking lights or message board(s) on Minnesota side of the river. Strategy was included in 2006 plan, but not yet addressed.
6. Pursue a hill cut along State Highway 35 west of Milltown to address snow drifting and visibility concerns.	2006				3.3	Exclude from plan.	Relative to other road improvement concerns, likely not a priority at this time. Would require easement or land from adjacent landowner. No cost estimate available.
7. Complete the connections of the County Highway fuel systems, garage doors, and communications systems to the back-up generator.	revised		6.6			Highway Dept.	Has the generator, but all connections not made and subject to funding approval. Highway Department considering a new facility, which would make this issue moot and could be removed as a strategy.
8. Pursue grant funding to make cost-sharing available for the installation of storm shelters at mobile home parks where no existing shelter alternatives exist.	new		7.2			Emergency Mgmt, municipalities, park owners	Would be contingent on park owner participation. Coordinate with villages or cities when opportunities and needs exist.
9. Continue to work with local power providers to bury electrical lines in areas prone to outages due to falling trees/limbs or high winds.	new		7.2			Electric Cooperatives and Municipal Electric Utilities	Polk-Burnett Elec. Coop has no priority "hotspots" or projects at this time, but identified a number of areas more prone to outages which they may address in the future.
10. Pursue the installation of weather warning sirens in unincorporated areas of high residential growth. Coordinate with those cities and villages who are in need of siren replacement, battery back-up, or additional siren coverage.	2006; slightly revised	8.9				Emergency Mgmt, municipalities, park owners	Grant funding for warning sirens has been very limited in the past and may not be available. Policies for siren testing and use should be in-place prior to installation of any new sirens.
11. Pursue grant funds for dry hydrants for fire protection in areas of concentrated development where other water sources are not readily available.	new		X			Fire Department, municipalities, maybe Emergency Management	Grant funding may be available. To date, needs identified for Atlas Millpond, Evergreen Ave/300th St, White Ash Lake (3), CTH "H"/Apple River, and Brush Lake, but other sites may be needed. Identifying matching funds a challenge for volunteer fire departments. This strategy was added based on input received by fire departments after initial prioritization was complete.

2011 Plan Strategy	2006, revised, or new	Priority (check one)				If recommended, likely key parties to be involved.	Comments, Proposed Changes, or Alternatives
		High (8-10)	Med (6-7.9)	Low (4-5.9)	Exclude		
Planning & Policy Strategies							
12. Continue to work with communities and other service providers to expand awareness of and participation in the Polk County Special Needs Registry for times of emergency.	new		6.6			Polk County Aging, Public Health, and Emergency Management	Has struggled to attract participants. Can be a challenge to maintain.
13. PLACEHOLDER - Add a strategy to address NFIP Status if certain cities and villages do not adopt updated floodplain maps and floodplain zoning ordinance.	new						Adoption of the map updates is underway. <u>This strategy may be removed</u> in the final plan prior to adoption of this plan.
14. Continue to monitor river and lake overbank flooding on the two Sand Lakes and along the Apple River. If repetitive problems begin to occur, investigate mitigation alternatives.	new			5.5		Polk County Land Information, Emgy Mgmt, and municipalities	No specific strategies or current issues identified. Some past problems remedied and may have been adequately addressed, but low water levels in recent years.
15. Encourage local communities in the Cooperative Fire Protection areas to administer burning permits in a manner consistent with WDNR approach for the Intensive Fire Protection areas.	new		7.2			Fire Departments, WDNR, Emergency Management	Assistance from WDNR available for implementation. Uncertain of the extent of need or demand on this.
16. Continue to maintain or advocate for up-to-date emergency operating plans and dam failure analysis for county dams, high hazard dams, and dams with critical infrastructure within their shadows.	new	8.9				Emergency Management, Dam Owners	County Emergency Management has been receiving dam plans on a fairly consistent basis to date.
17. Revisit and expand the Polk County Continuity of Government Plan.	new		7.7			Polk County government	Basic plan complete, but needs updating and not very robust.
18. Encourage the county and municipalities to integrate hazard mitigation issues and strategies into their comprehensive plans.	new		6.6			Polk County Planning, WCWRPC	No state requirement to address hazard mitigation as part of comp. planning, though being encouraged by FEMA and Wisconsin Emergency Management.
19. Adopt County ordinance language which requires new mobile home parks to construct or identify per formal agreement a storm shelter for their residents. Provide model language to cities and villages for consideration.	revised	8.3				Polk County Planning/Zoning and Emergency Management	Not many new mobile home parks being constructed. If a rezoning is needed, this could potentially be required as part of a conditional use permit. Could be expanded to include emergency plans and notification procedures.
20. Continue to work with other county, regional, and state organizations to secure grant funding support for countywide LIDAR, then request an update to the D-FIRMS in the future.	new		7.7			Polk County Land Information	Some ongoing discussion for a regional or state LIDAR project. Uncertain of feasibility of a second update to D-FIRMS in near future if LIDAR is available unless this is funded locally.
21. Continue the development of geographic informational systems (GIS) data for hazard mitigation and emergency management purposes, including completion of parcel mapping. Consider additional GIS coverages in the future, such as mapping of siren coverage areas, emergency shelters, dam shadows, dry hydrants/water sources, and building point files.	revised	8.3				Polk County Land Information	WDNR has developed a building point database for all or parts of eight northern towns which could be maintained and expanded upon. Advocate for common coordinate systems for data sharing.

2011 Plan Strategy	2006, revised, or new	Priority (check one)				If recommended, likely key parties to be involved.	Comments, Proposed Changes, or Alternatives
		High (8-10)	Med (6-7.9)	Low (4-5.9)	Exclude		
Planning & Policy Strategies (cont.)							
22. Work with Town of Clam Falls to encourage dam shadow zoning for the Godfrey Lake Dam so that it may be re-classified from a HIGH hazard dam to a LOW hazard dam.	new			5.0		Town of Clam Falls, WDNR	As owner, Town has primary responsibility and role of County is minimal, if any.
23. Every five years, Polk County will update its orthophotography to allow tracking of land-use trends and anticipate potential hazards, unless alternative photography exists.	2006		7.7			Polk County Land Information	Flights flown in 2001, 2006, and 2010. Fewer flights could be needed during periods of reduced development.
24. Investigate the feasibility of centralized testing and triggering of sirens through county dispatch.	revised		7.8			Polk County Sheriff's Dept/Dispatch, municipalities	National Weather Service now provides more localized warnings now. Would require city and village agreement, as well as agreement by the County/Dispatch. Must also consider what additional equipment/costs will be needed by Dispatch.
25. Discuss with the County's citizen planning committee the potential amendment of the County subdivision ordinance to require installation of dry hydrants in rural subdivisions without community water systems.	revised			5.0		Polk County Land Information, Planning & Zoning	During the planning process, fire departments identified seven different locations in need of dry hydrants, but there could be additional needs.
26. Investigate the development of an annex to the County Emergency Operating Plan for events involving livestock quarantine or mass casualties.	new				0	Exclude from plan.	Models from other counties may exist. Uncertain if this would be best addressed by an annex to the EOP or addressed by other agencies. Deemed a very low priority at this time.
27. Conduct a survey of emergency power generator capability and needs for EOCs and other critical facilities. Identify alternatives to address identified needs.	new	8.3				Polk County Emergency Management	Critical facilities could include long-term care facilities and emergency shelters. Uncertain of the need or demand.
28. Provide to municipalities a model agreement for use of non-municipal buildings as public storm shelters.	revised		7.7			Polk County Emergency Management	FEMA has guidance for storm shelter operational plans and Red Cross has shelter agreements for recovery. It may be possible to pull together different aspects of these examples to create a model storm shelter agreement.
29. Encourage municipalities to adopt regulations which require mobile homes to be properly secured or anchored with tie-downs.	2006				X	Exclude from plan.	State regulations require anchoring and footings for manufactured homes produced on or after 4/1/07. There is no requirement if built on piers for homes produced before this date, except for certain alterations. Local building codes cannot be more restrictive than the UDC.
30. Encourage municipalities to update local Uniform Dwelling Codes to require homes and commercial buildings to incorporate tornado-proofing technology (e.g., basements, safe rooms, construction materials) in new construction.	new				X	Exclude from plan.	According to Wisconsin Code officials, a local municipality cannot have building code ordinances that are more or less restrictive than the UDC. Uncertain if this strategy is feasible.

2011 Plan Strategy	2006, revised, or new	Priority (check one)				If recommended, likely key parties to be involved.	Comments, Proposed Changes, or Alternatives
		High (8-10)	Med (6-7.9)	Low (4-5.9)	Exclude		
Communication & Coordination Strategies							
31. Explore the feasibility of establishing a Reverse 9-1-1 system.	2006; slightly revised		6.6			Polk County Land Information & Emergency Management	Funding is a barrier to implementation. Also, difficult to track and maintain cell phone numbers for residents without land line phones, should such contact information be desired.
32. As grant opportunities allow, continue to assist local fire departments and emergency services agencies with communications equipment and pager upgrades for narrowbanding.	2006; slightly revised		6.6			Polk County Emergency Management	On-going. Polk County plans to switch to narrowband in September 2011. Most equipment will be acquired by end of 2011.
33. Implement a NOAA All Hazard Radio project to include addressing the current gap in coverage area and distributing radios (or discount vouchers) to mobile home residents and/or critical facilities.	new	X	6.6			Polk County Emergency Management and NOAA; potentially ARES/RACE & retailers	Would replace VARs through attrition. Current coverage area gap in center of county needs to be addressed prior to distribution of radios; need tower site and any related rent/maintenance funding. \$30,000 for NOAA equipment. After further discussion by steering committee, this was made a high priority.
34. Work with Fire Departments and municipalities to consider the development of a countywide fire mutual aid agreement.	revised		7.2			Fire Departments, Polk County Emergency Mgmt, municipalities	Barron County fire services agreement could be a model. Most Polk County fire departments have mutual aid, some with formal agreements.
35. Pursue development of a second central County emergency communications tower and antenna.	new				X	Exclude from plan.	A certain amount of back-up redundancy does exist in the communications system. A second central tower is likely economically unfeasible at this time. Could potentially address as part of county continuity plan.
36. Continue to involve electric providers, County Land Information/G.I.S., County health and aging services, and local non-profits (e.g., housing authorities, long-term care facilities) in exercises and discussions on their relationships with the incident command system.	new		7.2			Polk County Emergency Management and others involved	This strategy does identifies relationships and procedures in preparation for and response to an event; it does not necessitate that every entity have a physical presence in the EOC.
37. Establish emergency procedures for contacting residents and facilities in the dam shadows of "HIGH" and "SIGNIFICANT" hazard dams.	new	8.3				Polk County Emergency Management, Dam Owners	Would be contingent on related GIS data for dam shadows as referenced above. If significant contacts needed, could expand the strategy to explore the feasibility of auto-dialing system similar to that used in Chippewa Co.
38. As resources allow, continue to support the County Skywarn Spotter Program and ARES/RACES group, including their efforts to attract new members and their implementation of the Automatic Packet Reporting System (APRS).	revised		7.2			Polk County Emergency Management, NOAA, ARES/RACES	Ongoing. Modified and amendment by steering committee following prioritization based on input from ARES/RACES group.

2011 Plan Strategy	2006, revised, or new	Priority (check one)				If recommended, likely key parties to be involved.	Comments, Proposed Changes, or Alternatives
		High (8-10)	Med (6-7.9)	Low (4-5.9)	Exclude		
Education & Outreach Strategies							
39. Increase public awareness of driveway access, grade, width/clearance, long-dead end roads, and turn-around issues for large emergency vehicles.	2006; slightly revised			5.0		Fire Departments, Municipalities, Emgy Mgmt	County and most towns have ordinances, but some issues in rural areas still exist. Amend Strategy #44 to include a presentation to Towns Association based on input from fire departments, and delete as a separate strategy.
40. Polk County Emergency Management will continue to provide bi-annual presentation(s) to the Towns' Association on available resources and hazard event reporting. Encourage towns to bring key staff to the presentation and maintain their emergency operating plans. Extend invitations to city and villages, or provide a similar presentation for incorporated areas.	2006; slightly revised		7.7			Polk County Emergency Management and Towns Association	Turnover in local, elected officials requires an ongoing commitment to re-education and outreach. Integrate Strategy #43.
41. Polk-Burnett Electric Cooperative will conduct periodic training for county and municipal officials and response providers using the high voltage emergency training unit.	2006; slightly revised	9.4				P-B Electric Cooperative	
42. Polk County Emergency Management will work with other pertinent county departments to host a meeting(s) with long-term care facilities and other health care service providers on emergency planning and roles during an event.	new		7.7			Polk County Emergency Management	Some providers have approached the county with questions; need to ensure that provider plans do not have unrealistic expectations of public sector during an event.
43. Increase resident knowledge on flood insurance and the typical limitations of homeowner's policies to cover flood damage.	new			4.4		Polk County Emergency Management	Homeowner's policies typically do not cover flood damage. Abt. 25% of all NFIP insurance claims are for areas outside the 100-year floodplain. Many low value homes have no insurance.
44. Increase preparedness of campgrounds and resorts to severe weather by promoting use of weather radios and educational outreach to encourage the identification of storm shelters.	new		6.5			Polk County Emergency Management	Most resorts may have shelters per county staff, but not certain on campgrounds.
45. Work with local media on a concerted effort to increase public awareness of the volunteerism needs in the county for ARES/RACES, Red Cross, local fire departments, first responders, and other local emergency services.	new		6.6			Volunteer agencies and services	ARES/RACES added after prioritization based on input from radio operators.
46. Continue to expand educational efforts and partnerships regarding alternatives to mitigate stormwater and flash flooding run-off, such erosion controls, rain gardens, natural vegetation buffers, permeable pavement, shoreland practices, and forest management in areas with steep slopes.	new		7.2			Polk County Land Information and Land & Water Conservation Dept	Supports continuing current efforts. Has benefit of reducing non-point pollution and silt loading.
47. Polk County should continue to support WDNR and local wildfire awareness in the Towns of Sterling and West Sweden, such as continued public service announcements and increased signage. Work with WDNR, local fire departments, and the communities to determine interest in additional community wildfire protection planning or Firewise-style programming.	new	8.9				WNDR, municipalities, Fire Departments, Emergency Management	Supports continuing current efforts. Initial strategy expanded to reflect input of local fire department.
48. Polk County, municipalities, and fire departments in the Intensive Fire Protection areas should continue to advocate for and participate in WDNR wildland training exercises.	new		X			WNDR, municipalities, Fire Departments, Emergency Management	Supports continuing or expanding current efforts. Also allows for improved coordination between neighboring fire departments. Initial strategy expanded to reflect input of local fire department. Strategy added after the initial strategy prioritization.

Strategy Alternatives - Multi-Jurisdictional	2006, revised, or new	Prioritization Alternatives for cities and villages were not scored and only a relative priority for projects is provided. For strategies with multiple communities, the priority may vary for each individual municipality. Priorities are subject to change.	If recommended, likely key parties to be involved.	Comments or Proposed Changes
Multi-Jurisdictional Strategies - PROJECTS				
49. DRESSER, FREDERIC, LUCK, MILLTOWN, OSCEOLA, ST. CROIX FALLS - Continue efforts to remedy the stormwater and flash flooding problems in each community, including any necessary studies and potential development of a community stormwater management plan.	revised	High Priority , though the priority can vary by community and location. Milltown has experienced the most flood-related damage in recent years.	Municipalities working with their utilities and public works.	For mitigation dollars, must demonstrate that benefits outweigh costs. It is imperative to gather good documentation of any flood events (e.g., flood depths, damages, costs).
50. BALSAM LAKE, DRESSER, FREDERIC, MILLTOWN, OSCEOLA - Identify storm shelters (or a second storm shelter site) for residents, execute formal agreements for shelter use, and use local media to educate residents on availability. If a shelter is not readily available, pursue grant funding to construct a public storm shelter as opportunities allow.	revised	High Priority , though the priority can vary by community.	Municipalities, potential shelter owners, County Emergency Management	Shelters and safe rooms are eligible for mitigation dollars, with funding based on population served w/in 0.5 miles with good access and hours of shelter availability. FEMA has design guidelines for shelters. Consider who unlocks doors, pets, security, and advertising as part of policies.
51. CLEAR LAKE, DRESSER, LUCK, MILLTOWN, OSCEOLA, AMERY - Pursue additional sirens for replacement of aging equipment or added geographic coverage as funding opportunities allow. Potentially coordinate through a multi-jurisdictional or countywide project.	2006	Medium-to-High Priority , though the priority can vary by community.	Municipality and siren owners.	Grant funding limited, so less likely to be a countywide project. Sirens often owned by fire departments, rather than directly by municipalities. If needed, formal policy for triggering sirens should be adopted prior to new sirens installed.
52. ST. CROIX FALLS - Work with the Polk County to encourage State of Wisconsin and Minnesota agencies establish a warning or queuing system for east-bound traffic on U.S. Highway 8 approaching the "St. Croix Falls" hill under icy or dangerous conditions.	2006	Medium-to-High Priority.	WisDOT, MNDOT, County Highway, Law Enforcement, City, Taylor Falls	Corresponds to a similar county strategy. This was also a strategy in the 2006, but not implemented and no significant discussion underway.
53. BALSAM LAKE, CENTURIA, FREDERIC, MILLTOWN – Should funding opportunities arise, acquire additional electric power generators for emergency use.	2006; slightly revised	Medium Priority , with priority varying by facility. Critical facilities (e.g., fire stations, EOCs) may be of higher priority.	Municipalities, facility owners, electric providers	Potentially eligible for mitigation funding. Costs will vary, since some facilities may need improvements to allow connection.
54. LUCK - Work with electric utilities to bury power lines along Highway 48 which is prone to falling trees and limbs. Coordinate such projects with municipal street and other utility improvements when opportunities arise.	new	Low Priority , since damages have not been significant to date, but may increasingly become more critical.	Village of Luck, electric provider	Electric provider (Xcel) not eligible for mitigation funds, otherwise this may have been prioritized higher.
55. CENTURIA, CLAYTON, LUCK, FREDERIC, MILLTOWN - Pursue battery back-up or emergency generators for existing sirens as funding opportunities allow. Potentially coordinate through a multi-jurisdictional or countywide project.	new	Low Priority , though priority can vary by community.	Municipality and siren owners.	Could be implemented in conjunction with #55 above.

Strategy Alternatives - Multi-Jurisdictional	2006, revised, or new	Prioritization Alternatives for cities and villages were not scored and only a relative priority for projects is provided. For strategies with multiple communities, the priority may vary for each individual municipality. Priorities are subject to change.	If recommended, likely key parties to be involved.	Comments or Proposed Changes
Multi-Jurisdictional Strategies - POLICIES				
56. ALL INCORPORATED AREAS – If flooding or other emergency occurs, compile and document all damages and costs with pictures, testimony, invoices, etc., for potential future grant funding or reimbursement.	new	High Priority , but only implemented should an event occur.	Municipality/public works, residents, Emergency Mgmt	Documentation is critical to grant funding and reimbursement.
57. ALL INCORPORATED AREAS - Update, as needed, and maintain local emergency operating plans and continue to participate in mock event exercises and training sessions when opportunities arise. Develop and maintain siren use and testing policies as part of these plans. Consider development of continuity of operations plans for critical government services and records management.	revised	High Priority overall, though some communities are up-to-date.	Municipality, local responders	Status of emergency operating plans varies by community. During community meetings, most were in good shape and only needed updated contact information.
58. ALL INCORPORATED AREAS - Continue to work with Polk County Emergency Management to ensure communications interoperability and to pursue funding support to replace and upgrade communications equipment for municipal utilities, street departments, and local emergency services providers	new	High Priority	Emergency Management, municipalities, response providers	Ongoing effort.
59. ALL INCORPORATED AREAS – Municipal staff and elected officials identified as having a first line, supervisory, or other key role during an emergency as identified in the community emergency operating plan should complete FEMA ICS 100, 200, and 700.A training which is available on-line.	new	Medium-to-High Priority	Emergency Management, municipalities, response providers	Provide key players with a basic understanding of NIMS and ICS. Some elected officials or key staff may not fully understand their roles or the system, even though the are listed in the municipality's emergency plans. Current training levels vary by community.
60. ALL INCORPORATED AREAS – If the community has not to date, adopt Wisconsin Department of Transportation third-party billing rates for equipment use, or its own equipment rate schedule, by resolution or other administrative policy.	revised	Medium-to-High Priority	Municipalities	Provides a record prior to an event, rather than re-acting afterwards and using FEMA rates which may not be agreeable to the community. Osceola has adopted language as part of Village Code. Monona adopted by resolution.
61. ALL INCORPORATED AREAS - Incorporate hazard mitigation and emergency preparedness activities into community comprehensive plans and land use procedures (e.g., site plan review) as opportunities allow. Other planning efforts potentially related to mitigation include: continuity of government plans, stormwater management plans, and capital improvements plans. Consider the use of official mapping and subdivision standards to avoid the creation of long, dead-end streets.	revised	Medium Priority	Municipalities and Plan Commissions, with input from residents, critical facilities, and emergency responders	Communities are encouraged to integrate SafeGrowth concepts and mitigation strategies into their comprehensive plans, capital planning, and local codes. Mitigation efforts may impact more than one comp plan element. In some cases, recognizing the county mitigation plan within a local comprehensive plan may be sufficient.
62. CLAYON, LUCK, AMERY - Consider development of a public storm shelter agreement and policy with those entities currently providing facilities as a public storm shelter.	revised	Medium Priority	Municipality, response providers, and shelter owners	An agreement and policy is recommended to ensure public access when needed, to prevent conflicts, and to address any liabilities or other concerns for the facility owner.
63. AMERY – The City, response providers, housing authority, and other facilities should continue to cooperatively prepare for and exercise their emergency plans for multi-family housing complexes and long-term care facilities.	revised	Medium Priority	City, response providers, housing authority, long-term care facilities, apartments	Amery has a sizable number of long-term care, senior housing, and low-income housing complexes, some of which are multi-story. Cooperation on emergency planning has been excellent within Amery to date.
64. ALL INCORPORATED AREAS – As deemed necessary, develop or modify public works mutual aid agreements to cover all levels of potential support (e.g., utilities, debris clean-up, generators, administrative) during or following an emergency.	revised	Medium-to-Low Priority , though varies by community. This topic has been receiving increasing attention in recent years due to liabilities, billing rates, etc.	Municipalities	Wisconsin Rural Water Association has an excellent public works mutual aid agreement model which many communities use. However, it is unclear if this model addresses mutual aid beyond water system and wastewater system support.

APPENDIX M.

POTENTIAL STATE AND FEDERAL GRANT PROGRAMS FOR MITIGATION PROJECTS

Potential Federal and State Grant Programs for Hazard Mitigation

adapted and amended from: Wisconsin Emergency Management. *Resource Guide to All Hazards Mitigation Planning in Wisconsin*. April 2003. p19-20

This is a selection of more commonly used grant programs, but is not 100% complete.

These programs and requirements are subject to change. Contact these agencies for application materials, program changes, and additional potential funding sources not identified here.

#	Federal or State Agency and Grant Program Name	Address and Telephone Contact Information	Eligible Activities	Federal, State and Local Cost Share Requirements	Other Program Characteristics	Grant Application Due Date
1	Federal Emergency Management Agency, Hazard Mitigation Grant program (HGMP)	Wisconsin Emergency Management P.O. Box 7865 2400 Wright Street Street, Madison, WI 54707-7865	Flood proofing, acquisition and relocation of flood prone properties, elevation of flood prone properties, wind resistant or retrofit, storm water improvements, education and awareness, All Hazards Mitigation Planning efforts	Federal - 75% State - 12.5% Local - 12.5%	Local government must be in compliance with the National Flood Insurance Program to be eligible. Projects must be cost-effective, environmentally sound and solve a problem.	After a Presidential Disaster Declaration
2	Federal Emergency Management Agency, Pre-disaster Mitigation (PDM) Program	Wisconsin Emergency Management P.O. Box 7865 2400 Wright Street Street, Madison, WI 54707-7865	Grants can be used for management costs, information dissemination, planning, technical assistance and mitigation projects	Federal - 75% Local - 25%	Must have an approved hazard mitigation plan.	Typically, pre-applications due abt. July and application due abt. Sept.
3	Federal Emergency Management Agency, Flood Mitigation Assistance (FMA) Program	Wisconsin Emergency Management P.O. Box 7865 2400 Wright Street Street, Madison, WI 54707-7865	Acquisition, relocation, elevation and flood-proofing of flood-prone insured properties, flood mitigation planning	Federal - 75% Local - 25%	Repetitive loss properties given a high priority. Must have an approved hazard mitigation plan.	Typically, pre-applications due abt. July and application due abt. Sept.
4	Federal Emergency Management Agency, Public Assistance (PA) program	Wisconsin Emergency Management P.O. Box 7865 2400 Wright Street Street, Madison, WI 54707-7865	Repair of infrastructure damaged during a flood that results in a Presidential Disaster declaration. Cost effective mitigation measures may be eligible during the repair of damaged facilities	Federal - 75% State - 12.5% Local - 12.5%		After a Presidential Disaster Declaration
5	Economic Development Administration, Economic Adjustment Program (see CFDA 11.307)	United State Department of Commerce, Economic Development Administration, 111 North Canal Street, Suite 855, Chicago, IL 60606-7204 312-353-7148	Improvements and reconstruction of public facilities after a disaster or industry closing. Research studies designed to facilitate economic development.	Federal - 50%-70% Local - 30%-50%	Documenting economic distress, job impact and proposing a project that is consistent with a Comprehensive Economic Development Strategy are important funding selection criteria	Anytime
6	Economic Development Administration, Public Works and Development Facilities (see CFDA 11.300)	United State Department of Commerce, Economic Development Administration, 111 North Canal Street, Suite 855, Chicago, IL 60606-7204 312-353-7148	Water and sewer, industrial access roads, rail spurs, port improvements, technological and related infrastructure.	Federal - 50%-70% Local - 30%-50%	Documenting economic distress, job impact and proposing a project that is consistent with a Comprehensive Economic Development Strategy are important funding selection criteria	Anytime
7	Wisconsin Department of Commerce, Community Development Local Grant, Public Facilities Emergency Program	Wisconsin Department of Commerce, 201 West Washington Avenue, PO Box 7970, Madison, WI 53707-7970 608-266-8934	Repair of water, sewer, street, curb and gutter, police and fire stations	Federal - 75% Local - 25%	Available after a state and/or Presidential Disaster declaration. these funds can be used towards the local match to receive FEMA public assistance and HMGP funds	After a Disaster event
8	Wisconsin Department of Commerce, Community Development Block Grant, Public Facilities Program	Wisconsin Department of Commerce, 201 West Washington Avenue, PO Box 7970, Madison, WI 53707-7970 608-266-8934	Water, sewer, street, curb and gutter, libraries, fire stations and community centers	To receive maximum points \$1.5 of local match to every \$1 of state Community Development Block Grant	A community's economic distress score influences funding determination. These funds can be used as a local match to receive FEMA Public Assistance and HMGP funds.	Anytime
9	Wisconsin Department of Transportation (DOT), Flood Damage Aid	Wisconsin Department of Transportation, 4802 Sheboygan Avenue, Madison, WI 53707 608-267-5254	Replacement and improvement costs for major flood damage to a road or road structure under local jurisdiction. To help defray costs of repairing major flood damage to any public street, alley, or bridge not located on the State Trunk Highway System	State - 75% of replacement costs and 50% of improvement costs, reimbursed by local	Repairs or replacements can include resign to prevent or reduce future flood damage. If Federal Disaster Aid is received, community is ineligible for State Federal Disaster Aid.	Applicant must submit final costs within 2 years following flood damage
10	Wisconsin Department of Transportation (DOT), Transportation Enhancement funds	Wisconsin Department of Transportation, 4802 Sheboygan Avenue, Madison, WI 53707 608-267-5254	Activities that "enhance" the surface transportation infrastructure "above and beyond" basic highway projects, can include: landscaping and scenic beautification, acquisition of scenic easements, and scenic or historic sites.	Federal - 80% Local - 20%	Can provide scenic vista and runoff areas, parking and landscaping along flood-prone riverways. Can acquire flood-prone areas along roads for green corridors. Food damage reduction potential is not the primary purpose of the program.	Even-numbered years. Application forms available in January. Must be submitted by April. Funds granted competitively.
11	Wisconsin Department of Commerce, Division of Housing and Community Development CDBG - Emergency Assistance Program	Wisconsin Department of Commerce, 201 West Washington Avenue, PO Box 7970, Madison, WI 53707-7970 608-267-3682	Assists local governments in response to a natural or manmade disaster. Can be used to address damage to housing, public infrastructure, businesses, community buildings, etc.	Varies, depending upon whether the community is already an entitlement community for CDBG funding.	Must give preference to households at or below 80% of the county median income.	After a disaster event.

12	Wisconsin Housing and Economic Development Agency Temporary Housing Grants	WHEDA 201 W. Washington Ave, Ste. 700 Madison WI, 53703 608-266-7884 800-334-6873	WHEDA has provided grant support to communities in the past following a disaster event for housing needs.	contact WHEDA for more information	contact WHEDA for more information	After a disaster event.
13	Wisconsin Department of Natural Resources, River Protection Grant Program	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	River organization development, education, special river study needs to help protect rivers, water quality, habitat, etc.	State - 75% maximum Local - 25%	\$10,000 maximum grant Local gov'ts and non-profit organizations may apply.	1-May
14	Wisconsin Department of Natural Resources, River Protection Grant	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Purchase of land or easements, restoration of in-stream or shoreland habitat	State - 75% maximum Local - 25%	\$50,000 maximum grant, adoption of outdoor recreation plan required	May 1
15	Wisconsin Department of Natural Resources, Lake Planning Grant	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Water quality studies, land use analysis, ordinance analysis, planning recommendations	State - 75% maximum Local - 25%	\$10,000 maximum per grant, but can receive up to \$50,000 in total grants	February 1 and August 1
16	Wisconsin Department of Natural Resources, Lake Protection Grant	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Projects to protect and improve water quality and their ecosystems.	State - 75% maximum, not to exceed \$200,000 Local - 25%	Acquisition of land and easements also eligible	May 1
17	Wisconsin Department of Natural Resources, Urban Rivers Grant Program	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Land acquisition and revitalization of urban water fronts	State - 50% Local - 50%	Project must be part of adopted outdoor recreation plan	May 1
18	Wisconsin Department of Natural Resources, Aids for the Acquisition and Development of Local Parks (ADLP)	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Acquisition and development of public outdoor recreation areas	State - 50% Local - 50%		May 1
19	Wisconsin Department of Natural Resources, Acquisition of Urban Green Space	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Funding the protection of natural spaces in proximity to urban development	State - 50% Local - 50%	Protect land with scenic, ecological or natural values in urban areas from development	May 1
20	Wisconsin Department of Natural Resources, Land and Water Conservation Fund - Federal Program Administered by State DNR	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Acquisition and development of outdoor parks and non-commercial recreation facilities	Federal - 50% Local - 50%	Funding comes from U.S. Department of Interior, project must be part of an adopted outdoor recreation plan	May 1
21	Wisconsin Department of Natural Resources, Municipal Flood Control Project	Wisconsin Department of Natural Resources, 101 S. Webster Street, PO Box 7921, Madison, WI 53707-7921 608-266-7555	Acquisition, flood proofing, wetland-floodplain restoration, storm water projects, flood insurance studies, and floodplain mapping.	State - 70% Local - 30%	Maximum grant cannot exceed 20% of funding available. Cities, villages, towns, and metropolitan sewer districts are eligible.	15-Mar
22	Wisconsin Department of Administration, Comprehensive Planning Program	Wisconsin Department of Administration Comprehensive Planning Program 101 E. Wilson Street, 9th Floor Madison WI, 53703 608-267-3369	Cost sharing in preparation of a community comprehensive plan as defined under State Statute.	Varies depending on community size and number of municipalities participating in the application.	Land use decisions must be consistent with comprehensive plan per State Statute. Comp plans may also include guidance, projects, and policies regarding hazard mitigation.	November 1
23	Wisconsin Emergency Management, Domestic Preparedness Equipment Grant Program	Wisconsin Emergency Management, 2400 Wright Street, Madison, WI 54707-7865 608-242-3232	Some equipment purchased for terrorism readiness may also have valuable emergency response use to mitigate impacts should an event occur.			
24	Wisconsin Department of Natural Resources, Targeted Runoff Management (TRM) Grant Program		Develop stormwater management facilities to control non-point source pollution, primarily in urban or developing areas.	May be able to leverage with Wisconsin DOT funds.		
25	U.S. Army Corp of Engineers Section 14-Emergency Streambank and Shoreline Protection	regional contact: Detroit District 477 Michigan Avenue Detroit, Michigan 48226 313-226-6764	Provide bank protection of highways, bridges, essential public works, and critical facilities endangered by flood-caused erosion.	Federal - 75% Local - 25%	Must meet U.S. Army Corps of Engineers economic feasibility and other criteria Maximum \$500,000 per project.	

26	U.S. Army Corp of Engineers Section 22-Water Resources Planning Grant	regional contact: Detroit District 477 Michigan Avenue Detroit, Michigan 48226 313-226-6764		Federal - 50% Local - 50%	Must meet U.S. Army Corps of Engineers economic feasibility and other criteria	
27	U.S. Army Corps of Engineers Section 205-Small Flood Control Projects (CFDA 12.106)	regional contact: Detroit District 477 Michigan Avenue Detroit, Michigan 48226 313-226-6764	Provision of specialized services through projects not specifically authorized by Congress.	First \$100,000 is federally funded, with remainder split 50% Federal/50% Local.	Must meet U.S. Army Corps of Engineers economic feasibility and other criteria Maximum \$7 million per project, though this may change.	
28	U.S. Army Corps of Engineers Section 208-Clearing Channels for Flood Prevention (CFDA 12.108)	regional contact: Detroit District 477 Michigan Avenue Detroit, Michigan 48226 313-226-6764	Provision of specialized services. Non-federal sponsor must provide all lands, easements, and rights-of-way.	Federal - 75% Local - 25%	Must meet U.S. Army Corps of Engineers economic feasibility and other criteria Maximum \$500,000 per project.	
29	U.S. Department of Agriculture, Farm Service Agency Emergency Conservation Program (ECP)	contact local Farm Service Agency	Perform emergency conservation measures to control wind erosion on farmlands and rehabilitate farmlands damaged by natural disasters; includes water conservation	Cost-sharing determined by County committees, following USDA guidelines.	Farm operator or landlord/owner in a disaster area or impacted by drought.	following a natural disaster event; eligibility determined by county FSA cmte
30	U.S. Department of Agriculture, Natural Resources Conservation Service, Watershed Protection and Flood Prevention	Wisconsin Natural Resources Conservation Service - NW Area 1304 N. Hillcrest Altoona, WI 54720 715-832-6547	Project grants and technical assistance to protect and utilize land and water resources in small watersheds. Emphasizes interdisciplinary planning teams.	Varies depending on nature of the project. Federal funding may be incorporated within other State Programs; check with WisDNR.	Agricultural related enterprises must account for at least 20% of the total benefits.	
31	U.S. Department of Agriculture, Natural Resources Conservation Service, Emergency Watershed Protect - Floodplain Easement	Wisconsin Natural Resources Conservation Service - NW Area 1304 N. Hillcrest Altoona, WI 54720 715-832-6547	Purchase floodplain easements as an emergency measure in floodplain areas which are impaired or have a history of repetitive flooding	Easement compensation varies by site and location. NRCS pays 100% of restoration costs.	Voluntary program to restore floodplain functions. Easements are permanent. Easement compensation based on offer, rate cap, and area market.	Sign-up period is in March.
32	U.S. Department of Agriculture - Rural Development, Housing & Community Facilities Programs	Rural Development Business & Community Programs 4949 Kirschling Court Stevens Point, WI 54481 Phone: 715-345-7610	Has been used for a wide variety of projects, including early warning systems, sirens, fire equipment, EMS buildings, shelters, radios, etc. Additional USDA programs available for larger projects.	Varies by community size, local household incomes, and funding availability	Counties and small communities; must work with USDA Rural Development officials from beginning of the project	
33	Wisconsin Department of Natural Resources, Forest Fire Protection (FPP) Grant	FFP Grant Manager Department of Natural Resources P.O. Box 7921 Madison, WI 53707-7921 (608) 267-0848	Equipment, training, prevention materials, communication equipment, mapping/rural numbering systems, ATVs, dry hydrants	For individual fire depts: min. \$750; max. \$10,000 For County Fire Assoc: min. \$5,000; max. \$25,000	Fire departments and County Fire Associations	varies; usually May, June or July
34	U.S. Homeland Security Assistance to Firefighters Grant Program	U.S. Dept. of Homeland Security 800 K Street NW Washington DC 20472-3620 1-866-274-0960	For Fire Departments and EMS organizations to enhance fire-related capabilities.	Varies by population served, but 5% - 10% for small communities	Applicants serving less than 500,000 population may not receive over \$1 mil in funding.	April or May
35	U.S. Department of Interior Rural Fire Assistance Outreach	U.S. Dept of Interior check up-to-date application materials for contact info.	Training, personal protective equipment, basic gear, limited communications equipment, basic tools, and other activities.	Minimum 10% local match.	Max. award of \$20,000 per fiscal year. Need to serve DOI lands.	April
36	U.S. Department of Homeland Security, Emergency Operations Centers (CFDA 97.052)	Department of Homeland Security 245 Murray Drive, SW. Washington, DC 20528 202-282-8000	Improve local capabilities to respond to emergencies and disasters	Phase 1 for assessment Phase 2 requires a 50% nonfederal cost share.	Local governments can be sub-grantees under the State.	
37	Federal Emergency Management Agency, Interoperable Communications Equipment (CFDA 97.055)		Explore uses of equipment and technologies to increase the interoperability among fire services, law enforcement, and emergency medical services.	Funding is discretionary. Max. Federal share is \$6 million. 25% nonfederal cost-share.	Local governments are nominated by the State to submit an application.	Contact FEMA headquarters.

APPENDIX N.

SUMMARY OF PLAN CHANGES SINCE THE 2006 COUNTY PLAN

The 2011 *Polk County Natural Hazards Mitigation Plan* was a complete review and update of the 2006 plan. This section highlights the major changes since the 2006 plan by plan section, including a brief description of how the steering committee reviewed and analyzed each section. In addition, between the third and fourth meetings of the steering committee, a rough draft plan was distributed to all committee members for review and comment on any sections.

Section I. Introduction

- A project brochure was developed and distributed to encourage participation.
- Stakeholder interviews included review of the 2006 plan recommendations.
- Town surveys were much more customized for each town in this plan and incorporated aspects of the 2006 plan to encourage input.
- A brief discussion was added as part of Section I.D. on how other plans, studies, etc., were considered and incorporated as part of the planning process.
- Sign-in sheets for the community meetings were included in Appendix C. Also added to Appendix C are the agendas and sign-in sheets for the steering committee meetings.
- In 2006, the Village of Turtle Lake participated in and adopted both the Polk County and Barron County hazard mitigation plans. With this rounds of plan updates, Turtle Lake participated in (and is anticipated to adopt) the Barron County plan, but was only consulted for the Polk County planning effort.
- Steering Committee Analysis & Review: The planning process, which is summarized in Section I, was the focus of the first plan steering committee meeting, including a review of the process used during the 2006 plan and recommended changes for the plan update.

Section II. Community Profile

- Demographics and other data was updated. An expanded discussion of demographic trends and their potential relationship to emergency response and hazard mitigation planning was included.
- G.I.S. data for critical facilities has significantly improved and the list of critical facilities (Appendix E) was updated and amended.
- Steering Committee Analysis & Review: The highlights of the community profile were reviewed and discussed during the second plan steering committee meeting. Particular attention was paid to the analysis of demographic and development trends, and their implications for mitigation and emergency response.

Section III. Assessment of Hazard Conditions

- Hazards selected for assessment were adjusted slightly (page 37). Wildfire risks were given its own section and extreme heat was removed as a section.
- NCDC statistics and other data was updated and further supplemented for many risks. An introductory summary of risks, vulnerabilities, and some key issues was added for each risk sub-section.
- Issues, risks, needs, and concerns for each of the hazard risks based on meetings and stakeholder input were integrated into the different sub-sections.
- A brief section on possible hazard impacts of climate change was added (pages 42-45).
- A special threat analysis regarding Long-Term Power Loss was added (pages 48-53) as a separate sub-section, given its importance and relationship to multiple hazards.
- Enhanced Fujita Scale was integrated into the report (page 56).

- The discussion of historical tornado events was expanded (page 58-60).
- Licensed mobile home parks were identified and discussed (pages 62-63).
- Wisconsin Emergency Management data and vulnerability assessment for tornadoes and high wind events was integrated into the report (pages 64).
- Assessment of weather warning sirens was added (pages 63, 68).
- A more complete list of local/regional winter storm events was added (pages 72-73).
- Wisconsin Emergency Management data on hail events was integrated into the report, along with a discussion of recent hail, thunderstorm, and hail events in the county (pages 87-88).
- Additional attention given to defining the flood hazard (pages 93-97).
- A more complete review of local flooding events was added (pages 98-102).
- The flood assessment, as described in Appendix B, took advantage of new D-FIRM maps and available parcel mapping to identify potential development and vulnerabilities in floodplain areas (pages 105-108).
- Wisconsin Emergency Management HAZUS analysis of flood vulnerabilities was integrated into the report for comparison (pages 109-110).
- A new section was added to the flood analysis on projecting future flood vulnerabilities (pages 110-111)
- An expanded discussion of agricultural flooding risks and vulnerabilities was included (pages 112-113).
- Dams by Hazard Rating Map added and expanded discussion included (pages 117-121).
- Drought section was expanded to reflect the drought over much of the past decade and 2007 Agricultural Census statistics (pages 123-125), as well as recent trends and data on water quantity (pages 127-128).
- Wildfire was added as its own risk section with much more analysis, including an expanded history (pages 131-133), wildfire events map (page 134), inclusion of Wisconsin DNR assessment of communities-at-risk (pages 136-138) and WDNR March 2010 program assessment (page 138).
- Steering Committee Analysis & Review: An overview of NCDC data and other hazard trends were analyzed and discussed by the committee during their first meeting, including a review of the results of the hazard survey performed as part of the 2006 plan. As noted previously, some changes in scope were made. The analysis of the results of the full assessment and interview process were the focus of the steering committee's third meeting.

Section IV. Current Mitigation Activities

- Updated current activities and rough draft sections provided to different stakeholders for review.
- Steering Committee Analysis & Review: Current mitigation activities were reviewed and discussed as part of the third and fourth steering committee meetings.

Section V. Progress on the 2006 Mitigation Plan Strategies

- New section of plan. During stakeholder interviews, lead parties for each strategy from the 2006 plan were asked to provide an update on progress which was integrated into Table 26.
- All strategies from the 2006 plan were reviewed for potential inclusion as 2011 recommendations and any suggested modifications.

- Steering Committee Analysis & Review: Progress on the 2006 strategies was reviewed by the steering committee during its second and third meetings, including some discussion on potential strategy alternatives.

Section VI. Mitigation Goals and Strategies

- Steering committee reviewed and updated the plan goals as discussed on page 164.
- The mitigation strategies were generally organized into projects and policies.
- The feasibility analysis in Appendix L provides the relative priority scores given by the steering committee. Comments and barriers to implementation from the steering committee and other stakeholders related to each strategy were also included.
- For the highest rated projects, a special implementation section was added which provides both focus, cost estimates (if available), and guidance. It is expected that this approach may help increase interest levels and use of the plan following adoption.
- Steering Committee Analysis & Review: Plan goals were reviewed and discussed as part of the third steering committee meeting. In June 2011, a strategy alternatives survey was distributed via mail to all steering committee members. The survey results yielded relative priority of the alternatives, barriers to implementation, and guided the selection of which strategies would be recommended in the final plan. The draft plan, with recommended strategies based on the survey results, was reviewed by committee members in June and July 2011. At its fourth meeting, the steering committee discussed and considered potential changes and additions to the plan, including the recommended strategies.

Section VII. Plan Adoption & Maintenance Process

- Plan coordination updated based on new strategy recommendations.
- Steering Committee Analysis & Review: The plan adoption and maintenance process was discussed and determined by the steering committee during its fourth meeting.

Changes that Address Reviewer Comments on 2006 Plan

The following plan changes were made to address FEMA review comments on the 2006 plan:

1. **Incorporation of Other Plans:** The 2006 plan included a discussion of other related plans, studies, etc., as part of the review of current mitigation activities and the plan coordination section. The reviewers recommended including language on incorporation of other plans as part of the planning process narrative. As recommended, a brief discussion on this topic was added as part of Section I.B.
2. **Separate Dam Failure and Flooding:** The reviewer recommended separating dam failure and flooding into separate section since these events can occur independently. This plan update expands upon the discussion of dam failure, though it remains part of the flood section in order to minimize redundancies. While these two events can occur independently, the actual flooding impacts are similar. For most communities, the dam shadows are effectively analogous to expanded floodplains, are regulated as part of floodplain zoning, and are typically mitigated in similar ways (e.g., buyouts, public park property, floodproofing, warning systems). And landowners with improvements and personal property within dam shadows are encouraged to obtain flood insurance to mitigate their potential losses. Further, the recent dam failures in Polk County (Kennedy Mill Dam 2001, Upper Osceola Dam 2002) were the result of flash flooding events as

classified by the National Climatic Data Center as discussed in the text. The current approach was deemed sufficient to recognize both the relationships between flooding and dam failure, while still recognizing those concerns unique to dam failure and individual higher risk dams. This approach will be continue to be reconsidered with future plan updates.

- 3. Improved Hazard Risk Mapping and Vulnerabilities to Buildings and Infrastructure:** Flooding and, to a lesser degree, wildfire are noted as the only two hazard risks with definable geographic areas of greater risk. The availability of updated GIS data as described in Appendix B allowed for the identification of parcels with improvements within or overlap the 100-year floodplains for most of the county as mapped in Figure 30 and summarized in Table 22. Available critical facilities GIS data was also used to identify which of these facilities may also be located within the 100-year floodplain (pages 111-112). However, no dam shadows in the county are currently available in a GIS format to allow for analysis and identification of structures and this weakness has been integrated into recommended plan strategy.

The maps of reported wildfires (Figure 34) and communities-at-risk (Figure 35) show the relationship between past wildfire events and the county's forested areas, as well as the WisDNR assessment of development in the wildland-urban interface. Other new maps in the plan included mobile home park locations.

- 4. Assessment of Vulnerabilities to Future Buildings and Infrastructure:** Specific projections on the numbers of future structures, buildings, or critical facilities for certain hazards are not available. To help compensate, Section II included projections and expanded discussion related to population, housing, property values, and general development patterns. WEM analysis on projecting vulnerabilities from tornadoes and high winds was added (page 64). A special sub-section of the flood assessment was added to discuss projected future flood vulnerabilities (pages 110-111). And the wildfire assessment discusses growth trends for the communities most at risk (page 138). Future plan updates will strive to better address this data weakness as more local land use data or other data sources become available. But, again, only flooding, and to a lesser degree wildfire, only have definable areas of potentially higher risk.
- 5. Estimating Potential Financial Losses:** Greater effort was made to integrate potential losses into the vulnerability assessment for all hazards, as well as the methodologies or sources of this information. The reader will find many more loss numbers compared to the 2006 plan. This is, in part, reflected in the new data sources as described in Appendix B and the integration of the WEM tornado/high winds data, the WEM HAZUS flood analysis data, and the 2007 Census of Agriculture statistics found within the updated plan. The special section added on long-term power outages provided an opportunity to focus more on the vulnerabilities and potential losses related to this threat. It is recognized that estimating losses for some hazards (hail, ice) remains difficult.
- 6. Cost Effectiveness for Priority Projects:** The updated plan provides a greater focus on priority projects and expands the discussion on related costs, potential funding sources, and other implementation guidance for these priorities.

When completing the feasibility analysis in Appendix L, the steering committee considered barriers to implementation, including costs. For priority projects, a new subsection was added (Section VI.D.) which identifies potential funding sources and provides estimated cost ranges, if available. As the steering committee and communities reviewed and amended this table, it provided an additional opportunity to consider the costs-benefits of the priority projects. As noted in the plan text, a cost-benefit review should be performed prior to implementation.

