

Mitigation Plan

Bayfield County All-Hazard Mitigation Plan



Prepared for Bayfield County

1.0 Planning Process

Disasters caused by natural hazards have become more costly. The impact of these losses has a much greater magnitude when considered at the local level rather than from the state or national perspective. Budgets, staff, and resources in general are fewer and farther between at the local level. The County and communities within Bayfield County have historically worked well together and will into the foreseeable future. The Bayfield County All-Hazard Mitigation Plan addresses natural hazards that impact the County and identifies mitigation strategies to minimize those hazards.

Mitigation is defined as “sustained actions taken to reduce or eliminate long-term risk to human life and property from hazards and their effects”. 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. Mitigation, or prevention, can decrease the impact and therefore the consequences and costs of a natural hazard event.

Mitigation is an important component of the emergency management cycle that includes mitigation, preparedness, response, and recovery. It is the only phase of emergency management planning that is dedicated to breaking the cycle of damage, reconstruction, and repeated damage. Mitigation planning focuses on coordination of resources and actions that produce benefits by undertaking planned mitigation actions that will reduce human suffering and the demands for funding of reconstruction after future disasters.

Participating jurisdictions in this plan are the City of Bayfield, City of Washburn, Red Cliff Band of Lake Superior Chippewa, Village of Mason, Bayfield County, and the towns within the county. Plan adoption by each of these jurisdictions is documented in Annex C of this document.

Partnerships with local, state, and federal agencies were identified and developed during the development and update of this plan. Several of the mitigation strategies included in the previous version of this plan have been completed. These are documented in the Mitigation Strategies table. New strategies to consider and implement were also added to this table, as participants have identified new priorities and areas of improvement since the original writing of this plan.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000, Public Law 106-390) was signed into law on October 30, 2000 and amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act. This act established the requirement for local and tribal governments to prepare an All Hazards Mitigation Plan to be eligible for funding from Federal Emergency Management Agency (FEMA) through the Pre-Disaster Mitigation Grant Program, Flood Mitigation Assistance Program and the Hazard Mitigation Program. The act further established the requirement that natural hazards such as tornadoes, floods, wild fires, and severe thunderstorms need to be addressed in the risk assessment and vulnerability analysis parts of an All Hazards Mitigation Plan. The act also required local and tribal governments to have a Hazards Mitigation Plan in place in order to utilize funding through the Pre-Disaster Mitigation Grant.

The Disaster Mitigation Act of 2000 defines the local All Hazards Mitigation Plan as follows:

“A 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. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding.”

The Disaster Mitigation Act further defines that a Pre-Disaster Mitigation Plan should address the following five areas:

1. Planning Process
2. Planning Area
3. Risk Assessment
4. Mitigation Strategy
5. Plan Maintenance Process and Adoption

Bayfield County has followed this organizational structure as the format for the Hazards Mitigation Plan.

Public Involvement

Bayfield County Emergency Management was notified by Wisconsin Emergency Management in February of 2018 that the Federal Emergency Management Agency (FEMA) had approved a Planning Grant in the amount of \$30,000 through the Hazard Mitigation Grant Program (HMGP) and \$5,000 through Wisconsin Emergency Management for Bayfield County. Bayfield County had to provide an in-kind total of \$5,000 making a project total of \$40,000.

The first county planning committee meeting took place on March 1, 2018 with a defined goal of updating Bayfield County's All Hazard Mitigation Plan. The Local Emergency Planning Committee or LEPC served as the oversight committee for the development of the Bayfield County Hazard Mitigation Plan. The LEPC is a committee appointed by the County Board that includes representation from jurisdictions within the county, including response agencies, elected officials, and community groups. All LEPC meetings are open to the public and posted in announcements at the courthouse. The listing of the membership of the LEPC follows:

Change Committee List at the end depending on who has attended

Verne Gilles,	Citizen and Committee Chair
Al Krause,	Schools Representative
Ben Dufford,	Bayfield County Conservationist
Ben Garrett,	WDNR Wildland Fire Mitigation
Bob Miller,	Village of Mason
Bryon Daley,	Environmental Health Specialist, Red Cliff Band of Lake Superior Chippewa
Carrie Linder,	Human Services/ADRC
Dennis Pocernich,	County Board Chair
Gary Victorson,	EMS / Bayfield County Coroner
Jeff Lee,	Norvado Telephone Cooperative
Jennifer Augustine,	Northern Lights Health
Jim Whyte,	Director Of Education at Memorial Medical Center
Mark Abeles-Allison,	Bayfield County Administrator
Mark Scribner,	CenturyTel Phone Company
Mike BeBeau,	Xcel Energy Electric Utility
Nick Fletcher,	Northern Lights Health
Paul Houck,	Bayfield County Information Technology
Paul Susienka,	Bayfield County Sheriff
Sara Wartman,	Bayfield County Public Health

Scott Kluver, City of Washburn
Tom Kovachevich, City of Bayfield / Fire

The LEPC reviewed portions of the plan, assisted in development of the risk assessment matrix and finalized the rating of those identified risks. Throughout the course of the past year, the LEPC has met several times, typically at least once per month, to discuss updates to the plan, including demographics, event occurrences, vulnerability and risk assessment modifications, and updating the mitigation strategies. Below is a matrix of the LEPC meetings.

The All Hazard Mitigation Plan Update was presented and discussed at several meetings of the Bayfield County Unit of the Wisconsin Towns Association. Several participating towns had recently completed Comprehensive Plans, and information from these was taken into consideration where appropriate in this plan update. The Towns Association was used to provide ongoing information and updates to elected officials throughout the development of the All Hazards Mitigation Plan and planning process.

As the planning process continued to evolve, individual communities and representatives were sought for participation and information on matters that directly impacted them. LEPC meeting invitations were widely distributed, and as always, these meetings are open to the public, with input from the public welcome. Meetings are posted in announcements at the courthouse. When these meetings were not convenient for those parties whose information was vital to the plan update, individual meetings or discussions were held to gather this information. These were typically done in-person after other meetings. Most of the comments received came from stakeholders involved in the overall planning process.

The Bayfield County Fire Association met almost monthly throughout the planning process and provided input related to risk analysis and mitigation strategies. Key representatives also served on the Bayfield County LEPC and provided valuable input to the plan update, particularly as it related to vulnerabilities and mitigation strategies.

Other groups or committees that have offered input throughout the planning process including completing and/or discussing the risk assessment matrix, are EMS service providers, the Sheriff's Department, Emergency Management and Child Support Committee, the Bayfield County Board of Supervisors, Bayfield County Highway Committee, local public works staff, and individual fire and ambulance departments.

Neighboring Counties, Ashland, Douglas, Sawyer and the Red Cliff Tribe of Lake Superior Chippewa, were all sent copies of the draft plan and asked to provide comments. No comments were received from the neighboring Counties' Emergency Managers or Red Cliff.

Jurisdictional Involvement

The specific jurisdictions participating in this plan are the City of Bayfield, City of Washburn, Red Cliff Band of Lake Superior Chippewa, Village of Mason and Bayfield County which covers the towns within the county. All plan on adopting the Bayfield County All-Hazard Mitigation Plan upon approval by Wisconsin Emergency Management and the Federal Emergency Management Agency. A summary of their involvement follows.

City of Bayfield - The City of Bayfield was represented at nearly all LEPC Committee meetings. In addition, input was received during the planning process through city staff and local meetings within the City. The City of Bayfield's current Comprehensive Plan was used to determine the demographics and future land use plans for the City.

City of Washburn - The City of Washburn was represented at nearly all LEPC Committee meetings. Input was received during the planning process through city staff.

Red Cliff Band of Lake Superior Chippewa - The Red Cliff Band of Lake Superior Chippewa has had input on the mitigation plan through membership on the LEPC. Specific mitigation strategies were developed in consultation with the Red Cliff Planner.

Village of Mason - The Village of Mason was represented at Bayfield County Fire Association, Bayfield-Ashland Counties EMS Council, and LEPC meetings. Elected officials and Village staff also provided input during the planning process.

Existing Plans

Existing plans were reviewed and incorporated into the All-Hazard Mitigation Plan as appropriate. Part II - Defining the Planning Area - draws on information developed for Comprehensive Plan adopted by the Bayfield County Board of Supervisors in 2018, with additions as necessary. Twenty-eight of the twenty-nine jurisdictions within the county have adopted Land Use Plans. Information from those plans was integrated into the Mitigation Plan as appropriate. The All-Hazard Mitigation Plan will augment the current County, Town, City and Tribal Land Use Plans already in place. Portions of the Mitigation Plan will be incorporated into other plans as the applicability is identified.

This will primarily be completed during updates of the existing planning documents.

A listing of plans and documents that provided information (and also incorporated information from the previous Hazard Mitigation Plan) for the Bayfield County All Hazard Mitigation Plan follows:

- Barnes Drummond Community Wildfire Protection Plan
- Bayfield County Hazard Analysis
- Bayfield County Emergency Operations Plan
- Bayfield County Land Use Plan
- Bayfield County Aging Unit - 3-Year Plan
- Bayfield County Shoreland Zoning Ordinances
- Emergency Action Plan
- Drummond Lake Dam Emergency Action Plan
- Murray Dam Emergency Action Plan
- Namakagon Dam Hazard Analysis
- Comprehensive Plans for: Barksdale, Town of Bayfield, City of Bayfield, Town of Bayview, Town of Bell, Town of Cable, Town of Clover, Town of Delta, Town of Drummond, Town of Eileen, Town of Grand View, Town of Iron River, Town of Kelly, Town of Keystone, Town of Lincoln, Town of Mason, Town of Namakagon, Town of Pilsen, Town of Russell, Town of Washburn, City of Washburn
- Town of Red Cliff Reservation Land Use Plan, Red Cliff Reservation Transportation Plan, Red Cliff Reservation Emergency Operations Plan,
- National Weather Service Historical Climate Data

The Bayfield County All Hazard Mitigation Plan has incorporated risk analysis and mitigation strategies for all jurisdictions within the county. Those jurisdictions include the county (covering the 25 towns), the City of Bayfield, the City Washburn, Red Cliff Band of Lake Superior Chippewa, and the Village of Mason. Persons from each of these jurisdictions offered input as the plan was being developed, including identifying local risks, comparing those risks with county risks, identifying mitigation strategies, and reviewing portions of the plan in draft form. In addition, each of these jurisdictions will be provided copies of the approved plan for their adoption. Resolutions will be included in Annex C to this plan.

Contact Information

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2.0 Bayfield County Pre-Disaster Mitigation Plan Description of the Planning Area

2.1 History

Bayfield County (originally LaPointe County) was created in 1865 and is named after British Naval Lieutenant Henry Bayfield, who first surveyed this area of the Great Lakes Region. Historically, Bayfield County's economy has been based on lumbering, fishing, and quarrying but has since become renowned as one of the Midwest's premiere tourism destinations.

2.2 Geography

Bayfield County, located in northwestern Wisconsin (approximate geographic center 46.30 degrees Lat, 90.17 degrees Long), is bounded on the west by Douglas County, south by Sawyer County and on the east by Ashland County. Bayfield County is the second largest county in geographic size in Wisconsin, encompassing 1,476.4 square miles. The county's spatial extent ranges from 30 miles east/west to nearly 60 miles north/south. Bayfield County has 86.2 miles of mainland shoreline on Lake Superior, the largest freshwater lake in the world. Four of the Apostle Islands (Eagle, Sand, York, and Raspberry) are also part of the county. In addition to Lake Superior, the county has a very diverse and extensive network of lakes (966), rivers, streams, and an abundant natural resource base.

Bayfield County is comprised of 25 unincorporated towns, two cities, one village, and one Indian reservation. Several small communities serve as the population centers for many towns, especially those along the Lake Superior shore.

2.2.1 Bayfield County Municipalities (2015 Population)

Town of Barksdale (792)	Town of Grand View (507)	Town of Washburn (532)
Town of Barnes (812)	Town of Hughes (515)	Village of Mason (76)
Town of Bayfield (746)	Town of Iron River (1,080)	City of Bayfield (544)
Town of Bayview (421)	Town of Kelly (398)	City of Washburn (2094)
Town of Bell (232)	Town of Oulu (496)	Town of Keystone (280)
Town of Cable (821)	Town of Pilsen (237)	Town of Lincoln (244)
Town of Clover (214)	Town of Port Wing (370)	Town of Mason (362)
Town of Delta (260)	Town of Russell (1262)	Town of Namakagon (255)
Town of Drummond (480)	Town of Tripp (212)	Town of Orienta (136)
Town of Eileen (672)		

Source: US Census Bureau, 2015 ACS

2.2.2 Unincorporated Communities

Barnes	Drummond	Iron River
Benoit	Grand View	Moquah
Cable	Herbster	Port Wing
Cornucopia	Ino	

2.2.3 Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin

In 1854, the Lake Superior Chippewa Indians entered into their last treaty with the United States. The Buffalo Subdivision reservation was created as part of this treaty for the Chief Buffalo subdivision of the

LaPointe Band of Lake Superior Chippewa Indians. Approximately 2,560 acres of land was allotted to great Chief Buffalo for his descendants to reside on. In 1863 a sequence of Presidential executive orders were issued to expand the boundaries of what is now the Red Cliff Reservation, which encompassed 14,166 acres by 1895.

- There is a total of 2,513 Red Cliff Tribal Members that live within Bayfield County
- There are a total of 5,312 total Red Cliff Tribal Members
- Approximately 43.7 percent of the Red Cliff Tribal Members live within the Reservation

Today, the Red Cliff Reservation and trust lands total about 14,541 acres. There is a total of 6,404 acres of tribally owned, 1,917 acres are individually allotted, and 6,220 acres are considered fee land. This area encompasses 22 miles of Lake Superior shoreline and about 46 miles of streams and rivers within the Red Cliff Reservation boundary.

In 2018, 76.8% of the population is in the labor force (excluding disabled population and the retired population that is not working)

Much of the above tribal information was made available from a tribal wide survey/count finished in May of 2018.

2.3 Geographic Province

Bayfield County is located in the glaciated region of Wisconsin and falls in two geographic provinces, the Northern Highland Province (north and south) and the Lake Superior Lowland Province. These provinces differ in diversity of flora and fauna, underlying geologic conditions, topography, soil conditions, and to some extent climate.

This description of the planning area addresses several elements through narrative and a series of maps and charts including:

- Population and Demographics
- Housing
- Outdoor Recreation
- Natural Environment
- Transportation
- Economic Conditions
- Coastal Resources
- Public and Community Facilities/Services

Population is an important contributing factor to both the pattern of settlement and development of a municipal unit. Significant increases or decreases in the number of inhabitants, along with the characteristics of income, education, and age, will impact economic development, land use, transportation, and use of public and private services. Examining past changes and present conditions in the population enhances the ability to prepare for and understand the future.

2.4.1 Historical Summary

Since its creation by the state legislature in 1865, Bayfield County (originally LaPointe County) has experienced periods of population growth and decline. In its first 20-some years of existence, the

county’s total population did not exceed 600 inhabitants. The introduction of railroads into the county in the 1880s, coupled with the development of mining and timber resources in the area, brought in numerous settlers, resulting in a period of growth peaking in 1920. Table 1 below displays the county’s historical population from 1850 to 1940.

Table 1: Bayfield County Historical Population, 1850 - 1950

1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950
489	353	344	564	7,390	14,392	15,987	17,201	15,006	15,827	13,760

Source: 1850-1890 - State of Wisconsin Census (discontinued after 1895) 1900-1950 US Census

2.4.2 Present Conditions

From 1950 to 1960 the County’s population decreased by 13.4 percent and from 1960 to 1970 it decreased by only 1.9 percent. From 1970 to 1980 the population rose by 186 (18.3%) inhabitants. The population steady increased, gaining 1,191 persons from 1980 to 2000. However, from 2000 to 2010, the County’s population only grew by one person. The American Community Survey has estimated a population of 15,050 for 2015. Table 2 displays population projections for the county generated by the Wisconsin Department of Administration (DOA) through 2040. It should be noted the DOA’s population projections are mathematical population estimates based on historical growth rates fertility, mortality, and migration rates. Other forces or dynamics that may affect future trends may include new developments or infrastructure such as subdivisions or public sewer and water that accommodate population growth, unforeseen business growth, or increases in the number of retirees locating in the county.

Table 2: Bayfield County Historical Population and Population Projections 1960-2040

1960	1970	1980	1990	2000	2010	2015	2020	2025	2030	2035	2040
11,910	11,683	13,822	14,008	15,013	15,014	15,050	15,105	15,100	14,860	14,330	13,725

Source: 1956-2010 - US Census, 2015 ACS, 2020-2040 - Wisconsin Department of Administration, Demographic Services

2.4.3 Countywide Population Trends

From 1950 to 1970, the County’s population declined substantially. Beginning in 1970, the county and unincorporated units show a continual increase through 2010 while the incorporated areas show a slight decline. The Village of Mason has steadily decreased since 1960. Projections to the year 2040 indicate that these trends are to continue with unincorporated areas to remain on a steady increase (see Tables 3 and 4).

Table 3 indicates the population of each civil division and their change in population from 1950 to 2015. Of the County’s 28 civil divisions, 12 units sustained a loss of population while the entire county reported a net gain of 9.51 percent for the period. Fifteen of Bayfield County’s 25 towns indicated growth, with all unincorporated areas averaging a 17.81 percent increase since 1950. This period, 1950 to 2015, marked the beginning of the trends identified above; increased seasonal home construction, conversion of seasonal homes to permanent residences, and an influx of individuals seeking aesthetically pleasing places to live. It should also be noted that during this period, the housing collapse and economic recession began (approximately 2008). This affected the housing market significantly, as well as employment and financial characteristic.

Table 3: Bayfield County Historical Population, 1950-2015

Municipality	1950	1960	1970	1980	1990	2000	2010	2015	Change: 1950 to 2015	
									Number	Percent
Towns										
Barksdale	573	585	574	762	756	801	723	792	219	38.22%
Barnes	226	194	311	493	473	610	769	812	586	259.29%
Bayfield	551	474	503	607	603	625	680	746	195	35.39%
Bayview	330	296	297	343	402	491	487	421	91	27.58%
Bell	301	238	205	247	237	230	263	232	-69	-22.92%
Cable	680	622	738	831	817	836	825	821	141	20.74%
Clover	430	274	277	254	213	211	223	214	-216	-50.23%
Delta	147	160	150	205	215	235	273	260	113	76.87%
Drummond	425	368	349	442	417	541	463	480	55	12.94%
Eileen	654	618	599	664	665	640	681	672	18	2.75%
Grand View	450	387	370	440	419	483	468	507	57	12.67%
Hughes	174	128	174	290	334	408	383	515	341	195.98%
Iron River	850	711	716	991	901	1,059	1,123	1,080	230	27.06%
Kelly	485	371	336	354	383	377	463	398	-87	-17.94%
Keystone	365	339	314	344	320	369	378	280	-85	-23.29%
Lincoln	320	254	206	280	294	293	287	244	-76	-23.75%
Mason	445	351	304	304	296	326	315	362	-83	-18.65%
Namakagon	205	125	224	286	276	285	246	255	50	24.39%
Oriente	187	116	108	109	114	101	122	136	-51	-27.27%
Oulu	725	649	505	547	513	540	527	496	-229	-31.59%
Pilsen	266	265	193	222	203	203	210	237	-29	-10.90%
Port Wing	588	487	385	525	434	420	368	370	-218	-37.07%
Russell	526	419	475	791	978	1,216	1,279	1,262	736	139.92%
Tripp	198	196	138	145	182	209	231	212	14	7.07%
Washburn	370	318	282	386	490	541	530	532	162	43.78%
TOTAL	10,471	8,945	8,733	10,862	10,935	12,050	12,317	12,336	1,865	17.81%
Tribal Lands										
Red Cliff Reservation	NA	NA	NA	686	857	1,078	1,123	1,146	460	53.68%
Villages										
Mason	140	100	119	102	102	72	93	76	-64	-45.71%
Cities										
Bayfield	1,153	969	874	778	686	611	487	544	-609	-52.82%
Washburn	2,070	1,896	1,957	2,080	2,285	2,280	2,117	2,094	24	1.16%
TOTAL	3,363	2,965	2,950	2,960	3,073	2,963	2,697	2,638	-725	-21.56%
BAYFIELD COUNTY	13,834	12,010	11,802	13,924	14,110	15,085	15,107	15,050	1,316	9.51%

Source: US Census Bureau and Red Cliff Band of Lake Superior Chippewa. Note: The Town of Cable figures for 1950, 1960, 1970 and 1980 include the Village of Cable. This dissolved into the Town of Cable in 1984. *Red Cliff Reservation numbers are calculated as part of the towns it lies within, primarily the Town of Russell and Town of Bayfield.

2.4.4 Projected Changes Through 2040

Table 4 indicates population projections for the civil divisions through the year 2040. Bayfield County is expected to retain a stable population through 2040. The projection shows a total net decrease of 8.59% or 1,289 residents from 2010 to 2040. The largest decreases in population will be in the Cities of Bayfield and Washburn.

Table 4: Bayfield County Population Projections, 2010-2040

Municipality	2010	2015	2020	2025	2030	2035	2040	Change: 2020-2040	
								Number	Percent
Towns									
Barksdale	723	792	695	675	645	600	560	-163	-22.54%
Barnes	769	812	820	855	870	875	860	91	11.83%
Bayfield	680	746	715	730	735	720	705	25	3.68%
Bayview	487	421	500	505	500	485	470	-17	-3.49%
Bell	263	232	275	285	285	280	275	12	4.56%
Cable	825	821	825	820	800	770	730	-95	-11.52%
Clover	223	214	215	215	210	200	190	-33	-14.80%
Delta	273	260	280	285	285	280	275	2	0.73%
Drummond	463	480	425	410	385	355	325	-138	-29.81%
Eileen	681	672	685	685	675	655	630	-51	-7.49%
Grand View	468	507	470	475	465	450	430	-38	-8.12%
Hughes	383	515	385	385	375	360	345	-38	-9.92%
Iron River	1,123	1,080	1,185	1,210	1,220	1,200	1,170	47	4.19%
Kelly	463	398	485	500	510	505	495	32	6.91%
Keystone	378	280	370	370	365	350	335	-43	-11.38%
Lincoln	287	244	285	280	270	260	245	-42	-14.63%
Mason	315	362	320	320	315	305	290	-25	-7.94%
Namakagon	246	255	240	230	220	205	190	-56	-22.76%
Oriente	122	136	125	125	125	125	120	-2	-1.64%
Oulu	527	496	520	515	500	475	450	-77	-14.61%
Pilsen	210	237	220	225	225	220	215	5	2.38%
Port Wing	368	370	360	350	335	315	295	-73	-19.84%
Russell	1,279	1,262	1,365	1,395	1,415	1,395	1,370	91	7.11%
Tripp	231	212	255	265	270	270	265	34	14.72%
Washburn	530	532	540	540	535	515	495	-35	-6.60%
TOTAL	12,317	12,336	12,560	12,650	12,535	12,170	11,730	-587	-4.77%
Tribal Lands									
Red Cliff Reservation	2,513	NA	NA						
Villages									
Mason	93	76	95	95	95	95	90	-3	-3.23%
Cities									
Bayfield	487	544	455	435	410	375	345	-142	-29.16%
Washburn	2,117	2,094	1,995	1,920	1,820	1,690	1,560	-557	-26.31%

TOTAL	2,697	2,638	2,450	2,355	2,230	2,065	1,905	-792	-29.37%
BAYFIELD COUNTY	15,014	15,050	15,105	15,100	14,860	14,330	13,725	-1289	-8.59%

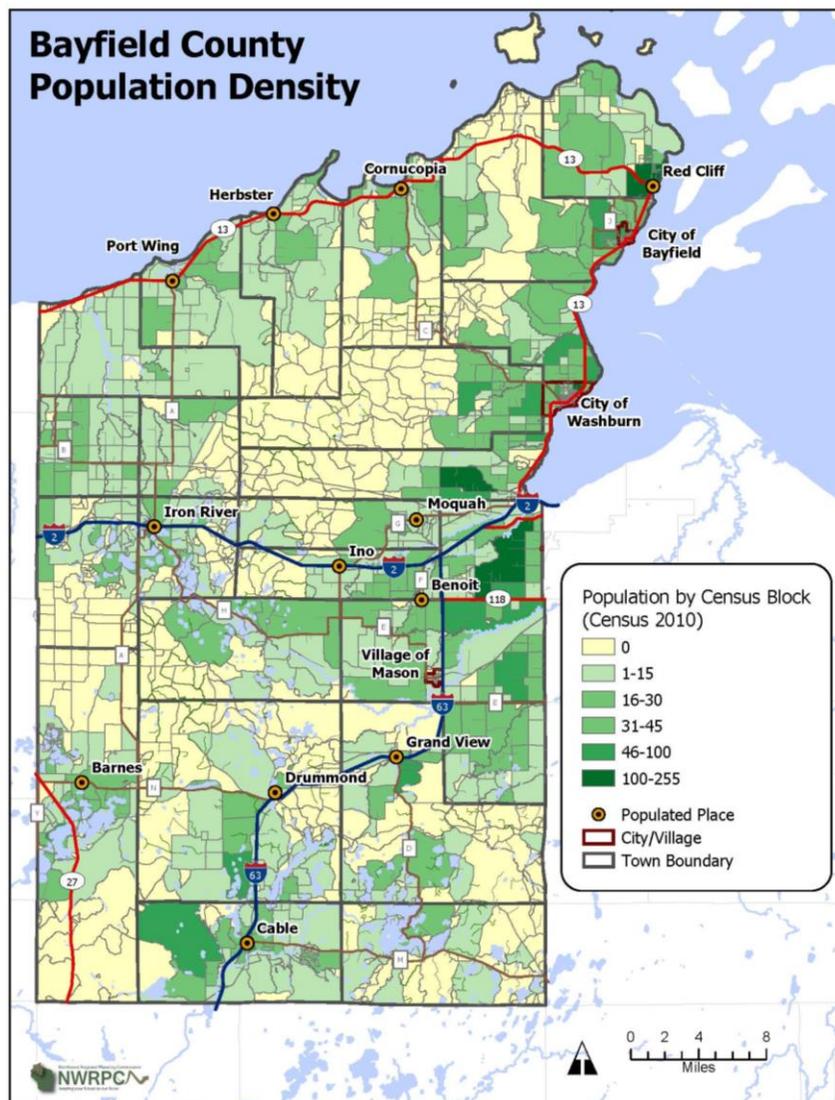
Source: US Census Bureau and Red Cliff Band of Lake Superior Chippewa. Note: The Town of Cable figures for 1950, 1960, 1970 and 1980 include the Village of Cable. This dissolved into the Town of Cable in 1984. *Red Cliff Reservation numbers are calculated as part of the towns it lies within, primarily the Town of Russell and Town of Bayfield

The Red Cliff Indian Reservation, which is located at the northeast tip of Bayfield County in the Town of Russell, comprises approximately half of the total acres in the Town of Russell. Native Americans of the Red Cliff band inhabit three-fourths of the Town of Russell, which has the largest population of any town in the county at 1,922 residents in 2010. Since 1950, the Town of Russell increased by 1,396 people.

Existing Population Density

The Population Density map below illustrates the population density throughout Bayfield County in 2010 (US Census data). As is shown, much of Bayfield County has a low population density—at ten persons per square mile or less—with higher densities found along the inland lakeshore areas and along major roadways.

Map 1: Bayfield County Population Density



2.4.7 Change from 2000 to 2015

Table 3 illustrates population changes in the individual municipal divisions of the county for the periods from 1950 to 2015. During this period, 17 municipal divisions experienced growth. The largest increases took place in the Towns of Barnes, Russell, and Hughes. The same 50-year period saw declines in the City of Bayfield, Village of Mason and Towns of Bell, Clover, Kelly, Lincoln, Mason, Orienta, Oulu, Pilsen, and Port Wing. Projections through 2040, illustrated in Table 4, indicate many of these trends to continue.

2.5 Age Distribution and Demographics

2.5.1 Summary of Changes in Population Age

In the decade from 2000 to 2010, the US Census reports a gain of 1,273 inhabitants for Bayfield County, a 19 percent increase in population. However, this increase was not uniform to all age groups within the county. The greatest changes for specific age groups (in absolute numbers) for the decade were the increase in persons aged 55 to 64 and 65 to 74. Table 5 details the demographic changes encountered by Bayfield County for the decade between 2000 and 2010.

One can see in the following chart how the age ranges differ between Bayfield County’s population and that of Wisconsin’s as a whole. The median age in Wisconsin is 38.4, while Bayfield County has a median age of 50.8. The Wisconsin Department of Administration projects that the population in Bayfield County will continue to be significantly older than Wisconsin well into the future.

Table 5: Bayfield County Age Change, 2000 - 2015

Age Category	2000	2010	2015	2000-2015 Change	
				Number	Percent
Under 5	794	664	617	-177	-22.29%
5 to 14	2175	1626	1595	-580	-26.65%
15 to 24	1527	1314	1400	-127	-8.34%
25 to 34	1401	1263	1249	-152	-10.84%
35 to 44	2379	1587	1430	-949	-39.90%
45 to 54	2452	2636	2318	-134	-5.48%
55 to 64	1821	2812	2965	1144	62.81%
65 to 74	1341	1867	2152	811	60.49%
75 to 84	836	896	993	157	18.82%
85 and over	287	349	331	44	15.33%
Selected Age categories					
All inhabitants over 75	1123	1245	1324	201	17.90%
All inhabitants over 65	2464	3112	3477	1013	41.11%
All inhabitants 45 to 64	4273	5448	5283	1010	23.64%
All inhabitants under 24	4496	3604	3612	-884	-19.66%
All inhabitants under 14	2969	2290	2212	-757	-25.50%
Total Population	15013	15014	15050	37	0.25%

Source: Calculated from US Census Bureau, and 2015 ACS

Table 6: Median Age (in years old)

1990	2000	2010	2015
37.1	42.1	49.4	50.8

Source: US Census Bureau, 2015 ACS

2.6 *Factors Affecting Population and Demographic Change*

Bayfield County is experiencing trends common to other counties in the northern portion of Wisconsin:

- A growing population of elderly (age 85 and over) inhabitants who remain, have family or other ties to the area;
- An influx of 45 to 54 year olds who are generally well educated, without children or with few children, and seek a tranquil setting to reside or start businesses;
- An increase of retired individuals (55 and over) who have spent their working career elsewhere and are now establishing a residence in the county or converting their summer home or seasonal dwelling into a permanent residence;
- A decrease in infants born into or moving with families into the county;
- An overall decrease in persons between the ages of 15 and 34; as this age group is most likely to seek employment and educational opportunities elsewhere.

These demographic changes are by no means uniform throughout all municipal units of the county, as several municipal units deviate from the overall county trends.

2.7 *Population Summary*

Two central trends are evident in examining the projections through 2030. First, towns that are remote or lack the traditional amenities for recreation or seasonal home construction (desirable lakefront property, ideal secluded building sites, proximity to recreational sites and activities) are projected to grow more slowly or experience a declining population. Secondly, civil divisions that have these amenities are projected to sustain a higher continued population growth.

Other population changes include an estimated 37.4% of the total population in 2025 will be 65 or older. The working age population will decline 35% and the loss of in-school population will amount to 30% over the next 30 years. This increase in the aging population throughout the County may pose challenges to various hazards the County faces. Some of these challenges may include difficulties with evacuation, caring for and finding adequate facilities for the displaced elderly population and explanation and caring for citizens affected by dementia and other mental health challenges.

2.8 *Income Levels*

County-wide, the median household income rose nearly 30 percent from 2000 to 2010. Most of the rural towns saw growth, while the Village of Mason and the City of Bayfield saw rather significant declines. Median household income is the median sum of money received in a calendar year by all household members 15 years of age and older, including household members not related to the householder, people living alone, and other nonfamily household members. Because many households consist of only one person, average household income is usually less than average family income.

Table 7: Median Household Income from 2000 to 2015

Municipality	2000	2010	2015	2000 - 2015 Change	
				Number	Percent
Towns					
Barksdale	\$45,714	\$65,694	\$61,964	\$16,250	35.55%
Barnes	\$28,250	\$50,284	\$56,250	\$28,000	99.12%
Bayfield	\$39,342	\$41,637	\$55,000	\$15,658	39.80%
Bayview	\$46,500	\$62,578	\$59,375	\$12,875	27.69%
Bell	\$29,688	\$50,417	\$45,875	\$16,187	54.52%
Cable	\$31,250	\$31,759	\$33,125	\$1,875	6.00%
Clover	\$27,875	\$30,750	\$49,688	\$21,813	78.25%
Delta	\$37,679	\$61,250	\$63,438	\$25,759	68.36%
Drummond	\$37,500	\$47,188	\$33,958	-\$3,542	-9.45%
Eileen	\$44,844	\$55,921	\$56,719	\$11,875	26.48%
Grand View	\$25,000	\$42,250	\$41,591	\$16,591	66.36%
Hughes	\$37,125	\$51,625	\$52,440	\$15,315	41.25%
Iron River	\$28,796	\$36,000	\$43,042	\$14,246	49.47%
Kelly	\$33,125	\$55,893	\$50,750	\$17,625	53.21%
Keystone	\$40,500	\$50,375	\$45,313	\$4,813	11.88%
Lincoln	\$27,917	\$42,847	\$39,167	\$11,250	40.30%
Mason	\$34,231	\$56,250	\$45,417	\$11,186	32.68%
Namakagon	\$20,625	\$44,688	\$49,375	\$28,750	139.39%
Orienta	\$33,333	\$42,188	\$42,500	\$9,167	27.50%
Oulu	\$35,625	\$47,361	\$48,929	\$13,304	37.34%
Pilsen	\$45,000	\$36,944	\$56,250	\$11,250	25.00%
Port Wing	\$30,000	\$31,985	\$38,542	\$8,542	28.47%
Russell	\$25,114	\$24,071	\$38,917	\$13,803	54.96%
Tripp	\$35,000	\$51,250	\$53,250	\$18,250	52.14%
Washburn	\$46,500	\$46,645	\$71,071	\$24,571	52.84%
Tribal Lands					
Red Cliff Reservation	\$24,412	\$23,299	\$38,167	\$13,755	56.35%
Villages					
Mason	\$32,917	\$26,875	\$42,813	\$9,896	30.06%
Cities					
Bayfield	\$32,266	\$29,167	\$41,094	\$8,828	27.36%
Washburn	\$33,257	\$43,036	\$40,319	\$7,062	21.23%
BAYFIELD COUNTY	\$33,390	\$43,176	\$46,665	\$13,275	39.76%

Source: US Census Bureau, 2015 ACS

A similar pattern can be seen when looking at median family incomes. A family consists of two or more people related by birth, marriage, or adoption residing in the same housing unit. Overall, the County saw this category grow approximately 36 percent, with the largest increases coming in the towns.

Per capita income grew more uniformly, with the county seeing over a 45 percent increase from 2000 to 2010. The only community to see a decline in per capital income was the Town of Orienta.

Table 8: Per Capita Income - 2000 to 2015

Municipality	2000	2010	2015	2000 - 2015 Change	
				Number	Percent
Towns					
Barksdale	\$19,680	\$33,384	\$30,893	\$11,213	56.98%
Barnes	\$16,406	\$28,619	\$31,142	\$14,736	89.82%
Bayfield	\$17,890	\$23,126	\$29,420	\$11,530	64.45%
Bayview	\$24,083	\$27,680	\$39,117	\$15,034	62.43%
Bell	\$18,683	\$36,216	\$32,619	\$13,936	74.59%
Cable	\$16,985	\$21,695	\$23,555	\$6,570	38.68%
Clover	\$15,355	\$31,072	\$30,160	\$14,805	96.42%
Delta	\$19,697	\$33,494	\$34,418	\$14,721	74.74%
Drummond	\$16,773	\$21,273	\$26,242	\$9,469	56.45%
Eileen	\$19,530	\$25,669	\$28,866	\$9,336	47.80%
Grand View	\$14,052	\$26,933	\$25,147	\$11,095	78.96%
Hughes	\$17,373	\$27,911	\$25,513	\$8,140	46.85%
Iron River	\$16,449	\$21,609	\$28,131	\$11,682	71.02%
Kelly	\$15,525	\$24,599	\$23,973	\$8,448	54.42%
Keystone	\$15,638	\$19,726	\$28,006	\$12,368	79.09%
Lincoln	\$13,530	\$22,541	\$23,523	\$9,993	73.86%
Mason	\$13,814	\$21,802	\$19,788	\$5,974	43.25%
Namakagon	\$17,576	\$31,567	\$40,157	\$22,581	128.48%
Oriente	\$19,775	\$18,679	\$31,540	\$11,765	59.49%
Oulu	\$15,017	\$18,061	\$20,839	\$5,822	38.77%
Pilsen	\$17,895	\$20,292	\$22,453	\$4,558	25.47%
Port Wing	\$17,355	\$19,755	\$28,736	\$11,381	65.58%
Russell	\$10,387	\$12,719	\$16,049	\$5,662	54.51%
Tripp	\$12,653	\$21,069	\$24,135	\$11,482	90.75%
Washburn	\$17,892	\$23,980	\$29,995	\$12,103	67.64%
Tribal Lands					
Red Cliff Reservation	\$9,497	\$12,015	\$15,617	\$6,120	64.44%
Villages					
Mason	\$12,742	\$24,512	NA	NA	NA
Cities					
Bayfield	\$18,377	\$23,296	\$26,153	\$7,776	42.31%
Washburn	\$15,331	\$25,431	\$24,776	\$9,445	61.61%
BAYFIELD COUNTY	\$16,407	\$24,028	\$26,485	\$10,078	61.43%

Source: US Census Bureau, 2015 ACS

2.9 Household Characteristics

2.9.1 Households

An analysis of the households in the county helps to establish a generalized understanding of the lives of the county’s inhabitants and an insight into community life. Understanding household composition and condition is essential in assessing future needs of the county’s inhabitants.

Table 9: Bayfield County Household Characteristics, 2015

Characteristic	Total	Percent of Households
Average Household Size	2.16	N/A
Average Family Size	2.66	N/A
Family Households	4,354	62.93%
Non Family Households	2,565	37.07%
Total Households	6,919	100.00%

Source: U. S. Census Bureau, 2015 ACS. Note: Percentages are not cumulative; they are representative subsets of the total percentage of households

The US Census identified 6,686 households in Bayfield County in 2010, an increase of 7.7 percent from 2000. Of all households, 4,368 (65.3%) are reported as family households and 1,932 (34.7%) are reported as non-family households.

2.10 Housing

Adequate housing is a cornerstone of every community. The ability of a county to address the demand for housing is key to its economic viability and the well-being of its inhabitants. By studying changes in the number of housing units and other housing characteristics, we are able to gain insight into changes taking place within the county. Changes in housing characteristics and numbers can and do signal changes occurring within local municipalities and the county.

2.10.1 Total Housing Units

Total housing units in Bayfield County have been steadily increasing since 1980. According to the U.S. Census Bureau, total housing units in 1980 were recorded at 9,642 units. In the ten years from 1980 to 1990, 1,276 housing units were added, compared to only 722 from 1990 to 2000. From 2000 to 2010, 1,359 housing units were added. A total of 3,357 housing units were added to the county in the 30-year period from 1980 to 2010 for a total of 12,999 housing units, representing a 34.8 percent increase.

As mentioned earlier, the period from 2000 to 2010 saw a more significant increase in total housing units than from 1990-2000. A detailed breakdown of total housing units by local unit of government for 1980 to 2010 is shown in Table 7. Total housing unit change by local unit of government ranged from negative 6.5 percent (Village of Mason) to 153.5 percent (Town of Orienta).

2.10.2 Projected Change in Housing

For the period 1980 to 2010, Bayfield County exhibited a 34.8 percent increase in total housing units. The County is expected to see additional housing units in the coming decades, as the population continues to increase.

Table 10: Bayfield County Total Housing Units, 1980-2015

Municipality	1980	1990	2000	2010	2015	1980 - 2015 Change	
						Number	Percent
Towns							
Barksdale	284	318	353	371	419	135	47.54%
Barnes	1,049	1,307	1,486	1,564	1,509	460	43.85%
Bayfield	364	344	491	644	690	326	89.56%
Bay view	192	206	283	310	292	100	52.08%
Bell	343	364	412	514	519	176	51.31%
Cable	672	753	697	778	730	58	8.63%
Clover	255	263	364	416	404	149	58.43%
Delta	253	362	328	378	375	122	48.22%
Drummond	645	621	645	693	746	101	15.66%
Eileen	239	274	275	308	339	100	41.84%
Grand View	449	502	529	587	560	111	24.72%
Hughes	311	393	343	373	387	76	24.44%
Iron River	857	915	973	1,011	1,045	188	21.94%
Kelly	141	165	168	221	194	53	37.59%
Keystone	145	139	186	202	216	71	48.97%
Lincoln	150	178	191	226	221	71	47.33%
Mason	137	153	151	165	173	36	26.28%
Namakagon	536	625	532	596	644	108	20.15%
Oriente	101	151	201	256	278	177	175.25%
Oulu	237	263	267	304	291	54	22.78%
Pilsen	85	91	104	135	144	59	69.41%
Port Wing	282	314	356	365	317	35	12.41%
Russell	319	413	506	574	618	299	93.73%
Tripp	96	114	130	159	166	70	72.92%
Washburn	156	201	227	254	248	92	58.97%
TOTAL	8,298	9,429	10,198	11,404	11,525	3,227	38.89%
Tribal Lands							
Red Cliff Reservation	243	343	429	472	524	281	115.64%
Villages							
Mason	46	35	35	43	50	4	8.70%
Cities							
Bayfield	392	460	403	482	492	100	25.51%
Washburn	906	994	1,004	1,070	1,067	161	17.77%
TOTAL	1,344	1,489	1,442	1,595	1,559	215	16.00%
County							
BAYFIELD COUNTY	9,642	10,918	11,640	12,999	13,134	3,492	36.22%

Source: US Census Bureau and Red Cliff Band of Lake Superior Chippewa *Red Cliff Reservation numbers are also included in the Town of Russell's totals.

Table 11: Land Area and Total Housing Units Per Square Mile 1980-2015

Municipality	Area (sq. mi.)	1980	1990	2000	2010	2015	1980 - 2015 Change	
							Number	Percent
Towns								
Barksdale	55.2	5.1	5.7	6.4	6.7	7.6	2.5	48.83%
Barnes	117.8	8.9	11.1	12.6	13.3	12.8	3.9	43.93%
Bayfield	89.2	4.1	3.9	5.5	7.2	7.7	3.6	88.67%
Bayview	41.5	4.6	5	6.8	7.5	7.0	2.4	52.96%
Bell	59.7	5.8	6.1	6.9	8.6	8.7	2.9	49.89%
Cable	69.4	9.7	10.9	10.1	11.2	10.5	0.8	8.44%
Clover	59.6	4.3	4.4	6.1	7	6.8	2.5	57.64%
Delta	69.8	3.6	5.2	4.7	5.4	5.4	1.8	49.24%
Drummond	137.3	4.7	4.5	4.7	5	5.4	0.7	15.60%
Eileen	35.2	6.8	7.8	7.8	8.7	9.6	2.8	41.63%
Grand View	104.4	4.3	4.8	5.1	5.6	5.4	1.1	24.74%
Hughes	52.2	6	7.6	6.6	7.1	7.4	1.4	23.56%
Iron River	31.5	27.3	29.1	31	32.1	33.2	5.9	21.52%
Kelly	36.7	3.8	4.5	4.6	6	5.3	1.5	39.11%
Keystone	35.8	4.1	3.9	5.2	5.6	6.0	1.9	47.16%
Lincoln	35.5	4.2	5	5.4	6.4	6.2	2.0	48.22%
Mason	35.7	3.8	4.3	4.2	4.6	4.8	1.0	27.52%
Namakagon	65.1	8.2	9.6	8.2	9.1	9.9	1.7	20.64%
Oriente	54.1	1.9	2.8	3.7	4.7	5.1	3.2	170.45%
Oulu	35.4	6.7	7.4	7.5	8.6	8.2	1.5	22.69%
Pilsen	34.9	2.5	2.6	3	3.9	4.1	1.6	65.04%
Port Wing	46.7	6.1	6.7	7.6	7.8	6.8	0.7	11.28%
Russell	49.9	6.4	8.3	10.2	11.5	12.4	6.0	93.51%
Tripp	34.8	2.8	3.3	3.7	4.6	4.8	2.0	70.36%
Washburn	85.1	1.8	2.4	2.7	3	2.9	1.1	61.90%
Tribal Lands								
Red Cliff Reservation	22.7	10.7	15.1	18.9	20.8	23.1	12.4	115.74%
Villages								
Mason	0.7	92	70	70	60.5	71.4	-20.6	-22.36%
Cities								
Bayfield	0.9	560	657.1	575.7	560.3	546.7	-13.3	-2.38%
Washburn	3.9	232.3	254.9	257.4	274.5	273.6	41.3	17.77%
BAYFIELD COUNTY	1,477.90	6.5	7.4	7.9	8.8	8.9	2.4	36.72%

Source: US Census. *Red Cliff Reservation numbers are also included in the Town of Russell's totals.

2.10.3 Occupied Housing Units

The U.S. Census identifies 6,686 occupied housing units in Bayfield County in 2010. Of these, 5,457 (81.6%) are found in the county’s unincorporated areas. At present, the county maintains an overall average of 8.8 housing units per square mile.

2.10.4 Owner Occupied Units

Just less than one-half of all housing units in Bayfield County are owner occupied. The U.S. Census identified 5,465 (42.0% of all housing units) as owner occupied in 2010, representing a 6.6 percent increase for the county from 2000. The Census identifies 2.26 persons per owner-occupied housing unit in 2010.

Renter Occupied Units

The U.S. Census reports 1,221 renter occupied units in the county in 2010, comprising 18.3 percent of all occupied housing units, and an increase of 13.1 percent from 2000 Census. The Census identifies 2.06 persons per rental unit in 2010.

Seasonal/Recreational Housing Units

Table 13 displays seasonal housing units in Bayfield County from 1980 to 2015. Seasonal housing units are increasing throughout every municipal division in the county, with the exception of the Town of Hughes, which saw a one-unit decrease. In 2015, approximately 43.77 percent of total housing units were designated for seasonal, occasional, and/or recreational use.

Table 12: Bayfield County Occupied Housing Units 1980-2015

Municipality	1980	1999	2000	2010	2015	1980 - 2015 Change	
						Number	Percent
Towns							
Barksdale	247	275	303	306	318	71	28.74%
Barnes	209	220	278	397	408	199	95.22%
Bayfield	202	220	261	306	346	144	71.29%
Bayview	119	148	197	204	209	90	75.63%
Bell	113	105	115	139	139	26	23.01%
Cable	330	346	381	412	416	86	26.06%
Clover	106	90	99	116	117	11	10.38%
Delta	82	93	107	119	130	48	58.54%
Drummond	185	205	231	224	237	52	28.11%
Eileen	213	234	249	278	299	86	40.38%
Grand View	170	178	222	221	248	78	45.88%
Hughes	113	136	166	169	215	102	90.27%
Iron River	414	434	485	526	509	95	22.95%
Kelly	110	134	140	177	157	47	42.73%
Keystone	112	113	146	159	141	29	25.89%
Lincoln	91	115	118	129	120	29	31.87%
Mason	109	109	112	114	126	17	15.60%
Namakagon	128	132	149	132	147	19	14.84%

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Orienta	44	48	52	62	70	26	59.09%
Oulu	190	172	192	207	202	12	6.32%
Pilsen	70	67	84	99	87	17	24.29%
Port Wing	189	176	194	187	179	-10	-5.29%
Russell	217	309	406	461	475	258	118.89%
Tripp	55	67	78	91	92	37	67.27%
Washburn	134	159	189	222	220	86	64.18%
TOTAL	3,952	4,285	4,954	5,457	5,607	1,655	41.88%
Tribal Lands							
Red Cliff Reservation	179	259	347	392	428	249	139.11%
Villages							
Mason	39	33	26	34	33	-6	-15.38%
Cities							
Bayfield	325	306	289	261	273	-52	-16.00%
Washburn	794	891	938	934	1006	212	26.70%
TOTAL	1,158	1,230	1,253	1,229	1279	121	10.45%
County							
BAYFIELD COUNTY	5,110	5,515	6,207	6686	6919	1,809	35.40%

Source: US Census Bureau, 2015 ACS. *The 1980 figure also includes the data for the Village of Cable which dissolved in the Town of Cable in 1984.

**Red Cliff Reservation numbers are also included in the Town of Russell's totals.

Table 13: Bayfield County Seasonal Housing Units 1980-2015

Municipality	1980*	1999	2000	2010	2015	1980 - 2015 Change	
						Number	Percent
Towns							
Barksdale	12	22	29	44	75	63	525.00%
Barnes	788	1,051	1,160	1,141	1,017	229	29.06%
Bayfield	60	97	200	288	308	248	413.33%
Bay view	16	49	77	96	68	52	325.00%
Bell	206	244	284	345	339	133	64.56%
Cable	171	293	284	314	254	83	48.54%
Clover	131	159	252	278	258	127	96.95%
Delta	158	259	200	245	228	70	44.30%
Drummond	393	384	397	438	474	81	20.61%
Eileen	9	15	19	8	26	17	188.89%
Grand View	228	290	294	341	272	44	19.30%
Hughes	156	216	165	191	155	-1	-0.64%
Iron River	329	430	403	437	417	88	26.75%
Kelly	8	17	18	32	30	22	275.00%
Keystone	18	20	35	30	66	48	266.67%
Lincoln	36	53	64	89	86	50	138.89%

Mason	9	21	35	40	39	30	333.33%
Namakagon	292	371	374	421	439	147	50.34%
Orienta	46	97	140	192	199	153	332.61%
Oulu	11	49	52	82	84	73	663.64%
Pilsen	9	13	18	29	47	38	422.22%
Port Wing	20	89	137	159	130	110	550.00%
Russell	24	52	83	74	101	77	320.83%
Tripp	21	29	45	59	68	47	223.81%
Washburn	3	13	28	27	28	25	833.33%
TOTAL	3,154	4,333	4,793	5,400	5,208	2054	65.12%
Tribal Lands							
Red Cliff Reservation	42	43	65	51	58	16	38.10%
Villages							
Mason	0	3	7	4	4	4	400.00%
Cities							
Bayfield	2	65	91	110	145	143	7150.00%
Washburn	3	29	31	68	29	26	866.67%
TOTAL	5	97	129	182	174	169	3380.00%
County							
BAYFIELD COUNTY	3,159	4,430	4,922	5,582	5,386	2227	70.50%

Source: US Census. *Please note: The 1980 Census did not designate a specific category for Seasonal Housing Units. The 1980 figures are the number of Year-Around Housing Units subtracted from the Total Housing Units and may not be the most accurate gauge of Seasonal Housing Units in Bayfield County. There are included here as a point of reference only. **Red Cliff Reservation numbers are also included in the Town of Russell's totals.

2.11 Housing Density

2.11.1 Total Housing Density

Figure 3 and Figure 4 indicates Bayfield County's position in total housing unit density for the 60-year period from 1940 to 2000. The data reveals the pattern of housing development per square mile for Bayfield County. Housing density has increased since 1940 as second home construction has flourished and permanent residents have moved out into the rural areas.

2.11.2 Housing Unit Density

Map 3.2 and 3.3 illustrates housing unit density from both the 2000 and 2010 federal Census. The maps clearly reveal the pattern of development within the incorporated units along lakeshore and riverfront property and along the major highway corridors. Of note, sizeable areas of the county have eight or fewer housing units per square mile.

2.12 Housing Stock

2.12.1 Age of Housing Stock

The 2010 American Community Survey (ACS) reports that 27 percent of all housing units in Bayfield County were constructed between 1990 and 2010, while 53.4 percent were constructed between 1940 and 1980, and 19.6 percent constructed before 1939. Table 11 indicates in more detail the age of the county’s housing stock.

Table 14: Age of Bayfield County Housing Stock

Year Structure Built	Structures	
	Number	Percentage
2014 or later	13	0.10%
2010 to 2013	144	1.10%
2000 to 2009	2,305	17.55%
1990 to 1999	2,184	16.63%
1980 to 1989	1,550	11.80%
1970 to 1979	2,206	16.80%
1960 to 1969	861	6.56%
1950 to 1959	958	7.29%
1940 to 1949	775	5.90%
1939 or earlier	2,138	16.28%
Total	13,134	100.00%

Source: US Census Bureau, 2015 ACS

2.12.2 Drinking Water Access

Based on 1990 U.S. Census data of the county’s 10,918 total housing units in 1990, 2,359 (21.6%) have access to water through either public or private water works, 7,596 (69.6%) using an individual drilled well, 297 (2.7%) using an individual dug well, and 666 (6.1%) using some other source of water. Most of Bayfield County’s rural areas do not have access to municipal water systems and rely on individual wells for their water supply. This data has not been collected in more recent Censuses; however a significant majority of housing units are still on private wells.

2.12.3 Sewer Access

Based on 1990 U.S. Census data, of the county’s 10,918 total housing units, 2,548 (23.3%) have access to a public sewer, 7,247 (66.4%) make use of a septic tank or private outside waste treatment system, while 1,096 (10.0%) identified some other means of waste disposal. As of 2012, the Bayfield County zoning office tracks septic tank usage. In October of 2012, the County was tracking 7,150 septic systems and 1,664 holding systems. Most rural towns in the county do not have access to sewage and wastewater systems and rely on holding tanks, drain fields, and private septic systems for waste disposal. At present, all incorporated municipal units of government in Bayfield County have sewer and wastewater systems in place and, in several instances, extend their systems to adjoining, unincorporated units of government. Table 12 summarizes sewer and wastewater treatment systems currently in use in Bayfield County.

Table 15: Sewer and Wastewater Treatment Systems in Bayfield County

Municipal Systems	
Location	Type of System
City of Washburn	Collection & Treatment
City of Bayfield	Collection & Treatment
Village of Mason	Collection & Treatment
Town of Port Wing	Collection & Treatment
Clover Sanitary District	Collection & Treatment
Bell Sanitary District	Collection & Treatment
Iron River Sanitary District	Collection & Treatment
Pikes Bay San. District and Town of Bayfield	Collection & Treatment
Grand View Sanitary District	Collection & Treatment
Drummond Sanitary District	Collection & Treatment
Cable Sanitary District	Collection & Treatment
Telemark Resort (Cable)	Activate & Treatment
Great Lakes Visitor Center	Collection & Treatment
Red Cliff San. District (Town of Russell)	Collection & Treatment

2.12.4 Heating Fuel

According to 2010 Census data, of the county’s 6,990 occupied housing units, 75.6 percent are identified as using utility gas, bottled, tank, or LP gas as their primary source of heat. Table 13 illustrates in detail the type heating fuel in use by Bayfield County’s occupied housing units.

Table 16: Heating Fuel of Bayfield County Housing Stock - 2015

House Heating Fuel	Occupied Units	
	Number	Percentage
Utility Gas	1576	22.78%
Bottled, Tank, or LP Gas	2590	37.43%
Electricity	832	12.02%
Fuel Oil, Kerosene	479	6.92%
Coal or Coke	2	0.03%
Wood	1320	19.08%
Solar Energy	5	0.07%
Other Fuel	89	1.29%
No Fuels Used	26	0.38%
Total	6,919	100.00%

Source: US Census Bureau, 2015 ACS

2.12.5 Structural Characteristics

According to the 2010 American Community Survey (ACS), of the 12,842 total units, 10,827 (84.3%) are identified as 1-unit detached, 100 (0.8%) as 1-unit attached, 480 (3.8%) as having 2 to 4 attached units,

239 (1.9%) as having 5 to 9 attached units, and 186 (1.5%) as having 10 or more attached units. Additionally, 1,010 units (7.9% of total units) are identified as mobile home, trailer, or other housing type.

2.12.6 Select Housing Characteristics

According to 2010 ACS, of the total 12,842 housing units, 163 (2.3%) were identified as lacking complete plumbing facilities, while 141 (2.0%) were identified as lacking complete kitchen facilities.

2.12.7 Housing Value

According to 2010 Census data, 3,103 homes were mortgaged, while 2,613 were not mortgaged. The median monthly payment for mortgaged units is \$1,168 and \$416 for non-mortgaged housing units. The median value of an existing owner-occupied home was identified at \$157,300. Tables 14 through 18 offer a more detailed view of home value and monthly owner costs for mortgaged and non-mortgaged homes in Bayfield County as well as data on gross rental costs.

Table 17: Home Value of Owner-Occupied Units - 2015

Home Value	Bayfield County		Wisconsin		United States	
	Units	Percentage	Units	Percentage	Units	Percentage
Less than \$50,000	405	7.12%	86,903	5.62%	6,768,763	9.06%
\$50,000 to \$99,999	1,059	18.61%	224,900	14.54%	11,461,502	15.34%
\$100,000 to \$149,999	1,034	18.17%	341,383	22.06%	11,804,066	15.80%
\$150,000 to \$199,999	1,120	19.68%	325,457	21.04%	11,244,363	15.05%
\$200,000 to \$299,999	1,163	20.44%	341,329	22.06%	13,637,664	18.25%
\$300,000 to \$499,999	643	11.30%	170,480	11.02%	11,822,996	15.82%
\$500,000 to \$999,999	227	3.99%	46,512	3.01%	6,302,238	8.44%
\$1,000,000 or more	40	0.70%	10,223	0.66%	1,670,499	2.24%
Total	5,691	100%	1,547,187	100%	74,712,091	100%

Source: US Census Bureau, 2015 ACS

Table 18: Mortgage Status and Selected Monthly Owner Costs - 2015

Monthly Housing Cost	Bayfield County		Wisconsin	
	Units	Percentage	Units	Percentage
Less than \$400 per month	49	1.60%	4,065	0.40%
\$400 to \$599 per month	189	6.20%	23,373	2.30%
\$600 to \$799 per month	390	12.80%	69,104	6.80%
\$800 to \$999 per month	484	15.90%	118,900	11.70%
\$1,000 to \$1,499 per month	1,139	37.40%	362,797	35.70%
\$1,500 or more per month	795	26.10%	438,000	43.10%
Total	3,046	100.00%	1,016,234	100.00%

Source: US Census Bureau, 2015 ACS

Table 19: Gross Rent (Renter Occupied Units) - 2015

Monthly Rental Cost	Bayfield County		Wisconsin	
	Units	Percentage	Units	Percentage
Less than \$200 per month	26	2.50%	7,745	1.08%
\$200 to \$299 per month	81	7.80%	24,660	3.43%
\$300 to \$499 per month	268	25.79%	65,824	9.15%
\$500 to \$749 per month	358	34.46%	233,525	32.46%
\$750 to \$999 per month	230	22.14%	220,391	30.63%
\$1,000 or more per month	76	7.31%	167,362	23.26%
No Cash Rent	189	n/a	32,403	n/a
Total	1,039	100.00%	719,507	100.00%

Source: US Census Bureau, 2015 ACS

Table 20: Monthly Owner Costs as a Percentage of Household Income - 2015

Percent of Household Income Spent on Housing Costs	Bayfield County		Wisconsin	
	Number	Percent	Number	Percent
Less than 15.0%	536	18.43%	216,637	21.50%
15.0% to 24.9%	1,048	36.04%	399,687	39.66%
25.0% to 34.9%	555	19.09%	189,830	18.84%
35.0% to 49.9%	354	12.17%	102,717	10.19%
50.0% or more	402	13.82%	95,633	9.49%
Not Computed	13	n/a	3,320	n/a
Total:	2,908	100.00%	1,007,824	100.00%

Source: US Census Bureau, 2015 ACS

Table 21: Gross Rent as a Percentage of Household Income - 2015

Percent of Household Income Spent on Rental Costs	Bayfield County		Wisconsin	
	Number	Percent	Number	Percent
Less than 20.0%	374	30.46%	194,569	25.88%
20.0% to 24.9%	101	8.22%	93,013	12.37%
25.0% to 29.9%	143	11.64%	83,402	11.09%
30.0% to 34.9%	133	10.83%	61,007	8.11%
35.0% to 49.9%	135	10.99%	105,752	14.06%
50% or more	153	12.46%	169,120	22.49%
Not Computed	153	n/a	169,120	n/a
Total	1,228	100.00%	751,910	100.00%

Source: US Census Bureau, 2015 ACS

2.12.8 Summary

As indicated by the 2015 American Community Survey, 25.73 percent of housing units in Bayfield County are valued at \$100,000 or less. Over 45.08 percent of owner occupied households are spending 25 percent or more of their total income on monthly housing costs, while 45.92 percent of renters are spending 25 percent or more of their income on rental units.

2.12.9 Housing Trends

As indicated in the population section of this plan, Bayfield County is expected to have a decreasing population through the year 2040 (WI DOA), while at the same time sustaining an increase in total housing units. The central factors addressing this include seasonal home construction, demographic changes, and the availability of economic opportunities.

2.12.10 Demographic Changes Affecting Housing

In the years between 2000 and 2015, Bayfield County saw a consistent population. The impacts affecting housing are minimal.

3.0 Bayfield County Natural Hazards Mitigation Plan - Risk and Vulnerability

3.1 *Response Capabilities*

Bayfield County's ability to respond to an emergency event or situation begins with the countywide enhanced 9-1-1 system. Each landline 9-1-1 call made from within Bayfield County is routed to the Bayfield County 9-1-1 Public Safety Answering Point (PSAP) / county communications center. Wireless 9-1-1 calls may be routed to another county's PSAP based on location of the cell tower receiving the call. The call taker/dispatcher at the PSAP quickly gathers location and situational information and pages the appropriate emergency service agency to respond.

Response is based on service areas, facilities and equipment. Emergency response agencies are critical in protecting the citizens of Bayfield County. The existing response agencies, and the equipment they provide, address local needs and support regional needs. Bayfield County agencies provide mutual aid to one another as well as providing and receiving mutual aid from adjacent counties.

The following summary and description serves as an inventory of the emergency response agencies serving Bayfield County.

3.2 *Fire Services*

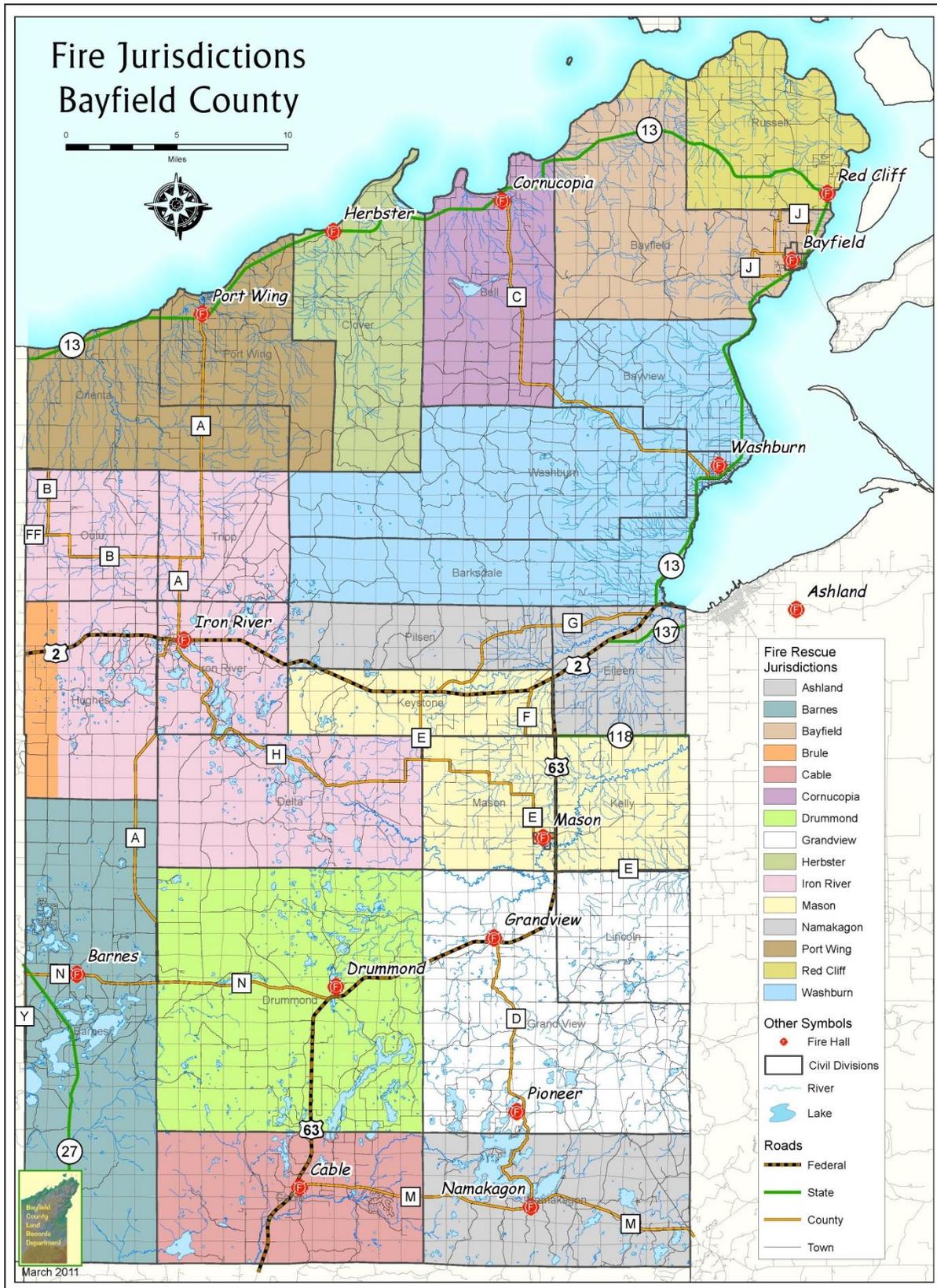
Fifteen fire departments provide fire protection within Bayfield County. Departments are dispatched thru the Bayfield County 9-1-1 PSAP. Apparatus and equipment resources are updated annually thru the Bayfield County Fire Association. The response areas are based upon local jurisdictional boundaries.

- ASHLAND – Ashland Fire Department is located within the City of Ashland and contract with the Town of Eileen and Pilsen for fire protection. They are a career department and are considered part of the state regional hazardous materials response system.
- BARNES – Barnes Fire Department serves the Town of Barnes – an area of 126 square miles – with two engines (pumping capacity) and one tender (water capacity).
- BAYFIELD – Bayfield Fire Department serves the City and Town of Bayfield with two engines and one tender – an area of over 90 square miles.
- BRULE – Brule Fire Department is contracted to respond into the western portion of the Town of Hughes – and area of 13 square miles. They maintain two engines and two tenders.
- CABLE – Cable Fire Department provides fire protection to the Town of Cable – an area of 72 square miles. They maintain one engine and one tender.
- CORNUCOPIA – Cornucopia Fire Department provides fire protection to the Town of Bell, an area over 60 square miles. They maintain one engine and one tender.
- DRUMMOND – Drummond Fire Department provides fire protection to the Town of Drummond, an area of 144 square miles. They maintain one engine and one tender.
- GRAND VIEW – Grand View Fire provides fire protection to the Towns of Grand View and Lincoln – an area of 144 square miles. They maintain two engines and two tenders.
- HERBSTER – Herbster Fire Department provides fire protection to the Town of Clover – an area of more than 60 square miles. They maintain one engine and one tender.
- IRON RIVER – Iron River Fire provides fire protection to the Towns of Delta, Hughes, Iron River, Oulu and Tripp – an area of over 234 square miles. They maintain three engines and two tenders.

- MASON – Mason Fire provides fire protection to the Towns of Kelly, Keystone, Mason, and the Village of Mason an area of 144 square miles. They maintain one engine and two tenders.
- NAMAKAGON – Namakagon Fire provides fire protection to the Town of Namakagon – an area of 72 square miles. They maintain three engines and one tender.
- PORT WING – Port Wing Fire provides fire protection to the Town of Port Wing – an area of more than 100 square miles. They maintain two engines and two tenders.
- RED CLIFF – Red Cliff Fire provides fire protection on Red Cliff Tribal Lands and the Town of Russell – an area of approximately 49 square miles. They maintain one engine and two tenders.
- WASHBURN – Washburn Fire provides fire protection to the City of Washburn and the Towns of Barksdale, Bayview, and Washburn – an area of 180 square miles. They maintain two engines and two tenders.

In addition to the apparatus listed, twelve of the departments maintain brush trucks, four-wheel drive vehicles carrying varying amounts of water. This type of apparatus is especially useful in the wild land fire scenario. All fire departments have cooperative agreements with and work closely with the Wisconsin Department of Natural Resources (DNR) and the US Forest Service to provide fire protection to structures in the wildland urban interface areas of the county.

Map 2: Bayfield County Fire Jurisdictions



3.2.1 Law Enforcement Agencies

The general welfare and protection of citizens during emergencies, both natural and man-made, is the responsibility of law enforcement.

Five law enforcement agencies provide service within Bayfield County: City of Bayfield Police, City of Washburn Police, Red Cliff Tribal Police, Town of Iron River Police and Bayfield County Sheriff's Office. The Sheriff's Office is statutorily responsible to provide law enforcement protection to all of Bayfield County – an area of nearly 1500 square miles. In addition, the Sheriff is the senior law enforcement officer in the county and has authority over resources in the law enforcement service during a major incident/emergency. If the incident is within the jurisdiction of a local police department, or constable, the Sheriff and the local law enforcement official shall coordinate the law enforcement response. If county law enforcement resources are exhausted, the Sheriff coordinates mutual aid directly with other agencies or through the Emergency Police Services (EPS) Area Director. A few towns have their own Town Constable, who can write citations and enforce local ordinances.

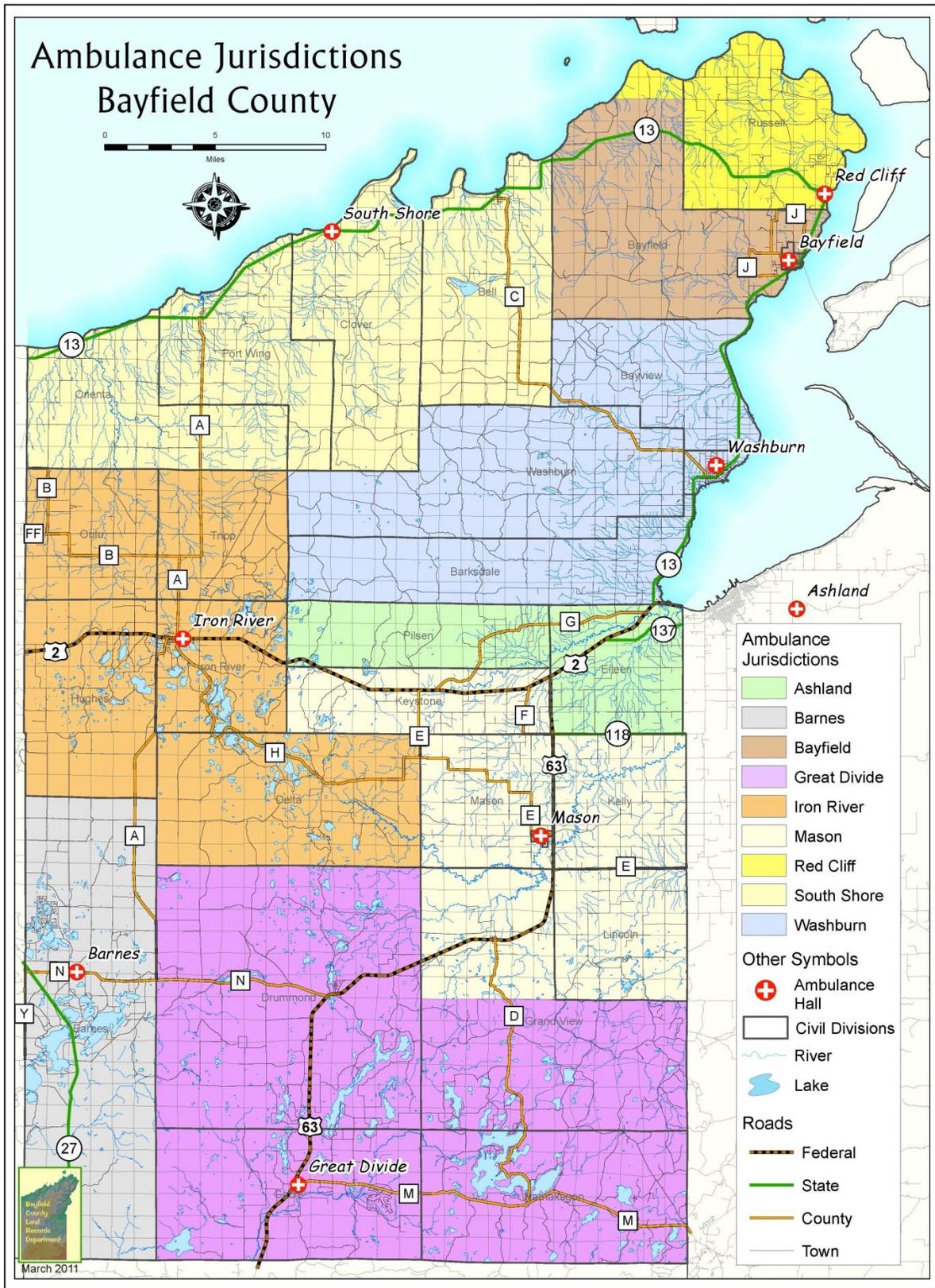
3.2.2 Ambulance Services

Nine ambulance services provide emergency medical response within Bayfield County. They are dispatched through the Bayfield County 9-1-1 PSAP. Their response areas are based upon local jurisdiction boundaries.

- ASHLAND - The Ashland Ambulance operates from the Ashland Fire Department. Their contract area includes the Towns of Eileen and Pilsen within Bayfield County. They also contract with several towns in Ashland County. They provide ALS (Advanced Life Support) intercept as requested and available to assist local ambulance services. They have four ambulances and an intercept van available for staffing.
- BARNES – The Barnes Ambulance serves the Town of Barnes, an area of 126 square miles. The service shares a facility with the Barnes Fire Department and has one ambulance available for staffing.
- BAYFIELD – The Bayfield Ambulance serves the City of Bayfield as well as the Town of Bayfield, an area over 90 square miles. The service shares a facility with the Bayfield Fire Department and has two ambulances available for staffing.
- GREAT DIVIDE – The Great Divide Ambulance is located in Cable and serves the Towns of Cable, Drummond, south 2/3 of Grand View and Namakagon. Their contract area in Bayfield County is 360 square miles. They also contract with several towns in Ashland County. Great Divide has five ambulances in the two counties available for staffing.
- IRON RIVER – The Iron River Ambulance contracts with the towns of Delta, Hughes, Iron River, Oulu and Tripp, an area of 235 square miles. The service shares a facility with Iron River Fire and has two ambulances available for staffing.
- MASON – The Mason Area Ambulance contracts with the north 1/3 Town of Grand View, and Towns of Kelly, Keystone, Lincoln, Mason, and the Village of Mason, an area of 180 square miles. Mason Ambulance shares facilities with Mason Fire having two ambulances available for staffing.
- RED CLIFF – The Red Cliff Ambulance is operated by the Red Cliff Band of Lake Superior Chippewa Indian Tribe and serves Tribal lands and the Town of Russell, a response area of approximately 49 square miles. Red Cliff Ambulance shares a facility with Red Cliff Fire and operates two ambulances available for staffing.

- SOUTH SHORE – The South Shore Ambulance has one ambulance available for staffing based in Herbster (unincorporated) and contracts with the Towns of Bell, Clover, Orienta and Port Wing. Their primary response area is approximately 216 square miles.
- WASHBURN – The Washburn Area Ambulance primary service area includes the City of Washburn and Towns of Barksdale, Bayview and Washburn, an area of approximately 180 square miles. Based in the City of Washburn they maintain three ambulances available for staffing.

Map 3: Bayfield County Ambulance Jurisdictions



3.2.3 Medical Facilities

As the population of Bayfield County ages, medical facilities are becoming increasingly important assets to local communities. There are no hospitals in Bayfield County. People needing services provided by hospitals may use Memorial Medical Center in Ashland, the Hayward Area Memorial Hospital in Hayward, or St. Mary’s in Superior. Both Essentia and St. Luke’s Hospitals in Duluth offer extensive services and are linked closely with our local hospitals. Helicopters are available for extreme emergencies. There are a few various local medical providers in communities throughout the County, including the Red Cliff Community Health Center, the Mishomis Wellness Center, North Lakes Community Clinic and the Bayfield County Health Department.

3.2.4 Assisted Living Facilities

Senior care facilities are becoming an increasingly important regional asset to meet the changing needs of our aging population in a manner that permits residents to age with dignity. Many area residents who grew up and have spent a large portion of their lives in Bayfield County will wish to remain here during their retirement years. In addition, the rural atmosphere has led northern Wisconsin to attract a lot of transplant retirees. These individuals occasionally need assisted living facilities. Without an adequate supply of facilities to accommodate these individuals, Bayfield County could lose that segment of their population.

Table 22: Bayfield County Nursing Homes

Facility Name	Address	Type	Capacity
Oaks at Northern Lights	702 Bratley Drive, Washburn	CBRF	17
Willow Manor	68290 N District Street, Iron River	CBRF	8
Chequamegon Area Assisted Living	320 Superior Avenue, Washburn	RCAC	12
Northern Lights Health Care Center	706 Bratley Drive, Washburn	NH	75

Source: Wisconsin Department of Health Services

There are five assisted living facilities in Bayfield County. These are categorized into groups, which are briefly discussed below.

- **Adult Day Care (ADC)** provides services for a portion of a day in a group setting. These facilities are not licensed, but may be certified.
- **Adult Family Homes (AFH)** provides residence care for up to four adults who are not related to the operator.
- **Community-Based Residential Facilities (CBRF)** are residential facilities serving five or more adults with treatment, care, and services that are beyond the room and board level.
- **Residential Care Apartment Complexes (RCAC)** are independent living facilities for five or more adults. These may be attached to portions of nursing homes or community based residential facilities.
- **Nursing Homes (NH)** provide constant care to residents that have significant difficulty completing daily living activities.

The Bayfield County Courthouse and Annex are critical facilities in that they establish communication methods for emergency responders throughout the County. This facility allows for the provision of government services. A back-up power supply is one of the primary projects identified for this plan update.

Heavy Equipment Inventory

Every municipal jurisdiction in the county has heavy equipment, including machines needed for roadwork, grading, and digging. There are also private contractors and construction companies that own heavy equipment. Both government and private heavy equipment owners may be able to respond to emergencies where equipment is needed.

Risk Assessment

The development of a risk assessment is a process that involves identifying hazards, profiling each hazard, evaluating each hazard in terms of frequency and probability, and then assessing a planning area's vulnerability to each hazard in terms of magnitude, severity exposure and consequences. The Bayfield County All Hazards Mitigation Plan addressed such a risk assessment as follows:

- Identify natural hazards that can affect Bayfield County Provide descriptions of those natural hazards identified
- Provide information on previous occurrences of each hazard event
- Estimate the probability of future effects from each hazard
- Describe and rate the county's vulnerability to each hazard

Natural Hazards are evaluated according to the Natural Hazard Identification and Assessment Matrix. That list includes:

- Flooding: Flash
- Winter Heavy Snow
- Winter Blizzard
- Wildfire
- Extreme Cold
- Storms: Damaging Wind
- Inland Erosion
- Storms: Lightning
- Winter Ice Storm
- Extreme Heat
- Flooding: River
- Coastal Erosion
- Storms: Hail
- Public Health Emergency
- Fog
- Flooding: Storm water
- Tornado
- Dam failure
- Landslides
- Flooding: Lake

All jurisdictions share equal risk to those stated hazards unless otherwise noted.

The Natural Hazard Identification and Assessment Matrix developed for Bayfield County was patterned after the Matrix presented in the "Resource Guide to All Hazards Mitigation Planning in Wisconsin". A copy of the Matrix is included as Table 19. Each hazard was listed and participants were asked to assign a risk rating of 1 - low, 2 - medium, or 3 - high for each of the risk assessment criteria listed in the table. The criteria by which the hazards were rated included frequency of occurrence, probability of occurring in the future, past hazard events causing injuries, sickness, and/or death, damage to business, funds expended on past recovery, population still vulnerable, homes still vulnerable, business still vulnerable and critical infrastructure vulnerable to each hazard. The total number for each hazard represented which hazards present the highest risk for this planning area.

Participants in the assessment process included the Sheriffs Committee of the Bayfield County Board of Supervisors, Sheriff, Chief Deputy, City of Bayfield Zoning, City of Washburn Zoning, County Zoning, Red

Cliff Tribe, Local Emergency Planning Committee (LEPC) members, County Land Records, and Town Elected Officials.

The natural hazards were grouped according to major categories and will be addressed as follows:

- Erosion
- Dam Failure
- Extreme Temperatures
- Flooding - Flash, Lake, River, Stormwater
- Severe Weather - Damaging Winds, Hail, Lightning
- Tornadoes
- Wildfires
- Winter Storms - Blizzard, Heavy Snow, Ice

It is important to note, that throughout the discussions of Bayfield County's hazards and risks, that several times it was mentioned that due to the improved forecasting, and greater access to information (via NOAA radios, television, smartphones, etc.), the damage, both to lives and property, has been reduced. As these processes and the technologies that make access to information better and faster continue to evolve, we anticipate that the impact of hazards will continue to decline.

Climate Change

The challenges posed by climate change, such as more intense storms, frequent heavy precipitation, heat waves, drought, and extreme flooding could significantly alter the types and magnitudes of hazards faced by communities and the emergency management professionals' serving them. Emergency managers have to be poised to respond to disasters and support preparedness efforts nationwide (WI-DMA). In the past 50 years, average statewide temperatures have increased by about 1.1°F. It is also likely that the state will see more extreme weather events.

Currently, Wisconsin Emergency Management has the opportunity to influence and encourage local mitigation efforts through training, technical assistance, and resource allocation. To reflect this, WEM has included several new action items in the Mitigation Strategy. These strategies are: 1) Incorporating information on planning for future conditions into trainings 2) Incorporating Climate Resilient Mitigation Activities into the scoring system for project applications 3) Updating WEM's local mitigation plan review document to include criteria on the assessment of changing future conditions, including weather patterns

A growing number of County, single Jurisdiction, University and Tribal plans are including climate change into their Hazard Mitigation Planning and future development efforts.

BAYFIELD COUNTY NATURAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1=Short 2=Intermediate 3=Long	0 = N/A 1=Long 2=Intermediate 3=Short	0 = N/A 1=Localized 2=Intermediate 3=Countywide	0 = N/A 1=High 2=Moderate 3 = Low or none	0 = N/A 1=High 2=Moderate 3 = Low or none	0 - 100%
FLOODING: FLASH	2.86	1.36	1.50	2.93	2.21	2.57	1.29	2.07	2.57	65.5%
WINTER HEAVY SNOW	2.93	2.07	1.36	2.07	1.93	1.64	2.86	1.50	1.71	61.6%
WINTER BLIZZARD	2.86	2.14	1.07	2.14	2.00	1.64	2.79	1.50	1.79	59.8%
WILDFIRE	2.64	1.29	2.36	1.36	2.14	2.50	1.86	1.86	1.93	56.1%
EXTREME COLD	2.93	2.14	1.07	1.21	1.93	1.36	2.36	1.79	1.29	53.5%
STORMS: DAMAGING WINDS	2.14	2.14	2.14	2.14	2.21	2.57	1.93	2.07	2.57	52.9%
INLAND EROSION	2.79	1.00	1.29	1.79	2.14	2.00	1.07	2.00	1.36	48.9%
STORMS: LIGHTNING	2.21	1.86	2.57	1.07	1.71	2.50	2.00	2.14	1.86	48.3%
WINTER ICE STORM	2.14	2.00	1.36	2.07	2.14	1.93	2.79	1.79	1.93	47.6%
EXTREME HEAT	1.93	2.00	1.00	1.07	1.93	1.36	2.29	2.00	1.29	34.6%
FLOODING: RIVER	2.00	1.14	1.29	1.21	1.36	2.14	1.21	2.29	1.43	33.5%
COASTAL EROSION	2.14	1.00	1.29	1.00	1.43	1.36	1.00	2.00	1.43	31.3%
STORMS: HAIL	1.36	1.07	2.00	1.07	1.07	2.43	1.93	2.14	2.07	26.0%
PUBLIC HEALTH EMERGENCY	1.29	2.07	0.79	1.43	1.86	2.07	2.00	1.64	1.64	24.1%
FOG	1.36	1.14	1.00	1.00	1.79	2.29	1.79	2.14	1.36	23.6%
FLOODING: STORMWATER	1.43	1.07	1.29	1.14	1.21	2.29	1.00	1.93	1.21	22.1%
TORNADO	1.00	2.29	2.29	1.43	1.43	2.36	1.93	2.14	2.07	22.1%
DAM FAILURE	1.43	1.07	1.07	1.00	1.29	1.64	1.00	2.14	1.43	21.1%
LANDSLIDES	1.14	1.07	1.21	1.07	1.14	2.14	1.00	2.21	1.36	17.8%
FLOODING: LAKE	1.21	1.00	1.43	1.07	1.07	1.50	1.07	2.14	1.29	17.8%
AVERAGE SCORE	1.99	1.55	1.47	1.46	1.70	2.01	1.76	1.98	1.68	

BAYFIELD COUNTY MANMADE/TECHNOLOGICAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Short 2 = Intermediate 3 = Long</i>	<i>0 = N/A 1 = Long 2 = Intermediate 3 = Short</i>	<i>0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide</i>	<i>0 = N/A 1 = High 2 = Moderate 3 = Low or none</i>	<i>0 = N/A 1 = High 2 = Moderate 3 = Low or none</i>	<i>0 - 100%</i>
ENERGY EMERGENCY	1.71	1.64	1.43	2.29	1.86	2.36	1.86	1.79	1.71	35.5%
COMMUNICATIONS DISRUPTION	1.64	1.50	1.14	2.07	1.71	2.86	2.07	2.07	1.79	34.7%
CYBER SECURITY	1.64	1.29	1.43	2.29	1.79	2.57	1.86	1.86	1.79	33.9%
MUNICIPAL UTILITY DISRUPTION	1.71	1.43	1.29	1.93	1.57	2.71	1.21	1.79	1.57	32.1%
MASS CASUALTY INCIDENT	1.29	1.93	1.21	1.29	1.36	2.79	1.14	2.14	1.79	24.4%
HAZARDOUS MATERIALS INCIDENT	1.29	1.43	1.43	1.36	1.57	2.57	1.07	1.64	2.00	23.3%
AVERAGE SCORE	1.55	1.54	1.32	1.87	1.64	2.64	1.54	1.88	1.77	

*** Mass casualty incident relates to a bombing, terrorist attack and active shooter

RED CLIFF HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1=Short 2= Intermediate 3=Long	0 = N/A 1=Long 2= Intermediate 3= Short	0 = N/A 1=Localized 2= Intermediate 3=Countywide	0 = N/A 1=High 2=Moderate 3 = Low or none	0 = N/A 1=High 2=Moderate 3 = Low or none	0 - 100%
WINTER HEAVY SNOW	3	2	1	2	2	1	3	3	2	50.0%
WINTER BLIZZARD	3	2	1	2	2	1	3	2	2	50.0%
FLOODING: FLASH	3	1	1	3	2	3	1	3	3	45.8%
WILDFIRE	3	1	2	1	2	3	2	1	2	41.7%
EXTREME COLD	3	2	1	1	2	1	2	3	1	37.5%
STORMS: DAMAGING WINDS	2	2	2	2	2	2	2	1	3	36.1%
WINTER ICE STORM	2	2	1	2	2	1	3	1	2	33.3%
STORMS: LIGHTNING	2	2	3	1	2	2	2	2	2	33.3%
INLAND EROSION	3	1	1	2	2	1	1	3	1	33.3%
EXTREME HEAT	2	2	1	1	2	1	2	3	1	25.0%
COASTAL EROSION	2	1	1	1	1	1	1	3	1	16.7%
FLOODING: RIVER	2	1	1	1	1	1	1	2	1	16.7%
TORNADO	1	2	2	1	1	3	2	1	2	13.9%
STORMS: HAIL	1	1	2	1	1	2	2	2	2	12.5%
FOG	1	1	1	1	2	3	2	3	1	11.1%
FLOODING: STORMWATER	1	1	1	1	1	2	1	3	1	8.3%
LANDSLIDES	1	1	1	1	1	1	1	2	1	8.3%
FLOODING: LAKE	1	1	1	1	1	1	1	3	1	8.3%
AVERAGE SCORE	2.00	1.44	1.33	1.39	1.61	1.67	1.78	2.28	1.61	

CITY OF BAYFIELD NATURAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPAREDNESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Short 2 = Intermediate 3 = Long	0 = N/A 1 = Long 2 = Intermediate 3 = Short	0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
WINTER HEAVY SNOW	3	2	1	2	2	2	3	1	2	62.5%
WINTER BLIZZARD	3	2	1	2	2	2	3	1	2	62.5%
FLOODING: FLASH	3	1	1	3	2	3	1	2	2	62.5%
INLAND EROSION	3	1	1	2	2	3	1	3	1	58.3%
WINTER ICE STORM	2	2	2	2	2	3	3	3	2	52.8%
STORMS: LIGHTNING	2	2	3	1	2	3	2	3	2	50.0%
EXTREME COLD	3	2	1	1	2	1	2	2	1	50.0%
STORMS: DAMAGING WINDS	2	2	2	2	2	3	2	2	2	47.2%
WILDFIRE	2	1	2	1	2	2	2	2	2	38.9%
EXTREME HEAT	2	2	1	1	2	1	2	2	1	33.3%
FLOODING: LAKE	2	1	1	1	1	3	1	3	1	33.3%
COASTAL EROSION	2	1	1	1	1	2	1	3	1	30.6%
FLOODING: STORMWATER	2	1	1	1	1	3	1	2	1	30.6%
TORNADO	1	2	2	1	1	3	2	3	2	22.2%
FOG	1	1	1	1	2	3	2	3	1	19.4%
STORMS: HAIL	1	1	2	1	1	3	2	1	2	18.1%
FLOODING: RIVER	1	1	1	1	1	3	1	3	1	16.7%
LANDSLIDES	1	1	1	1	1	3	1	3	1	16.7%
PUBLIC HEALTH EMERGENCY	1	1	1	1	1	3	1	2	2	16.7%
AVERAGE SCORE	1.95	1.42	1.37	1.37	1.58	2.58	1.74	2.32	1.53	

CITY OF BAYFIELD MANMADE/TECHNOLOGICAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
SCORE	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Short 2 = Intermediate 3 = Long	0 = N/A 1 = Long 2 = Intermediate 3 = Short	0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
MUNICIPAL UTILITY DISRUPTION	3	1	1	1	1	3	1	1	1	41.7%
MASS CASUALTY INCIDENT	2	3	1	1	1	3	1	2	2	38.9%
CYBER SECURITY	1	1	1	1	1	3	3	3	3	22.2%
HAZARDOUS MATERIALS INCIDENT	1	1	1	1	1	3	1	3	3	19.4%
COMMUNICATIONS DISRUPTION	1	1	1	1	1	3	3	2	2	19.4%
ENERGY EMERGENCY	1	1	1	1	1	3	2	2	1	16.7%
AVERAGE SCORE	1.50	1.33	1.00	1.00	1.00	3.00	1.83	2.17	2.00	

CITY OF WASHBURN NATURAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Short 2 = Intermediate 3 = Long	0 = N/A 1 = Long 2 = Intermediate 3 = Short	0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
FLOODING: FLASH	3	1	1	3	2	3	1	2	3	66.7%
WINTER BLIZZARD	3	2	1	2	2	2	3	1	2	62.5%
WINTER HEAVY SNOW	3	2	1	2	2	2	3	1	2	62.5%
WILDFIRE	3	1	2	1	2	2	2	2	2	58.3%
EXTREME COLD	3	2	1	1	2	2	2	1	1	50.0%
STORMS: DAMAGING WINDS	2	2	2	2	2	3	2	2	3	50.0%
STORMS: LIGHTNING	2	2	3	1	2	3	2	1	2	44.4%
WINTER ICE STORM	2	2	1	2	2	2	3	1	2	41.7%
INLAND EROSION	3	1	1	2	2	1	1	1	1	41.7%
EXTREME HEAT	2	2	1	1	2	2	2	1	1	33.3%
FLOODING: RIVER	2	1	1	1	1	2	1	2	1	27.8%
DAM FAILURE	2	1	1	1	1	1	1	2	1	25.0%
PUBLIC HEALTH EMERGENCY	1	2	1	2	3	2	3	2	2	23.6%
COASTAL EROSION	2	1	1	1	1	1	1	1	1	22.2%
STORMS: HAIL	1	1	2	1	1	3	2	2	2	19.4%
TORNADO	1	2	2	1	1	2	2	1	2	18.1%
FOG	1	1	1	1	2	3	2	1	1	16.7%
FLOODING: STORMWATER	1	1	1	1	1	3	1	2	1	15.3%
LANDSLIDES	1	1	1	1	1	2	1	1	1	12.5%
FLOODING: LAKE	1	1	1	1	1	1	1	1	1	11.1%
AVERAGE SCORE	1.95	1.45	1.30	1.40	1.65	2.10	1.80	1.40	1.60	

CITY OF WASHBURN MANMADE/TECHNOLOGICAL MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Low 2 = Moderate 3 = High</i>	<i>0 = N/A 1 = Short 2 = Intermediate 3 = Long</i>	<i>0 = N/A 1 = Long 2 = Intermediate 3 = Short</i>	<i>0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide</i>	<i>0 = N/A 1 = High 2 = Moderate 3 = Low or none</i>	<i>0 = N/A 1 = High 2 = Moderate 3 = Low or none</i>	<i>0 - 100%</i>
CYBER SECURITY	2	1	1	2	2	3	1	2	2	38.9%
ENERGY EMERGENCY	1	1	2	3	2	3	3	2	2	25.0%
HAZARDOUS MATERIALS INCIDENT	1	2	2	2	2	3	1	2	3	23.6%
MASS CASUALTY INCIDENT	1	3	2	1	1	3	2	2	3	23.6%
COMMUNICATIONS DISRUPTION	1	1	1	1	2	3	3	3	2	22.2%
MUNICIPAL UTILITY DISRUPTION	1	1	1	2	2	3	2	2	2	20.8%
AVERAGE SCORE	1.17	1.50	1.50	1.83	1.83	3.00	2.00	2.17	2.33	

VILLAGE OF MASON NATURAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Short 2 = Intermediate 3 = Long	0 = N/A 1 = Long 2 = Intermediate 3 = Short	0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
FLOODING: FLASH	2.00	1.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	38.9%
WINTER HEAVY SNOW	2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00	47.2%
WINTER BLIZZARD	2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	1.79	46.6%
WILDFIRE	1.00	1.00	2.00	2.00	2.00	1.00	3.00	2.00	2.00	20.8%
EXTREME COLD	2.00	2.00	1.00	2.00	2.00	2.00	3.00	1.00	1.00	38.9%
STORMS: DAMAGING WINDS	2.00	1.00	2.00	2.00	2.00	2.00	3.00	1.00	1.00	38.9%
INLAND EROSION	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	22.2%
STORMS: LIGHTNING	1.00	1.00	1.00	1.00	1.00	2.00	3.00	2.00	2.00	18.1%
WINTER ICE STORM	2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00	47.2%
EXTREME HEAT	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	13.9%
FLOODING: RIVER	2.00	1.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	36.1%
STORMS: HAIL	2.00	1.00	2.00	2.00	2.00	2.00	3.00	1.00	1.00	38.9%
PUBLIC HEALTH EMERGENCY	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	13.9%
FOG	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	13.9%
FLOODING: STORMWATER	2.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	25.0%
TORNADO	2.00	1.00	2.00	1.00	2.00	1.00	3.00	1.00	1.00	33.3%
LANDSLIDES	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	12.5%
AVERAGE SCORE	1.40	1.05	1.30	1.30	1.35	1.30	2.25	1.10	1.14	

VILLAGE OF MASON MANMADE/TECHNOLOGICAL HAZARD MATRIX

HAZARD EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	DURATION	WARNING TIME	AFFECTED AREA	PREPARED-NESS	RESPONSE CAPABILITY	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Event, secondary impacts</i>	<i>Time to prepare or evacuate</i>	<i>Size of area affected by hazard</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Short 2 = Intermediate 3 = Long	0 = N/A 1 = Long 2 = Intermediate 3 = Short	0 = N/A 1 = Localized 2 = Intermediate 3 = Countywide	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
ENERGY EMERGENCY	2.00	2.00	2.00	1.00	1.00	2.00	2.00	2.00	2.00	38.9%
COMMUNICATIONS DISRUPTION	2.00	2.00	2.00	1.00	1.00	2.00	2.00	2.00	2.00	38.9%
CYBER SECURITY	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	16.7%
MUNICIPAL UTILITY DISRUPTION	2.00	2.00	2.00	2.00	1.00	2.00	1.00	2.00	2.00	38.9%
MASS CASUALTY INCIDENT	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00	15.3%
HAZARDOUS MATERIALS INCIDENT	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00	15.3%
AVERAGE SCORE	1.50	1.50	1.50	1.17	1.00	2.00	1.50	2.00	2.00	

3.3 Flooding

HAZARD DESCRIPTION:

The National Flood Insurance Program (NFIP) defines flooding as a general or temporary condition during which the surface of normally dry land is partially or completely inundated by water.

Coastal Flooding

Coastal flooding can result from storms that cause large, wind-driven waves (wave run-up) or storm surge. The damage from coastal flooding can be more severe than that from riverine flooding because of the added force of waves. Coastal flooding is closely linked with lake levels, which can remain at high levels for prolonged periods.

Riverine Flooding

Riverine flooding can occur at any time of the year but is most likely to occur in spring, summer, and early fall. Spring flooding is the most common situation, where snowfall melt water can combine with rain to produce a gradual build-up of flow and velocity in streams over a period of days. This gradual increase in water volume eventually exceeds the streams capacity and flows over the banks. The period of flooding can last from a day or two to several weeks or longer, until the waters recede back to normal flow levels. These gradual flood events can oftentimes be forecast, and ample evacuation time given to prevent loss of life. Other forms of flooding such as flash floods and ice jam floods can occur very quickly, without advance warning, presenting a much greater danger to human life.

Flash Flooding

Because of their unpredictability and oftentimes violent nature, flash floods can be extraordinarily dangerous and devastating. These events can occur without warning in a matter of minutes to hours following heavy rainfall, dam failure or a sudden release of water from an ice jam.

Urban Flooding

Urban flooding can occur when an urban developed area experiences heavy rain or rapid snowmelt events. Urban areas are especially susceptible to this type of hazard because of the impervious surface presented by development, roads, parking lots, etc. These surfaces do not permit precipitation and snowmelt to infiltrate the soil, causing water to either pool or runoff. Heavy precipitation can also overwhelm municipal drainage systems, resulting in back-ups and flooding.

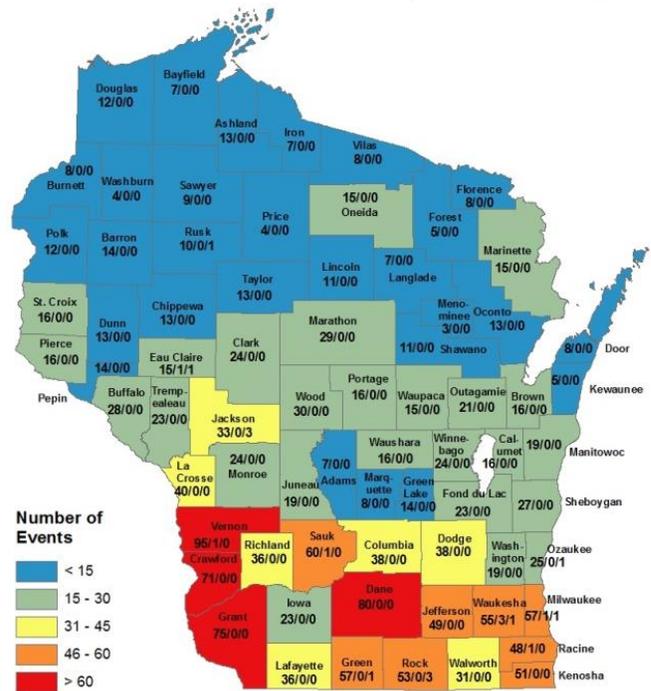
Ice-Jam Flooding

Ice-jam floods occur on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur. Backwater upstream from the ice dam



Wisconsin Flood Events 1844 - 2014

Events / # Deaths / # Injuries



can rise rapidly and overflow the channel banks. Flooding moves downstream when the ice dam fails, and the water stored behind the dam is released. At this time, the flood takes on the characteristics of a flash flood, with the added danger of ice flows that, when driven by the energy of the floodwave, can inflict serious damage on structures.

Bayfield County Flooding Initiative

In the past decade, Bayfield County has experienced a multitude of catastrophic flooding events that have resulted in the loss of life, property and economic opportunity. This statement serves as a call to action as well as an initiative to take as many feasible steps as possible to mitigate the negative effects of flooding in Bayfield County. This initiative will also require additional support from local, regional, state and federal groups, agencies and departments. Multi-Jurisdictional coordination and collaboration efforts are expected to be made to improve infrastructure flood resiliency as well as response and recovery to such events.

Regulations and Programs

In Wisconsin, all cities, villages and counties are required to adopt local floodplain zoning ordinances that meet or exceed the minimum standards established by the Wisconsin Department of Natural Resources (s. 87.30 Wisconsin Statutes).

State floodplain management regulations are found in Chapters 30.27, 59.971, 61.351, 62.231, 87.30 and 144.26, Wisconsin Statutes and Chapters NR 115, 116, 117 and 118 of the Wisconsin Administrative Code. Federal requirements for floodplain management are set forth in the National Flood Insurance Act as amended, EO 11988 and EO 11990.

Following the 1993 flood event in the Midwestern United States, congress authorized an appropriation of funds to assist communities in rebuilding. The Federal Emergency Management Agency (FEMA) and Wisconsin Emergency Management (WEM) created the Wisconsin Interagency Disaster Recovery Group (WIDRG) to coordinate distribution of these funds. Following a disaster, WIDRG assists local governments in their recovery effort and promotes disaster resistance during reconstruction. In addition, the Wisconsin State Hazard Mitigation Team works to develop and promote a statewide mitigation program. Both groups are led by Wisconsin Emergency Management.

The Hazard Mitigation Grant Program (HMGP), administered by WEM, provides funding for reducing flood-related disaster losses. WEM also administers the Flood Mitigation Assistance Program (FMAP), which provides funding for flood mitigation planning and for flood mitigation projects. A newly created program in 2001, the Pre-Disaster Mitigation Program (PDM) provides funding opportunities for local units of government and tribes to produce comprehensive hazard mitigation plans or for hazard mitigation projects. The National Flood Insurance Program (NFIP) is a federal program which enables property owners in participating communities to purchase flood insurance. Flood insurance is required in order to get secured financing to buy, build, or improve structures located within Special Flood Hazard Areas (SFHA's.) The Wisconsin Department of Natural Resources is the state agency that coordinates the NFIP in Wisconsin.

Bayfield County has recently undergone an update of FEMA floodplain mapping. These new maps have significantly reduced the number of structures that are located within mapped floodplains. Under the old floodplain maps, there were 804 buildings located in the floodplains. Now, there are 299 - a 63 percent reduction from the previous maps.

HISTORY AND OCCURRENCES

Flood related hazards in Bayfield County arise from a complex set of hydrologic and hydraulic interactions, including excessive precipitation, rapid snowmelt, ice or debris jams in waterway channels or a combination of those factors. These result in river flooding, stream flooding, coastal flooding and erosion, bank slumping, inland lake flooding, flash flooding, flooding from and storm water runoff and ponding. The effects of flooding can be devastation and cause extensive property damage. Town roads are particularly susceptible to damage occurring from flash flooding. Many times, this damage is due to culverts being undersized, damaged, or clogged from debris, or ditches overflowing. Although the probability of serious injury and loss of life is usually low, flooding increases the likelihood of long-term health hazards from water borne disease, mold, mildew, insect infestation and contaminated drinking water. Long-term damage to the environment may also result from flooding of sites containing hazardous materials or waste.

There have been several occurrences of major flood damage in Bayfield County. Three of those occurrences resulted in public assistance through a Presidential Disaster Declaration.

Flash flooding occurred in the City of Bayfield in 1942. Storm sewers and ravines could not handle the volume of water. Caskets literally were washed down onto the streets of the City. Clean up was expensive and damage was generally in the cemetery area and the areas around roads that traversed these filled ravines. A Presidential Disaster Declaration was received which provided for low interest loans.

In September of 1985, Bayfield County, along with Ashland and Douglas Counties, incurred almost \$3 million in public and private damages as a result of flash flooding that occurred due to heavy rains over Labor Day weekend. A Presidential Disaster Declaration was received.

During the summer of 1999, Bayfield County received public and private assistance through Presidential Disaster Declaration DR-1284 as a result of damages from flash flooding and downed trees that resulted from a series of heavy rainstorms with damaging winds that took place from July 4 through July 30. The resulting flash flooding washed out roads, culverts and bridges, which cut off communities from each other during the peak of summer tourist season. Getting the main roads passable was difficult as most of our towns have one and two person road crews. Often roads were damaged a second and third time by the multiple storms. The Floodwater also damaged homes and private wells. Many residents were isolated because they could not use roads submerged by standing and rushing waters. Projects that qualified for public assistance totaled more than \$1.5 million.

In April of 2001, flooding damage was again significant enough in Bayfield County that public assistance was received through Presidential Disaster Declaration DR-1369. Heavy winter snowfall combined with heavy spring rains while the ground was still frozen and before full snow melt led to spring flooding. Projects that qualified for public assistance totaled more than \$1.4 million.

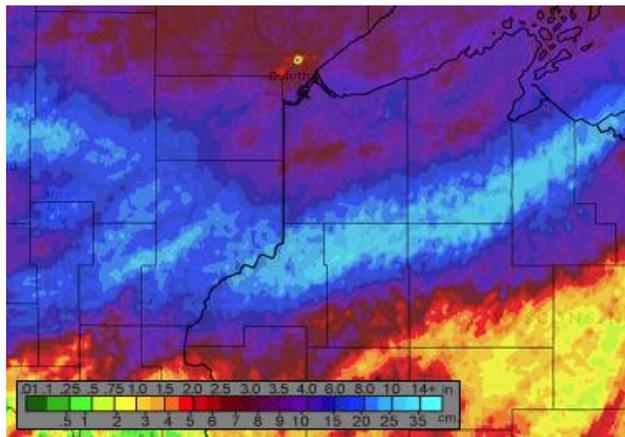
In July of 2005, four towns in Bayfield County, Eileen, Kelly, Keystone, and Lincoln, experienced the devastating effects of seven and eight inches of heavy rainfall. Many town, county and state roads were impassable. Culverts that had never been damaged before were destroyed and/or completely washed away; blacktopped roadbeds were undermined and damaged; gravel roads were scoured and washed away; and usual tiny streams overflowed their banks leaving fields of vegetation bent to the ground by the force of the waters. The storm was so localized that there were few reports of significant damage in other areas of the county or the state. Damage estimates for these four towns were well over \$120,000 equating to over \$70 per person in those jurisdictions. Damage to county and state roads was above

that amount. The report from the National Weather Service/Duluth: “There was up to 6 inches of rain overnight in parts of northwestern Wisconsin. In Bayfield County an observer reported 5.50 inches of rain with 2 to 3 inches falling in just 3 hours. Three county/state roads in the county were washed out, including STH 118 just west of US Hwy 63, CTH E and CTH F (each requiring major repairs). STH 137 was closed due to high water. North Fish Creek at Moquah in Bayfield County crested at a record 18.07 feet at 4 am, breaking the previous record of 16.73 feet on April 3, 2001. The creek rose 12 feet in a few hours. Flood stage is 12 feet.” In addition, numerous town roads were closed due to missing culverts and scouring and washing of road beds rendering them impassable. In October of 2005, flash flooding as a result of heavy rains again struck the county. Preliminary damage estimates to the public sector were \$345,000. The City of Washburn documented twelve inches of rain in a 24 hour period near their water treatment plant. The water treatment plant flooded, pumps failed and there was concern that debris may have caused damage to the facility. Main roads were underwater throughout the county. Although damage was significant throughout Bayfield County little damage was reported in surrounding areas and throughout the state.

In June of 2012, flash flooding swept through northwestern Wisconsin and portions of Minnesota. During the two day stretch, 8”-10” of water was dumped across the region. A Presidential Declaration was issued for northern Wisconsin, with damages in Bayfield County alone climbing over \$1 million. Many roads were washed out, resulting in difficult travel and access.

In July 11-12, 2016 multiple rounds of severe thunderstorms impacted much of east central to northeast Minnesota and northwest Wisconsin. During a 24-hour period the area received 8 to 12 inches of precipitation with the worst of the heavy rain and resulting flash flooding occurring in the evening hours. As an example, according to the National Weather Service, the area one mile west-south-west of the Town of Saxon recorded 9.80 inches of rain in a 24-hour period ending on July 12,

Radar Rainfall Estimates (5 am July 11 - 5am July 12)



Source: National Weather Service Station, Duluth, MN (2016)

County Highway E



Source: Bayfield County Website (July 11-12, 2016)

Highway 63



Source: Bayfield County Website (July 11-12, 2016)

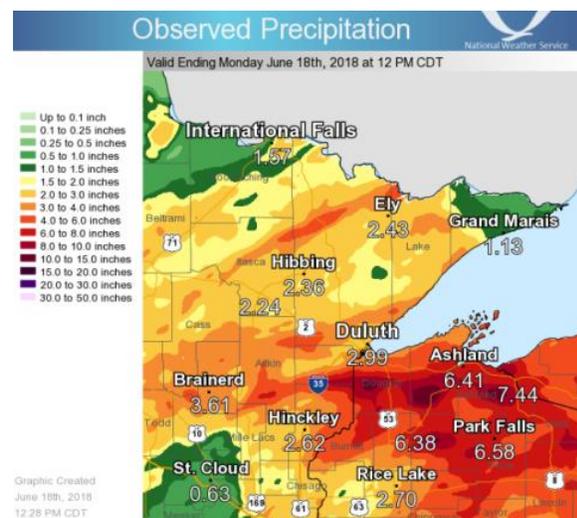
2016. In the area extending from Danbury in Burnett County to Hurley in Iron County the majority of the total precipitation fell within just eight hours. In addition, a bow echo type storm moved across northern Iron County and caused tremendous amounts of damage at Saxon Harbor. The harbor was devastated by the flooding and debris carried by the many creeks, rivers, and streams that converge in the immediate area. These storms resulted in widespread flash flooding across the region causing numerous road closures including the multiple-day closure of U.S. Highway 2, a major transportation corridor across northern Wisconsin. The flooding and damage to roadways was so severe in northwestern Wisconsin that residents and visitors were advised not to travel within much of the area due to washouts and inundated roadways. The timing of these storms also came during the peak tourist season in these areas of the state. Tragically, this event resulted in the loss of four lives and caused numerous injuries and medical emergency calls to local first responders. Immediately following the storm, many volunteer organizations and private sector partners provided assistance to residents impacted by the rainstorm and flooding. This event and the resulting damage have had a significant negative impact on the residents and communities of the area. Many of the area's state highways, county highways, and local roads were inundated with water and debris and had to be closed. Culverts and bridges were washed out, resulting in long detour routes for residents and the trucking industry. Highway crews were busy implementing road closures, making temporary road repairs, and cleaning up debris. Multiple harbors and marinas on Lake Superior received significant damage. In particular, Saxon Harbor in Iron County was housing 70 boats at the time of the July 12 storm. Of these, at least 12 were destroyed, 19 beached, and 6 sunk and later recovered. Two boats remain unaccounted for, while two vehicles and three camper trailers were also lost. Thirty-three floating docks were swept out into the lake and destroyed. The fish hatchery and wild rice operations of the Bad River Tribe also sustained major damage. This event has impacted over 350 homes and left behind tens of millions of dollars in public sector damage. Both the initial storm and a secondary severe thunderstorm event on July 21, 2016 caused tens of thousands of power outages across the northern part of the state and B-60 State of Wisconsin Hazard Mitigation Plan generated large amounts of debris. The stress on citizens and local emergency response efforts was further intensified by high heat index levels that occurred statewide from July 20- 22. On August 9, 2016, a Major Presidential Disaster Declaration was granted, resulting in federal assistance to eligible applicants in 8 counties and 1 Native American nation for flooding damage that occurred between July 11-12, 2016, and hazard mitigation throughout the state. The declared Counties included: Ashland, Bayfield, Burnett, Douglas, Florence, Iron, Sawyer, and Washburn, and the affected nation was the Bad River Band of the Lake Superior Chippewa.

June 14-17, 2018 Flood

Heavy rains have caused flooding and flash floods in northwestern Wisconsin. The National Weather Service says the area has received 7-12" of rain. The counties with the most damage include Douglas, Ashland, Bayfield, Price, Iron and Sawyer Counties.

Thursday, June 14th, 2018

Late Thursday evening, the 14th of June, numerous thunderstorms moved across the Northland. These storms would set the stage for more flooding in the next few days. Two to 4 inches of rain fell across parts of northwestern Wisconsin. The most rain fell over Iron and Price Counties. It is this



rain that helped cause the flooding in Houghton, MI. The NWS cooperative weather observer near Butternut had 1.06 inches of rain overnight while Hurley had 3.50 inches. Some roads and culverts were flooded. Some of the storms came with large hail. Half dollar size hail fell near New Post in Sawyer County, quarter-size hail fell near Ashland and Drummond while golf ball size hail fell 7 miles east northeast of Butternut.

Friday, June 15th, 2018

The deluge of rain began during the day of Friday, June 15th. This first round of storms brought large hail, damaging winds and torrential rain from east central Minnesota, across the Twin Ports and across northwest Wisconsin. Most of the hail reported was nickel size and smaller, however golf ball size hail fell in Carlton, MN. Trees and power lines were blown down in Duluth. Flash flooding occurred near Hurley when 2 feet of water covered U. S. Highway 2 at the intersection of County Road D. Far northern tier counties of Wisconsin received the brunt of the rain with amounts ranging from 2 inches to over 3".

Saturday/Saturday night June 16-17th, 2018

More thunderstorms developed the evening of the 16th and lasted overnight. Downburst winds caused significant damage on the Lac Courte Oreilles Reservation. Shingles and fascia were torn from the Headstart building on Trepania Road. Homes were damaged by fallen trees in the Hunter Township. Oak trees were uprooted. Another downburst brought down 30 large oak trees northwest of Spooner on Tanglewood Drive. There was also major tree damage near Spooner where a homeowner reported 30 large oak trees were blown over or snapped. This damage was in a small area of about 500 feet wide and less than a quarter mile wide and was likely due to a microburst, which is an intense thunderstorm downdraft. Winds could have reached 80 to 90 miles an hour.

More rain fell on Sunday, June 17th. 2" fell at Hayward, WI, 1.84" at Ashland, 1.35 at Hurley. Duluth, MN had 1", Brainerd 1.21" and 1.92" fell at Wright in Aitkin County.

From Saturday to Monday morning, the Town of Drummond located in southern Bayfield County received 15 inches of rain.

The following chart compiles information received from the National Weather Service of Duluth and summarizing the recorded flash flooding events in Bayfield County. Their damage estimates are based on initial assessment information received: You will note the absence of any documentation for flash flooding during April of 2001 even though almost \$1.5 million in projects was awarded through Presidential Disaster Declaration #1369. There has been other flash flooding damage to town roads in

Bridge Washout; Village of Mason (June 2018)



Source: Ready Wisconsin

Road Washout; Village of Mason (June 2018)



Source: Ready Wisconsin

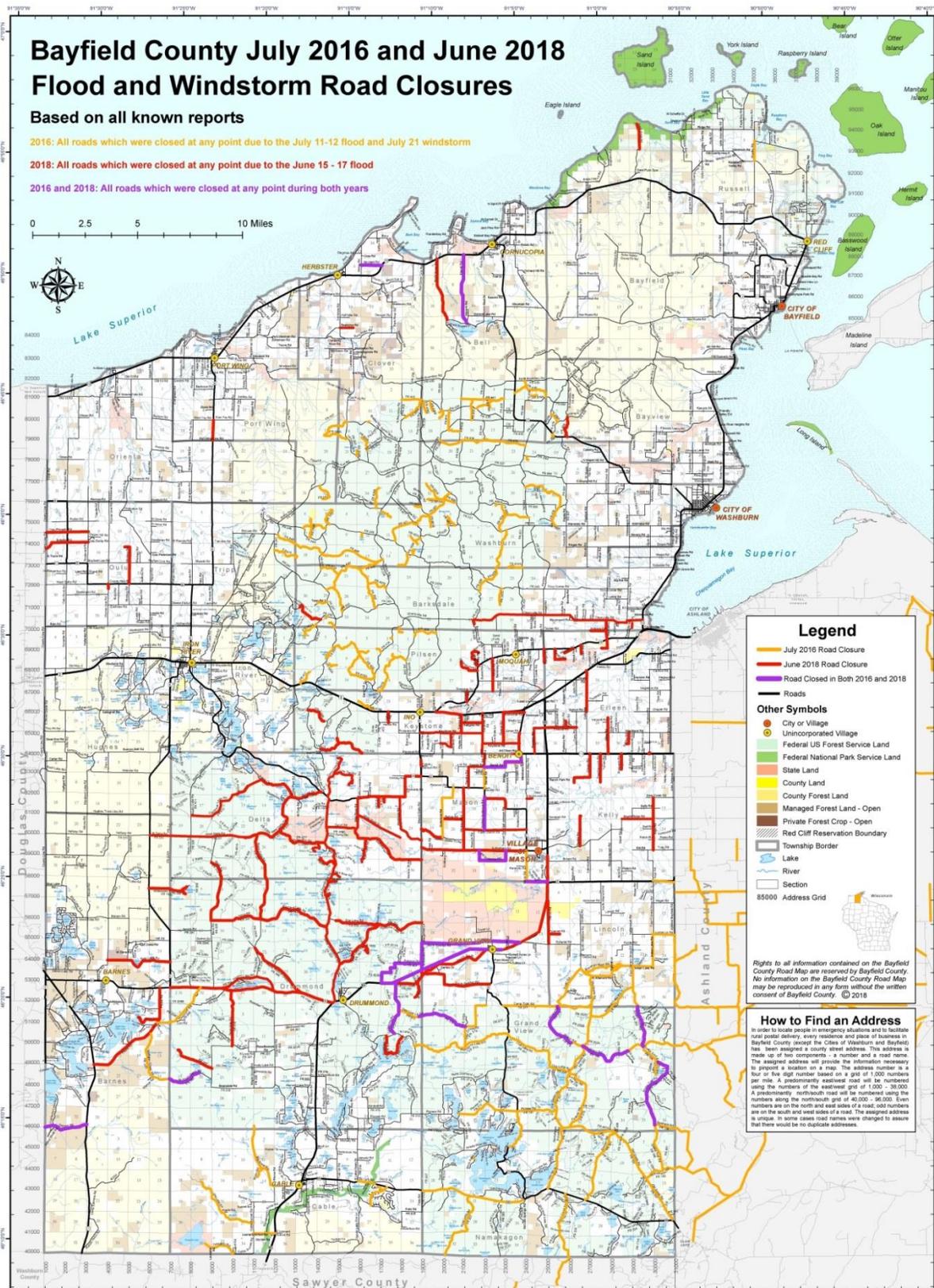
other years not a part of the National Weather Service records. This has identified the need for more accurate reporting locally and ongoing communication with the National Weather Service of Duluth related to the impact of natural hazard events in our county.

Table 23: Major Flash Flood Events

YEAR	DATE	DAMAGE	AREA / DESCRIPTION
1985	October 30- Sept. 2	\$3,000,000	Heavy rain caused public and private property damage.
1996	19-Apr	\$0	The combination of melting snowpack, ice jams, and heavy rain caused flooding of creeks, streams, and small rivers across northwest Wisconsin. High water near Odanah also closed a 300 yard stretch of U.S. Highway 2, the main east-west traffic carrier across northern Wisconsin.
1999	5-Jul	\$500,000	Highways and bridges from Port Wing to Bayfield and Washburn were flooded by heavy rain from slow-moving thunderstorms.
1999	14-Jul	\$1,500,000	Heavy thunderstorm rains caused US Hwy 2 and State Hwy 118 as well as numerous town roads to flood and partially or completely wash out in the east central portion of the county.
2001	10-Apr	\$1,400,000	Heavy winter snowfall combined with heavy spring rains while the ground was still frozen led to spring flooding.
2005	24-Jul	\$300,000	Heavy thunderstorm rains caused damage throughout the central portion of the county.
2005	October 3-5	\$345,000	Heavy thunderstorm rains caused damage throughout the central portion of the county.
2012	24-May	\$250,000+	Heavy rain caused road washouts and closures. The Town of Bell reported 5.3 inches of rain in three hours.
2012	May 27-28	\$300,000+	Storms dumped several inches of rain from Port Wing into the Bayfield area, causing public and private damage.
2012	June 19-20	\$1,000,000	Heavy rains caused damage throughout many of the unincorporated areas of the County due to road washouts.
2016	11-Jul	\$30,000,000 Estimated	The storm brought historic flooding with extremely high average rainfall amounts of 4 to 8 inches. There was a wide corridor of about 8 to 10 inches of rain from northern Iron County to northern Burnett County, including Saxon Harbor on Lake Superior, and the towns of Marengo, Cable, Hayward, Wascott, Minong, and Danbury. Total damage to roads and public infrastructure across northern Wisconsin was \$35 million. The Wisconsin governor declared states of emergency for the following counties: Iron, Ashland, Bayfield, Douglas, Burnett, Washburn, Sawyer, and Price. The President later declared disasters for all of the same counties, except for Price.
2018	June 14-17	\$11,000,000 Estimated	Heavy rains have caused flooding and flash floods in northwestern Wisconsin. The National Weather Service says the area has received 7-12" of rain. The counties with the most damage include Douglas, Ashland, Bayfield, Price, Iron and Sawyer Counties.

Source: NOAA

Map 4: Bayfield County July 2016 and June 2018 Flood and Windstorm Road Closures



PROBABILITY

Using the National Weather Service documentation together with information available locally, it appears that there is a nearly 100% probability that Bayfield County will experience flash flooding annually. However, the impact that this flooding has on public or private lands or areas will vary. It is estimated that there is a 50% probability that Bayfield County will experience flash flooding that will result in damage annually. The strongest impact of that flooding is on the transportation infrastructure of local and county/state roads impacting citizen's ability to travel, preventing students from attending schools, and creating distress to the tourist who is "trapped" in a community or unable to travel to their destination. The deterrence to tourism in the area will ultimately have the most impact.

VULNERABILITY: HIGH

Flooding is a high risk for Bayfield County. The preceding floodplain maps clearly depict the number of small streams and rivers that become a deluge after heavy rains as they move toward their home watersheds illustrating the potential for flash flooding. This is especially true as the waters rush toward Lake Superior.

There are many structures that would be damaged by flooding. Access to those structures and the people who may live in them may be impaired, however. Flooding impacts the transportation infrastructure especially by the washing and scouring of gravel roads, scouring shoulders, undermining blacktopped roads, as well as undermining and destroying culverts. River flooding is routine during spring melt and heavy rains.

The Cities of Bayfield and Washburn and the Red Cliff Band of Lake Superior, as well as Bayfield County participate in the National Flood Insurance Program (NFIP). These entities all protect flood hazard areas by significantly limiting development that can occur within these areas, by implementation and enforcement of ordinances and maps. There are no properties within Bayfield County that are repetitive or severe repetitive loss properties. The Village of Mason has not committed to participate in the NFIP, primarily due to a lack of resources.

The National Weather Service provides timely warning information concerning floods. When severe weather conditions occur that might result in flooding or flash flooding in Bayfield County, flash flood watch, flash flood warning or urban and small stream flood advisory weather bulletins are broadcast by the National Weather Service out of Duluth. These bulletins are disseminated over a number of telecommunication channels including NOAA Weather Radio and the Emergency Alert System (EAS). Local media routinely monitor these sources and rebroadcast the weather bulletins over public and private television and radio stations. NOAA Weather Radio is available to any individual with a weather alert radio.

MAGNITUDE

The term "flash flood" describes localized floods of great volume and short duration. In contrast to riverine flooding, this type of flood usually results from a torrential rain on a relatively small drainage area. Precipitation of this sort usually occurs in the summer. The sudden breakup of an ice jam or the failure of a dam may also result in flash flooding. Flash floods are a potential threat to life and property in areas characterized by steep terrain, high surface runoff rates, and narrow streams and/or subject to severe thunderstorms.

DURATION

Flooding events may come as flash floods or as slowly rising waters and may have impacts that last for days, weeks, months, or even years. Riverine flooding may last for weeks or longer dependent on local conditions.

FREQUENCY

Bayfield County experiences some minor flood events nearly every year. These events typically stem from melting snowfall, spring rains or summertime severe thunderstorm events. During these minor flood events, stream discharges increase beyond the capacity of the channel to accommodate the entire flow, especially where urban development increases runoff or alters the stream channel. The resultant flooding is oftentimes confined to ditches and low-lying areas and small streams. These minor flood events usually do not cause structural damage, but may result in substantial soil erosion. However, there has been an increased frequency in major flood events in the County. From 2012 to 2018 there has been 3 extremely large flood events (2 of which have been in a presidential disaster declaration).

AREA AFFECTED

The effects of flooding can be devastating and vary from a localized location to a multi-county event. Structures in the path of a flood can be torn from their foundations. Bridges and infrastructure can be quickly washed away with the floodwaters. Flooding can also disrupt power supplies, disable fuel sources, make roads impassable, and greatly hinder emergency response efforts. Although the probability of serious injury and loss of life is often low, personal property damage is usually heavy due to long periods of inundation. Flooding can increase the likelihood of long-term health hazards from water-borne diseases, mold, mildew, insect infestation, and contaminated drinking water. Long-term damage to the environment may also result from flooding of sites containing hazardous materials or waste.

POTENTIAL ECONOMIC IMPACT

Areas susceptible to flooding are considered highly unsuitable for development due to risks to lives and property. The Flood Insurance Rate Maps for Bayfield County are the most readily available source for identifying areas at risk. These maps can be viewed at the County Courthouse. FIRMs are intended to be interim maps prior to the completion of a more detailed study and may not include all flood hazard areas in the county. Additional field checking may be required to determine whether or not a given area is in the floodplain before development would be authorized or denied. Damages to transportation infrastructure can impact the flow of products and materials in the County as well as hinder tourism activity which can affect the local economy.

POTENTIAL POPULATION EFFECTED

The flood hazard poses the greatest direct risk to that portion of the population nearest to the affected areas. The population impacts associated with riverine flooding are likely to be low to moderate because some advanced warning is usually possible. Population impacts could easily be greater with flash flooding events, which oftentimes occur without advanced warning. Indirectly, flooding may impact a much larger portion of the county population due to road/bridge closures or other damages which limit accessibility to services, school, work, etc.

CRITICAL FACILITIES AND INFRASTRUCTURE AT RISK

It is important to note that while there are 299 structures that have been found to be in a Bayfield County floodplain and 50-60 structures that are located in close proximity to Lake Superior, many more structures are at-risk of flooding, particularly flash-flooding. A standard homeowner's insurance policy

does not typically cover high water or runoffs unless one has specific flood insurance. And while many properties in the County are not at risk of a lake rising to the point of causing damage, many more are at risk of being damaged by heavy rain and runoff events.

Northwest Regional Planning Commission 2018 Regional Flood Study Overview: Bayfield County
In November of 2018, the Northwest Regional Planning Commission completed a regional flood impact study which included Bayfield County. The information can be found in Annex C or on the following website. <http://nwrpc.com/DocumentCenter/View/1494>

3.4 Winter Storms

HAZARD DESCRIPTION

A variety of weather phenomena and conditions can occur during winter storms. For clarification, the following are National Weather Service approved descriptions of winter storm elements:

Heavy snowfall - the accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.

Blizzard - 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.

Ice storm - an occurrence where rain falls from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed objects near the ground.

Freezing drizzle/freezing rain - the effects of drizzle or rain freezing upon impact on objects that have a temperature of 32 degrees Fahrenheit or below.

Sleet - solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes. This ice does not cling to surfaces.

Wind chill - an apparent temperature that describes the combined effect of wind and low air temperatures on exposed skin.

Winter storms can vary in size and intensity to 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. 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 accumulation happen on the average only five times per season. Bayfield County receives most of its snow during early and late season storms with a seasonal average that exceeds 100 inches of snowfall.

True blizzard events are rare. However, blizzard like conditions often exists 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. 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.

Winter storms present a serious threat to the health and safety of affected citizens and can result in significant damage to property. Heavy snow or accumulated ice can cause the structural collapse of infrastructure, down power lines or isolate people from assistance and services.

HISTORY AND OCCURRENCES:

The winter season in Bayfield County runs from November to March. However, severe winter storms have occurred as early as October and as late as the latter half of April. The data used is from the NOAA Storm Data Publication.

October 31 - November 2, 1991, still referred to as the “Great Halloween Snowstorm”, was a major early-season snowstorm that struck late Halloween afternoon and continued into the early morning hours of November 2. This storm dumped over 30 inches of snow in Bayfield County. Snowfall rates occasionally ranged from 1 to 2 inches an hour. Strong northwesterly winds created 6 to 10 foot drifts. The storm closed schools and businesses, and shut down transportation systems—some for several days. Although the warnings related to this storm were issued by the National Weather Service citizens were largely not prepared due to their unwillingness to consider a heavy snowstorm possible so early in the winter season.

On December 18-19, 1996 Bayfield County felt the effects of a lake effect snowstorm along Lake Superior’s south shore. North winds blowing across Lake Superior resulted in over two feet of lake effect snow across northern Bayfield County. Some of those recorded amounts were 22 inches in Cornucopia and 14 inches near Bayfield.

That same year, on December 22-23, 1996 Bayfield County’s south shore of Lake Superior received lake effect snowfalls of 22 inches in Cornucopia and 12 inches near Bayfield. Gusty north winds of 20 to 30 miles per hour and temperatures from -10 to -20 degrees caused dangerous wind chills and blowing and drifting snow.

On January 4-5, 1997 a strong winter storm moved north from southern Wisconsin to producing a variety of precipitation types. Bayfield County experienced heavy snowfalls with 33 inches recorded in Cornucopia and 30 inches near Bayfield.

- The winter of 1996-1997 brought record snowfalls to the area. The concern for collapse of several structures throughout the area diverted local resources to assist with clearing roofs of large buildings that usually weather the winter season with few concerns.

Several heavy snowfalls were recorded in Bayfield County during the winter season of 2001. The first heavy snow occurred November 26-28 covering much of the county with 12 - 20 inches of snow. A February 24-25 storm covered much of the county with 20 inches of snow. A series of lake-effect snowfalls from Lake Superior left accumulations of 1 to 4 feet throughout the area. Those accumulations attributed to flooding events throughout the county when heavy rains fell before complete snowmelt in mid-April.

Feb 16-17-2006 Lake effect snow began at noon in Bayfield County and ended early the next morning. Oulu received 8.5 inches while 5 miles south of Herbster had 8 inches.

December 3, 2006 Heavy lake effect snow fell in about a 15 hour period across parts of northwest Wisconsin. 6 to 10 inches of snowfall were the rule across Bayfield and Iron counties. Cornucopia had 8 to 10 inches of snow while 8 inches fell in Bayfield. Northwest winds brought heavy lake effect snow to much of northern Bayfield County, where 6.5 inches fell in Bayfield, and 8 inches fell in Cornucopia.

January 29, 2007 Heavy snow off Lake Superior fell across northern Bayfield County from mid-day on January 29th through the early morning hours of the 30th. Totals were generally around a half foot, with Port Wing receiving 7.2 inches, and Oulu with 6 inches. Lesser amounts were recorded across the Bayfield Peninsula. Port Wing reported 7.2 inches of new snow while Oulu had 6.0 inches.

December 4, 2007 Lake effect snow fell over northwest Wisconsin. Snowfall rates of up to 1 inch per hour were common in the early evening hours, especially from Superior to Ashland. Snowfall totals ranged from 5 to 7 inches from Superior to Mason to northern Ashland County. Locally higher amounts, up to 10 inches, were reported in the Ashland vicinity.

January 13, 2008 Heavy lake effect snow developed over much of northwest Wisconsin, especially from the Bayfield Peninsula east into the Gogebic Range, during the midday hours of January 13, and persisted through late evening on January 14. Total snow accumulations ranged from 9 inches in Bayfield to about 20 inches in Gile.

April 10, 2008 A powerful late season winter storm hit northwestern Wisconsin, producing heavy wet snow. There were localized blizzard conditions along the south shore and head of Lake Superior. Six to 14 inches of snow fell, with the heaviest amounts from Siren to Spooner. Four inches or less fell from Phillips and points south. Wind gusts over 40 mph were common across much of northwestern Wisconsin, causing numerous power outages from falling trees. Approximately 500 trees were blown down in Bayfield County in the town of Bell. Waves were 15 feet or more on Lake Superior. Many schools and businesses were closed on the 11th.

January 6, 2010 A long lasting lake effect snow event affected much of the south shore of Lake Superior, with a general 6 to 12 inches of total snowfall. Localized amounts of up to 19 inches fell in Gile, with 14.5 inches falling in Oulu.

March 20, 2013 Parts of Iron and Bayfield counties, including at Gile and Cornucopia, received about 6 inches of lake effect snow.

December 21, 2013 A long duration lake event snow storm resulted in heavy snow across parts of northwest Wisconsin. The heaviest snow fell over northeastern Douglas County and the Ashland area. Snowfall totals include 31.5 in Ashland, 22 in Benoit, 16.9 near Cornucopia, 15.3 near Odanah, and 15 in Poplar.

January 16, 2014 North to northwest winds over western Lake Superior brought heavy lake effect snow to parts of northwest Wisconsin near Lake Superior late January 16th through midday January 17th. Snowfall amounts included 12 in Cornucopia, WI (Bayfield County), 10 in Gile, WI (Iron County), 8 in Maple, WI (Douglas County), and 6 in Mellen, WI (Ashland County).

December 16, 2016 Snow spread into northwest Wisconsin Friday afternoon and evening, with light to moderate snowfall rates continuing overnight into early Saturday morning. Cold northerly winds over western Lake Superior provided lake effect snow to areas downwind along the south shore. The snow generally began to subside late in the morning into the early afternoon Saturday, but the Arctic air flowing over Lake Superior maintained lake effect snow showers near the south shore through the evening. The wind over the Lake gradually became northwest late Saturday, so the lake effect snow showers lasted the longest along the western and northern side of the Bayfield Peninsula. Snowfall amounts ranged from 6 to 14 inches. There were reports of 6 to 11 inches of snow across northern parts of Bayfield Peninsula. The report of 11 came from near Cornucopia, WI.

From April 14 -16th, 2018 there was an unusually strong mid-April snowstorm. It brought heavy snow as far north and west as northeast MN and northwest WI. Snow first spread in force Saturday (April 14th) afternoon into northwest WI and east-central MN from the southwest. The snow then spread into the

rest of the Northland Saturday night into Sunday. The snow continued much of Sunday, then slowly diminished Sunday night into Monday. There was lingering lake effect snow along the South Shore into early Tuesday. Snowfall amounts ranged from 6-12 across northwest Wisconsin with upwards of 18-22 in isolated sections of Douglas, Bayfield and Ashland Counties. This storm generated strong northeast winds over Lake Superior. Throughout the Northwest, winds reached 69 miles an hour. The winds generated large waves of at least up to 15 feet over Lake Superior and along the South Shore to the Duluth and Superior area. Since it was cold, the waves and spray created a lot of icing along the Lake Superior shore. The strong winds across the Northland, especially close to and downwind of Lake Superior, caused blizzard conditions with the falling snow. Highway 2 in Ashland was closed for a time.

PROBABILITY

Using documentation from the National Weather Service together with information available locally it is projected that Bayfield County will experience at least one major winter storm annually.

VULNERABILITY: HIGH

All of Bayfield County is at high risk for winter storms with major storms predicted to occur each year in the future. The South Shore area bordering Lake Superior often receives heavier snowfall than other parts of the county due to "lake effect" snowfall that often doubles the amount of snowfall in the northern half of the county.

In the event of severe winter weather, the National Weather Service posts winter weather bulletins. These bulletins consist of advisories, watches and warnings that are issues concerning expected winter weather conditions. Some are used to alert the public of situations such as snow, winter weather, freezing rain or drizzle and blowing snow advisories. Others are used to warn the public of more serious weather situations which could pose a threat to life and property: winter storm watch and winter storm, heavy snow, blizzard, ice storm and sleet warnings. There are also bulletins that are not associated with precipitation but are used to alert and warn life freeze, wind and wind chill advisories and wind chill warnings. These bulletins are disseminated over a number of telecommunications channels including the NOAA Weather Radio and the Emergency Alert System. These weather information sources are routinely monitored by local media which rebroadcast the weather bulletins over public and private television and radio stations.

MAGNITUDE

The primary factor defining the magnitude of winter storms is snowfall. Most snow events in the county result in between 8 and 12 inches of snow, with extreme events resulting in over 30 inches. Wind is also a contributing factor to storm magnitude. Winter storms are commonly associated with strong, gusty winds which can result in severe blowing and drifting of snow. The wind chill factor, which describes the cooling effect of cold air and wind, can also create extremely hazardous conditions.

DURATION

Winter storms will generally last for one to two days, although lake effect snow squalls can persist as long as wind and atmospheric conditions remain favorable.

FREQUENCY

Historical data suggests that, in general, Bayfield County will experience about nine winter storm events per year. Due to Lake Enhancement, the county experiences a greater storm frequency than other areas in the State. But the County will encounter at least one major event a year.

AREA AFFECTED

In comparison to other natural hazards, winter storms can affect relatively large areas, even entire counties. Winter storms resulting from the lake effect tend to have the greatest impact in the higher elevations of the northwestern portion of the county.

POTENTIAL ECONOMIC IMPACT

Winter storms have the potential to negatively impact business and individuals. Conversely, snowfall attracts winter recreation enthusiasts, which brings revenue to the county. Heavy snows can cripple transportation infrastructure, causing travel delays and even road closures. As a result, businesses may experience revenue losses. Weather related traffic accidents also result in minor economic losses. The costs of snow removal can also be a significant burden, especially for county and local government. The economic impact of winter storms is very difficult to quantify. Snow removal costs and traffic accident cost data is not readily available. Economic impact to business as a result of lost revenue is also difficult to determine. In 2010, Bayfield County businesses generated about \$51,772,330 (2012 Economic Census) in sales, receipts and shipments. Assuming a worst case, county-wide event, the impact to businesses would range from 0\$ to \$141,842 per day.

POTENTIAL POPULATION EFFECTED

Winter storms affect the entire population of Bayfield County.

CRITICAL FACILITIES AT RISK

Winter storms pose the greatest threat to transportation infrastructure in Bayfield County, particularly major roadways such as US 2, STH 13, 63, 27 and part of 137. Bayfield County has a total of 2,363 miles of roadway which includes Federal, State, County, Local and County Forest roads.

<u>Road Type</u>	<u>Miles</u>
County Forest	143
County Highway	177
Local	1,888
State	89
Federal	66
Total	2,363

3.5 *Wildfire*

HAZARD DESCRIPTION

Wildfire is any instance of uncontrolled burning in brush, marshes, grasslands or field lands. A forest fire is an uncontrolled fire occurring in a forest or in woodlands, outside the limits of incorporated villages or cities. For the purpose of this assessment, both of these types of fires are being considered together.

Wisconsin Department of Natural Resources (DNR) reports an average of more than 1,500 wildfires annually consuming an average of 2,658 acres of land on lands they protect. Additional fires are reported on lands within the National Forest.

While most wildfires in Wisconsin are small in area, large fires can and do occur. In fact, one of the largest and most devastating wildfire in U.S. history occurred in Wisconsin. In October of 1871, wildfire struck the area around Peshtigo in northeastern Wisconsin killing an estimated 1,500 people. The Peshtigo fire burned over 1,200,000 acres in Wisconsin and the Upper Peninsula of Michigan before it was finally extinguished by late fall rains. This fire occurred at the same time as the Great Chicago Fire which received much greater publicity.

Bayfield County is part of the longest contiguous tract of land in Wisconsin with fuel types and topography that would support a wild fire beginning around the Grantsburg area (northwestern Burnett County), cross southeastern Douglas County, enter Bayfield County in the Town of Barnes and Hughes and continuing across the Bayfield peninsula. A map of the fire occurrences throughout northwest Wisconsin would support that high hazard area. It is for this reason that wildfires that occur only a few miles from the Bayfield County border are significant to our risk assessment.

Wildfires are capable of causing significant injury, death and damage to property. That potential continues to rise each year as more and more residences and recreational properties are built on forested lands creating the wildland-urban interface or WUI. The lake areas in the Town of Barnes, Drummond and Iron River are particularly illustrative of wildland-urban interface areas as the number of homes increases on forested lands surrounding those lakes. Although the lakes themselves may provide a buffer area to a major wildland fire, the increased population increases the risks of fire starts and need for aggressive interventions.

Wildfire Factors

Wildfires can occur at any time of day, during any month of the year. The major wildland fire season begins sometime in March and continues through November with the highest risk time in Bayfield County being the months of April and May. Several factors influence the susceptibility to wildfire.

Weather conditions are a significant contributing factor to wildfire susceptibility. In Wisconsin wildfire weather hazards are generally the most severe during spring, following snow melt and prior to the “green-up” of vegetation (trees completely leafed out and the underbrush is green again). Rains during the spring season and new green growth lessen the likelihood that wildfires will start and/or spread.

Weather related risk is greatest when multiple factors occur simultaneously.

Precipitation levels, temperature, relative humidity and wind speed are the primary factors influencing wildfire risk. Precipitation levels strongly influence the moisture content of fuels. Drought conditions and low relative humidity (a measure of the given temperature) can desiccate these fuels, increasing their vulnerability to ignition. High temperatures also reduce fuel moisture levels and tend to “preheat” fuels, allowing them to burn and spread faster. Wind conditions are the most significant weather related

factor contributing to wildfire. Windy conditions dry fuels and increase oxygen levels. With a steady oxygen supply, fuel and temperature become critical to sustaining a fire once it's ignited. Winds also influence the direction and rate of fire spread. In Wisconsin, wind direction almost always changes in a clockwise rotation and winds tend to be the strongest in mid-afternoon.

Fuels are combustible materials comprised of both living and dead vegetation. Wildfire is part of the natural disturbance regime which serves to reduce the amount of fuels present. These fuels have been accumulating during at least the past 50 years due to fire suppression, forest management and other wildland management policies and practices.

Fuel types vary in the ways they respond to fire, although all plants will burn if exposed to enough heat. Jack pine and red pine are among the most flammable forest species found in Bayfield County.

Wild fire fuels can also be described using vertical separation as ground, surface, ladder and aerial fuels.

- Ground fuels are comprised of combustible materials lying beneath the surface including roots, buried logs, deep duff and other organic matter. Ground fires, sometimes referred to as "bog fires" burn ground fuels and tend to smolder rather than producing much flame. These types of fires occur relatively infrequently.
- Surface fuels include combustible materials lying directly above the surface such as logs, stumps, logging slash, leaves, pine needles, grass and other vegetation. Surface fuels are referred to as light and flashy fuels because they ignite easily and burn rapidly. Surface fires consume surface fuels and are the most common type of wildfire occurring in the mixed forests of Bayfield County. These fires are generally of low intensity and do not kill mature trees, although some mortality may occur in moderate to severe surface fires.
- Aerial fuels include both living and dead plant materials in the upper forest canopy. Fires which burn through the canopy are referred to as "crown fires" which are the most destructive and dangerous class of wildland fire. Crown fires are also generally the most difficult fires to control. In catastrophic crown fires, tree mortality can be high. Given a pathway, intense surface fires can spread to the aerial fuels to become crown fires.

Ladder fuels such as shrubs or small trees of intermediate height, act as ladders carrying the flames from the forest surface up into the tops of trees.

Topography has a strong influence on wildfire behavior. Because heat rises, up sloping fire spreads more quickly as pre-heated fuels readily ignite. It is also difficult to fight fires on steeply sloping lands. Aspect also influences wildland fire risk as southern or southwestern slopes generally have lower relative humidity and higher temperatures than those on north or northeast slopes. Because of longer and more intense solar exposure, fuels along these slopes may be drier. Consequently, fire hazard is often higher on south and southwest facing hills.

HISTORY AND OCCURRENCES

The following information related to significant fires impacting Bayfield County and acres burned was obtained from the Wisconsin DNR.

The information for the years 2002 and 2004 was not available. Electronic files were beginning to be maintained at the state level and the information for those specific years was unavailable for this plan. We will continue to research that electronic availability or an alternative source of information.

Additional efforts will be made to integrate fire statistics for the Chequamegon-Nicolet Forest as this plan is updated.

It is important to note the importance of prescribed burns as a wildfire mitigation activity. Prescribed burns are regularly used to mitigate potential wildfires by burning what would otherwise have been fuel for potential wildfires. In addition, regulations and public knowledge about the dangers of wildfires has grown significantly since the 1920s and 1930s, when regulations began to discuss the importance of wildfire protection and regulation.

May 4, 1988 - DEER PRINT LAKE FIRE: The Deer Print Lake Project Fire occurred just across the border into Douglas County. Fire Headquarters and Staging were located in the Town of Barnes in Bayfield County. The fire began at approximately 3:30 in the afternoon, and was contained by 6:30 p.m. A change in wind direction and an increase in humidity aided DNR crews in containing the fire. The fire had started in several locations due to molten plastic dropping from equipment operating in the forest.

1995 - JACKMAN LAKE FIRE: The Jackman Lake Project Fire near Iron River was started by the heat generated by a town pick-up truck parked in the grass as a large tree was moved from the roadway. The fire spread southeast consuming just over 200 acres of wildland. The DNR set up Fire Headquarters and Staging at the Iron River Fire Hall. All surrounding fire departments were mobilized as several homes were very close to the path of the fire. Had the wind shifted even slightly, many lake homes would have been destroyed.

May 3, 1999 - SAWDUST LAKE FIRE: The Sawdust Lake Fire occurred just north of US Hwy 2 off Forest Road 241 on federal forest lands and was started by a power line blown down in the high winds of the day. This fire threatened the Great Lakes Transmission Pipeline Station #6, a multi-million dollar facility, but through use of air support and aggressive fire lines put in by bulldozers, the fire was directed away from the station and contained within several hours. Approximately 200 acres of forest land were consumed.

Table 24: Severe Fires

Year	Acres	Location
1929	8,450	Towns of Tripp and Washburn
1929	9,800	Towns of Bayfield, Bayview and Bell
1929	3,730	Towns of Bayfield and Bayview
1930	9,200	Towns of Clover and Port Wing
1930	3,000	Town of Washburn
1920	1,000	Town of Barnes
1931	1,887	Town of Delta
1936	5,720	Towns of Iron River, Tripp and Barksdale
1936	32,460	Towns of Highland (Douglas County) and Hughes
2013	7,499	Town of Barnes (Towns of Gordon and Highland, Douglas County)

Source: WI DNR Wildfire Database

Table 25: Wildfire by Year

Year	# of Fires	Average Acres Burned Per Fire	Total Acres Burned
1982	9	1.19	10.68
1983	14	0.43	5.96
1984	8	0.18	1.42
1985	14	0.29	4.09
1986	8	2.16	17.31
1987	35	1.67	58.48
1988	46	0.55	25.45
1989	28	1.92	53.8
1990	35	1.61	56.19
1991	23	0.48	11.11
1992	23	3.46	79.49
1993	20	2.4	48.08
1994	30	1.55	46.36
1995	21	1.67	35.01
1996	20	0.18	3.58
1997	24	0.99	23.67
1998	42	3.2	134.29
1999	12	0.61	7.26
2000	32	2.43	77.66
2001	16	0.58	9.33
2002	n/a	n/a	n/a
2003	30	2.92	87.47
2004	n/a	n/a	n/a
2005	17	0.62	10.59
2006	10	1.4	14
2007	34	1.3	44.34
2008	20	1.35	26.99
2009	30	3.49	104.65
2010	23	0.53	12.15
2011	17	2.64	44.92
2012	20	1.04	20.89
2013	8	0.35	2.79
2014	5	0.37	1.84

Source: WI DNR Wildfire Database

Causes of Wildfire

More than 90% of wildfires on lands protected by the DNR are caused by humans. And the number one cause of wildfire is debris burning. From 1982 to 2014, more than 40 of all wildland fires in the County were caused by the burning of brush, debris and other “working” fires. Outdoor burning is regulated by the state which authorizes these activities through the issuance of burning permits. Illegal burning and failure to follow the requirements of a burning permit cause numerous wildfires in Wisconsin.

Table 26: Wildfire Frequency By Month (1982- 2014)

<u>Month</u>	<u>#</u>	<u>%</u>
Jan	0	0.00%
Feb	1	0.15%
Mar	31	4.60%
Apr	239	35.46%
May	206	30.56%
June	35	5.19%
July	55	8.16%
Aug	31	4.60%
Sep	9	1.34%
Oct	46	6.82%
Nov	20	2.97%
Dec	1	0.15%

Source: WI DNR Wildfire Database

Other human-related

causes of wildfire in Bayfield County include equipment use, power lines, smoking, campfires, and deliberately set fires (incendiary). Lightning is the primary natural cause of wildfire.

Table 27: Wildfire Causes (1982-2014)

<u>Wildfire Cause</u>	<u>Number</u>	<u>Percent</u>
Campfire	27	4.01%
Debris Burning	285	42.28%
Equipment	75	11.13%
Incendiary	44	6.53%
Lightning	21	3.12%
Miscellaneous	201	29.82%
Railroad	1	0.15%
Smoking	20	2.97%
Total:	674	100%

Source: WI DNR Wildfire Database

Forest lands make up about 80% of Bayfield Counties total land area. Almost 35% of the forest is federal forest land, part of the Chequamegon-Nicolet National Forest. More than 20% of the forest land is county held forest. The remaining 45% of forest lands are held by Apostle Islands National Lakeshore, local municipalities, school districts, industry and private individuals.

The Wisconsin DNR has taken the lead on mitigation efforts related to wild fire. These efforts include memorandum of understandings with local fire departments for immediate response to wild fire, increased availability of wild fire suppression equipment to local fire departments through WDNR grant programs, increased staffing and equipment availability through both the WDNR and US Forest Service during the higher risk periods. Recent fire statistics from Wisconsin DNR illustrate the difference these mitigation efforts have made especially related to number of acres burned.

Impact of Blow Down Events

The US Forest Service developed the following description of the impact on wild fire of the 1999 blow down events. It is equally as applicable to the blow down of 2005 that was experienced throughout the Cable, Drummond, and Grand View areas.

Strong winds on July 5 and 27, 1999 [and September 13, 2005] caused widespread tree damage throughout northwest Wisconsin. Thousands of large trees were wind-thrown within Bayfield County. On July 30, 1999, another wind event occurred which was far more concentrated in impact. Over an area roughly 5 miles wide and 15 miles long, approximately one third of all mature trees were uprooted, broken, or mortally damaged. In many sites, total blow-down is contiguous for hundreds of acres. Most

of these severely impacted areas are federal properties under the fire protection jurisdiction of the Forest Service. The impacted or blow-down area is generally confined within 92,000 acres wherein there are quite variable levels of storm impacts. Within this general area, approximately 12,000 acres contain nearly 100% downed trees. Approximately 30,000 acres were moderately affected with less than 40% of the trees mortally damaged. The balance of blow-down area contains scattered patches of broken and uprooted trees. Approximately 6,400 acres of private lands, also under the fire protection responsibility of the Forest Service are within this 92,000 acre area.

Sandy rich to moist soils supporting appreciable timber volumes characterize the general area. The vast majority of the blow-down area has not been treated by fire or timber activities in 50 years. On the approximately 7000 acres presently being considered for salvage, over 60 million board feet are damaged. Areas not considered for salvage have similar biomasses foreboding extreme fire potential and resistance to control.

FIRE BEHAVIOR - The large quantity of foliage, twigs and limbs of the fallen and uprooted trees will markedly change fire behavior as compared to pre-storm conditions. To illustrate, prior to the wind events the affected areas typically offered 2 to 6 tons of available fuel per acre on a typical high fire danger, spring day. This fuel condition, under canopy, under moderate winds, typically produced fires that spread at 3 to 10 feet per minute with flame lengths of 1 to 3 feet. Under similar weather conditions, the severely impacted areas will, in contrast, offer 12 to 18 tons of available fuel per acre producing fires that will spread at 7 to 20 feet per minutes with flame lengths 6 to 12 feet.

Drought, or long periods of low humidity, will further exacerbate the difference between normal fire behavior for this area and the extreme fire potential of the blow-down area creating conditions in which the larger fuels will actively burn. Such conditions will increase the available fuel load to 20 to 30 tons per acre. On a typical, high fire danger day these conditions will yield a fire spreading at 2 to 25 feet per minute, producing flame lengths of 15 to 25 feet and generating over 3000 BTUs per square foot. Fires of this intensity can quickly develop massive convection columns, which in turn cause variable and gusty winds - further intensifying fire activity. This situation sets up a momentum feedback dynamic, which leads to fires of far greater intensity and speed than would otherwise be indicated by the ambient weather. These atmospheric/fire synergies can create exceptionally dangerous environments for firefighters.

In addition to the threat of private structure losses, there is great concern over the potential for panic and public confusion in the event of a conspicuous fire. Evacuation of residents in this vicinity will be a risky operation as many residences are remote with low standard egress. Many structures do not have telephone service and several are located well behind locked gates. The University of Wisconsin/Pigeon Lake campus with cabins and outdoor labs is within the impact area and will at times house numerous students without available transportation.

The impacted areas contain numerous camping and fishing sites considerable distances from roads. These recreation sites are particularly popular on warm dry weekends in the spring and early summer. Dispersed recreationists in these areas could be in extreme danger if not appropriately briefed on how to immediately find fire-safe environments.

Firefighter safety is also of concern. The expected fire intensity in the moderately to severely impacted areas will require extreme caution and professional preparation to insure firefighter safety is not compromised.

Community Wildfire Protection Plan - Barnes and Drummond

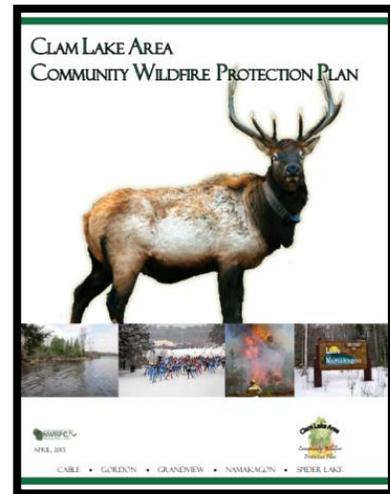
Past wildfire events in the State of Wisconsin and across the Country have heightened the awareness of the destructive potential of wildfire. A planning project for the Towns of Barnes and Drummond within Bayfield County was initiated after a series of investigative actions and initiatives set forward by federal, state and local resource management agencies, county and local government and local emergency response personnel in response to an expressed need to reduce the risks to life, property and infrastructure from the potential effect of wildfire. A planning team prioritized the identified at-risk areas and prioritized them according to the amount of public lands, fire history, fuel model types and housing density. A GIS model was developed and analyzed resulting in Barnes and Drummond receiving the highest priorities.



A steering committee was created in May of 2005 and was the principal body directing plan development. The committee included representatives from local jurisdictions, WDNR, US Forest Services and Bayfield County. Representatives from the Northwest Wisconsin Regional Planning Commission (NWRPC) facilitated committee meetings and drafted a plan narrative. The result of these efforts is a Barnes and Drummond Community Wildfire Protection Plan (CWPP) as defined by the federal Health Forests Restoration Act of 2003 (HFRA) and is designed to give the communities of Barnes and Drummond, local fire departments, Bayfield County, the WDNR, and the US Forest Service the information and tools necessary to reduce the potential risks to the community from the devastating effects of wildfire. Several of the mitigation actions related to wild fire are a direct result of that planning process.

Clam Lake Area Community Wildfire Protection Plan (Namekagon, Cable and Grand View)

In 2013, a steering committee was created to develop the Clam Lake Area Community Wildfire Protection Plan. Towns of Cable, Gordon, Grand View, Namakagon and Spider Lake all participated as well as the Wisconsin Department of Natural Resources, USDA Forest service and the Northwest Regional Planning Commission with the development of this plan. This plan followed the same format as the Barnes and Drummond Community Wildfire Protection Plan.



PROBABILITY

Bayfield County will continue to experience wild fires. Based on the history of wild fire, Bayfield County can expect one large wild fire or forest fire requiring resources from throughout the region every five to seven years.

VULNERABILITY: MEDIUM

All of Bayfield County is at medium risk for significant wildfire, especially wildfire. Forest fires are very possible, and indeed probable, in the higher risk pine areas throughout our county, especially in the towns of Barnes, Delta, Drummond, and Hughes and continuing into the Bayfield peninsula area of Barksdale, Washburn, and Bayview.

MAGNITUDE

The physical setting, weather and condition of forest fuels will dictate the magnitude of a wildfire. In forests with accumulated fuels, fire can burn very intensely and spread rapidly, possibly spreading into the tops of the trees. Surface fires can migrate into the tops of the trees via ladder fuels resulting in a condition referred to as “crowning.” Crown fires are very difficult to control and threaten communities, infrastructure and resources.

DURATION

In the absence of suppressive action by man, and given favorable weather and topographic conditions, a wildfire will burn until its fuel source is exhausted. In the pre-suppression era, fire duration was generally much longer than it is today. Between 1986 and 2014, the average length of time between wildfire detection and suppression was about 2 hours.

FREQUENCY

Bayfield County can expect to experience about 21 wildfire events annually, but the size and severity of each fire can vary greatly. These events are most likely to occur during the spring months, with the peak of the wildfire season in April and May. From the 32 year range from 1982 to 2014 there was an average of 21 wildfires a year. But the range of fires per year varied greatly from a high of 46 wildfires in 1988 to a low of 5 fires in 2014. From 2005 to 2014 the wildfire average is 18 a year.

AREA AFFECTED

The median area impacted by Bayfield County wildfire is 1.4 acres (excluding the major wildfires in the County). The county faces its greatest wildfire risk in areas where the built-up environment meets the forest environment. Other high risk areas exist across the county where there are hazardous forest fuels such as jack and red pine, grasslands and brushlands.

POTENTIAL ECONOMIC IMPACT

Increased rural development in Bayfield County in recent years has increased the potential threat of wildfire. Because most wildfires are human-caused, more people and increased activity in the wildland environment results in a higher wildfire risk. While most wildland fires in the county do not affect human development, there is a potential for structural damage or loss, especially with large crown fires. While rare, these events can consume hundreds, even thousands of acres of wildland fuels. Crown fires also tend to be unpredictable and move rapidly in response to changing environmental conditions.

Under normal spring conditions for this area, the dead limbs and branches under 3 inches in diameter will cure by mid-April. Without successful initial attack, a fire occurring on a typical high fire day, with the severely impacted area, will grow to over 150 acres within a few hours. A fire of this size will cause extensive and expensive mop-up problems. Residual smoke may cause safety and/or visibility problems for nearby communities and highways. A fire of this size, in this fuel type, will cost \$100,000 to \$250,000 in suppression and mop-up expenses and may significantly affect sensitive soil and plant resources.

Under the same scenario, but on a typical high to extreme fire danger day, an ignition will grow to 500 acres within a few hours. Roads, backfires, and air tankers will be ineffective in stopping the spread due to abundant spotting and high fire line intensity. The fire will continue to grow until it burns out of the severely impacted area or weather conditions moderate. Suppression costs would likely be in excess of \$700,000 and we would expect significant damage to a variety of sensitive natural resources. Moreover, such a fire will cause considerable safety problems for local residents and visitors.

The magnitude of a wildfire event will greatly influence its economic impact. For purposes of this analysis, it is assumed that all development in wildland areas is subject to some level of risk,

consequently, the total value at-risk is likely to exceed \$1 billion countywide. The forest products industry is a significant component of the county economy. There are a total of 301 jobs in the agriculture, forestry, fishing/hunting and mining industry (U.S. Census American Community Survey, 2015). A catastrophic wildfire would likely result in some economic losses in the forest products sector. Wildfires also impact the economy of the affected area, particularly the logging and tourism industries. Private and public campgrounds are located throughout the county, especially in those highly forested areas of Barnes, Delta, Drummond, Hughes, Iron River, Barksdale and Washburn. The income lost to area communities resulting from fire damage to campsites in those towns would have long lasting effects.

POTENTIAL POPULATION EFFECTED

The population at greatest risk from wildland fire residents within the wildland-urban interface. A large percent of the County population and structures are in the interface area, with an additional people residing within the intermix area.

As a result of blow-down events, significant public safety concerns will arise from wild fires in the vicinity. Scattered throughout the moderately and severely impacted areas are numerous private parcels, many with residences or vacation homes. These private homes that are under increased risk of loss due to fuel accumulation on federal forest lands. There is a great deal of concern that the County will experience a higher than normal fire occurrence in areas with extensive storm debris.

CRITICAL FACILITIES AT RISK

Critical facilities and infrastructure share a risk equal to that on other development.

3.6 *Extreme Temperatures*

HAZARD DESCRIPTION

Bayfield County's mid-latitude setting results in a high variability in annual temperature. The county's climate is characterized by relatively short, warm summers and long, cold winters. Within Bayfield County, both high and low temperatures outside of the normal range of variability can and do occur. These temperature extremes can last for extended periods and can pose as health risks to the general population. Perhaps most notable are periods of excessive cold experienced during the winter months.

During the months of December through March, the predominant upper level airflow is from the north-northwest. During these cold periods, arctic air can settle over the region, often for days, or even weeks. These periods are also often accompanied by lake-effect snow squalls as winds blow across the relatively warm waters of Lake Superior. Strong winds, which may accompany intense cold fronts, may also result in dangerous wind chills. The greatest risk from excessive cold temperatures is generally posed to children, the elderly, or those who work outdoors. The most common cold-related problems are hypothermia and frostbite.

During the summer months, strong high pressure ridges may allow excessive heat to build over the region. These warm periods, referred to as heat waves, typically occur during the summer months of June through August. When extreme heat is combined with high humidity, dangerous conditions can result. Like extreme cold, excessive heat also poses a risk to human health, particularly to the young, elderly, and those with health problems. The most common risks from excessive heat include: heatstroke/sunstroke, heat cramps, and heat exhaustion. The problems associated with excessive heat can be exacerbated by power outages resulting from the high electric consumption for air conditioning.

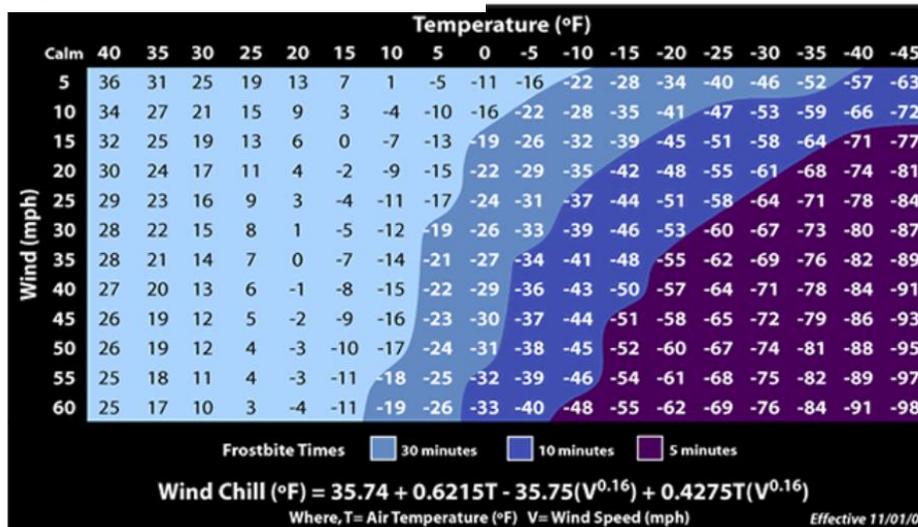
Extreme Heat - During extended periods of very high temperatures or high temperatures with high humidity, individuals can suffer a variety of ailments including heat exhaustion and heat stroke. Heat stroke in particular is a life-threatening condition that requires immediate medical attention. In addition to posing a public health hazard, periods of excessive heat usually result in high electrical consumption for air conditioning and fans which can cause power outages and brown outs.

The National Weather Service initiates alert procedures, advisories or warnings, when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat wave determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the Heat Index is expected to equal or exceed 105 degrees F and a nighttime minimum Heat Index of 80 degrees F or above for two or more consecutive days. (Due to lake effect, evening temperatures dramatically cool down. According to the Midwest Regional Climate Center, there has only been one recorded overnight low temperature of 80 degrees or higher since 1996.)

Extreme Cold - When winter temperatures drop significantly below normal, staying warm and safe can become a challenge. Extremely cold temperatures often accompany a winter storm when power outages and icy roads may already be of concern. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, you may also face indoor hazards. Many homes will be too cold - either due to a power outage or because the heating system is not adequate for the weather. When people use space heaters and fireplaces to stay warm, the risk of household fires increases as does the risk of carbon monoxide poisoning.

Wind chill is based on the rate of heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill. The following wind chill chart shows not how cold it is but how cold it feels outside. A temperature of zero degrees Fahrenheit combined with a wind of 20 miles per hour has an equivalent cooling effect of -22 degrees F. Exposure to cold temperatures, whether indoors or out, can cause other serious of life- threatening

Figure 1: Wind Chill Chart



Source: National Weather Service

health problems. Infants and the elderly are particularly at risk, but anyone can be affected. To keep yourself and your family safe, you should know how to prevent cold- related health problems and what to do if a cold-weather health emergency arises.

Frostbite is damage to body tissue caused by the tissue being frozen. Frostbite causes loss of feeling and a white or pale appearance in the extremity, such as fingers, toes, ear lobes, or the tip of the nose. If symptoms are detected, get medical help immediately! If you must wait for help, slowly rewarm the affected areas. However, if the person is also showing signs of hypothermia, warm the body core before the extremities.

Hypothermia is a condition in which the body temperature is lowered due to prolong exposure to cold. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. Take the person’s temperature if possible. If the body temperature is below 97 degrees F (35 degrees C) seek medical care immediately. If medical care is not available, begin warming the person slowly. Warm the body core first. If needed, use your own body heat to help. Get the person into dry clothing and wrap them in a warm blanket covering the head and neck. Do not give the person alcohol, drugs, coffee, or any hot beverage or food; warm broth is a better choice. Do not warm extremities first. This can move the cold blood toward the heart and can lead to heart failure.

HISTORY AND OCCURRENCES

Documentation related to extreme temperatures was only available from the National Weather Service of Duluth since 2001.

August 5, 2001 - Bayfield County experienced excessive heat, an extreme heat situation with temperatures in the 90s, dew points in the 70s and heat indices up to 105 degrees. Warnings were issued with citizens being encouraged to seek shelter in cool places including air conditioned buildings.

Summer, 2012 - Many northern Wisconsin and upper Midwest counties saw extreme heat during the months of June and July.

The National Weather Service of Duluth recorded 186 hours below zero from January 12-20, 1994. This set a record for the longest cold snap on record.

Record cold hit Bayfield County in February, 1996. February 2 was the coldest morning and a number of cold temperature records fell throughout the area with -33 recorded in the Bayfield area, -40 recorded near Port Wing, and -37 recorded near Mason. Northwest winds of 10 to 15 miles per hour combined with the cold temperatures created wind chills of -60 to -75. In anticipation of the dangerously cold weather it was announced the night before that schools in Bayfield County would be closed the next day. At the Duluth National Weather Service the temperature stayed below zero for 143 consecutive hours.

January 13-16, 2005 - Bayfield County, along with all of northwestern Wisconsin experienced extreme cold combined with extreme wind chill that began on January 13 when the high temperature for the day occurred at midnight, then fell through the day. Many schools closed on Friday, January 14, due to very cold wind chills. Sporting events were canceled and recreation areas, including ski hills and skating rinks, were closed. Wind chills that morning were in the -30s and -40s with frost bite times less than 10 minutes. Cold temperatures and wind chills continued through the weekend. By Monday morning temperatures were in the -20s and -30s but the winds were calm. By Tuesday, the 18th, the temperature finally broke zero, with highs ranging from the mid-teens to the mid-20s recovering well from the morning lows in the -20s.

January 19, 2008 - Bitterly cold temperatures, mainly in the teens and 20s below zero, combined with northerly winds to result in wind chill values as low as 40 below in portions of northwest Wisconsin during the morning hours of January 19. In Bayfield County, a 44-year old woman died of hypothermia after her car went into a ditch and she attempted to walk home.

January 30, 2008 - An Arctic air mass combined with brisk winds to produce wind chills of 40 to 55 below in northwest Wisconsin during the morning hours of January 30. Many school districts canceled classes due to the extreme weather.

January 13, 2009 - A strong cold front passed through northwestern Wisconsin during the late afternoon of the 12th. Arctic air became firmly entrenched after the frontal passage, and temperatures fell below zero and remained there through the morning of the 16th. The cold temperatures led to the death of a Hayward man during the early morning of the 13th. Authorities believe he died while sleepwalking outside his home. Northwestern Wisconsin had 80 to 90 consecutive hours below zero. Morning low temperatures during each of these mornings ranged from the 20s and 30s below zero in much of northwestern Wisconsin. Wind chills bottomed out in the 30s to 40s below zero on the mornings of the 15th and 16th. Most schools and outdoor recreation were closed on these days. A 51-year-old Hayward man died of hypothermia while sleeping walking the morning of 13th. His body was found 200 feet from his home.

January 7, 2014 - Bitterly cold Arctic air resulted in a prolonged period of very dangerous wind chills of -40 to -50 across northwest Wisconsin. The coldest period was early Monday January 6th. The observed wind chills Monday morning included -53 near Shell Lake, -51 near Clam Lake, -49 at Glidden, -48 at Superior, Siren, and Phillips, and -44 at Hayward. Most schools and some businesses were closed both Monday and Tuesday.

January 27, 2014 - The combination of Arctic air and winds of 15 mph (higher in some areas) resulted in a prolonged period of dangerously cold wind chill temperatures of 40 to 55 degrees below zero across northwest Wisconsin. The coldest period was early Monday. Most schools across northwest Wisconsin closed for both Monday and Tuesday.

February 27, 2014 - Dangerous wind chills of -35 to -45 degrees below zero developed across parts of northwest Wisconsin early February 27th.

March 1, 2014 - Winds Chills fell to dangerous levels of -40 to -50.

January 5, 2015 - Temperatures of 15 to 25 degrees below zero and 5 to 10 mph winds resulted in wind chills near 40 degrees below zero.

Extreme Heat (Midwestern Regional Climate Center data from 1893-Present):

- 834 recorded days that reached 90 degrees or higher
- 20 recorded days over 100 degrees
- 107 has been the hottest recorded day on record (July 23, 1934)
- For the past 30 years, there have been 215 recorded days that have reached 90 degrees or higher. Using the past 30 years or data. It is expected to have 6.94 days of heat over 90 degrees a year.

Extreme Cold (Midwestern Regional Climate Center data from 1893-Present):

- 1101 recorded days that was 10 degrees or lower
- 19 recorded days with a high temperatures that was -10 or colder
- -41 was the coldest recorded low in history set on January 17, 1982 and January 17, 2005
- Coldest recorded high temp was January 23, 1935 at -16 degrees for the high
- For the past 30 years, there have been 266 recorded days that have reached 10 degrees or lower. Using the past 30 years or data. It is expected to have 8.58 days of below 10 degrees a year.

PROBABILITY

Based on documentation from the National Weather Service of Duluth and other information available, Bayfield County will be impacted by extreme heat/cold temperature almost every year

VULNERABILITY: MEDIUM

Extreme temperatures will affect all areas of Bayfield County. Residents and visitors to this area are probably caught more off guard by a period of extreme heat than by the extreme cold as Lake Superior due to the nature of this area. Extreme heat may also impact radio infrastructure as none of our tower buildings are air- conditioned.

MAGNITUDE

Extreme temperatures can take the form of extreme heat or extreme cold, with the latter being a more common occurrence in Bayfield County. Temperatures that climb to 10-15 degrees or more above the average high temperature for the region and last for extended periods of time are considered high temperature extreme events. The National Weather Service issues a heat advisory when a heat index of 105 to 115 is expected for at least 3 hours every day, or if nighttime lows are expected to remain above 80 for at least 2 consecutive nights. One of the major concerns with extreme cold is the wind chill effect. The National Weather Service (NWS) issues a wind chill advisory when the combination of cold air and winds of 10 mph or greater will create hazardous wind chill values of between 20 and 34 degrees below zero. NWS issues a wind chill warning when the combination of very cold air and strong winds will create dangerously low wind chill values. This will result in frost bite and lead to hypothermia or death if precautions are not taken.

DURATION

Extreme hot or cold periods can last from a day to, in extreme cases, a week or longer.

FREQUENCY

Historical data from the previous 30 years suggests that, in general, Bayfield County can expect 8.58 days of a daily high temperature of 10 degrees and below a year. In general, Bayfield County can experience about 6.94 days of heat of 90 degrees or higher.

AREA AFFECTED

Extreme temperatures are likely to affect large areas. In all likelihood, an extreme temperature event would affect all of Bayfield County simultaneously. Temperature moderation caused by the heat-sink effect of Lake Superior may somewhat mitigate both summertime extreme highs and winter cold in those areas directly adjacent to the coast.

POTENTIAL ECONOMIC IMPACT

Extreme temperatures have the potential to negatively impact business and individuals. Business closure due to extreme temperature events is unlikely. The most notable cost associated with extreme temperature events would be the increased costs of heating or cooling. While no specific data is available to estimate potential heating or cooling costs, it is assumed that, based on increases in heating or cooling degree days, energy use costs could easily double during these extreme temperature events.

POTENTIAL POPULATION EFFECTED

Extreme temperature events will likely affect the entire population of Bayfield County. The most susceptible are young children, the elderly and those who work outdoors.

CRITICAL FACILITIES AT RISK

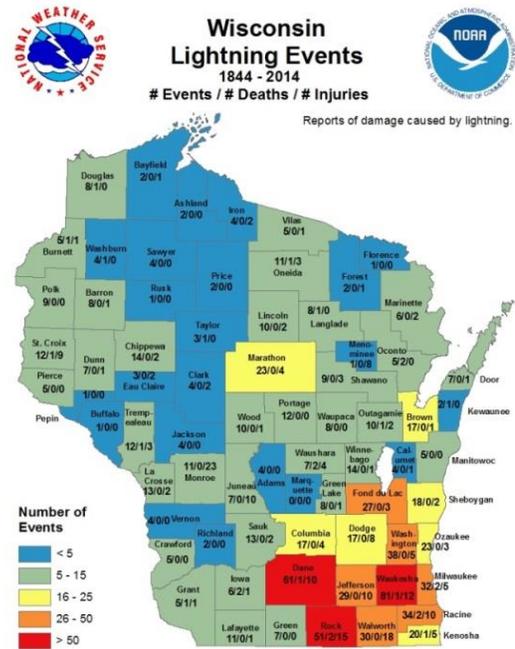
While critical facilities are unlikely to be affected to a great degree, public infrastructure could be damaged due to the severe weather conditions. Extreme heat or cold events could tax local utilities, especially the electric service industry. As demand increases, energy usage could exceed available supply resulting in localized or regional power outages. Extreme cold events could cause damage to pipes and other utility lines, resulting in loss of service and costly repairs.

3.7 Thunderstorms

HAZARD DESCRIPTION

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 (cumulo-nimbus clouds) form and 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: downbursts with winds of 58 miles per hour or greater (often with gusts of 74 miles per hour or greater), hail $\frac{1}{4}$ 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. It 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. Excessive rains or flooding and tornadoes are covered separately in this document.



On the ground directly beneath the storm system, the mature thunderstorm is initially felt as rain, which is soon joined by a strong downdraft. The downdraft spreads out from the cloud in gusting, divergent winds and brings a marked drop in temperature. Even where the rain has not reached the ground this cold air stream flowing over the earth’s surface is a warning that the storm’s most violent phase is about to mature.

A thunderstorm often lasts no more than 30 minutes in a given location because an individual thunderstorm cell frequency moves between 30 and 50 miles per hour. Strong frontal systems may spawn more than one squall line composed of many individual thunderstorm cells. Thunderstorms may occur individually, in clusters or as a portion of a large line of storms that may stretch across an entire area. Therefore it is possible that several thunderstorms may affect a specific area in the course of a few hours.

Severe thunderstorms can cause injury or death and can also result in substantial property damage. They may cause power outages, disrupt telephone service and severely affect radio communications and surface/air transportation, which may seriously impair the emergency management capabilities of the affected jurisdictions.

Lightning is a sudden and violent discharge of electricity from within a thunderstorm due to a difference in electrical charges and represents a flow of electrical current from cloud-to- cloud or cloud-to-ground. Nationally, lightning causes extensive damage to buildings and structures, kills or injures people and livestock, starts untold number of forest fires and wildfires and disrupts electromagnetic transmissions.

The general public perceives lightning as a minor hazard. However, lightning-caused damage, injuries and deaths establish lightning as a significant hazard associated with any thunderstorm. Damage from lightning occurs in four ways:

1. Electrocution or severe shock of humans and animals;
2. Vaporization of materials along the path of the lightning strike;
3. Fire caused by the high temperatures associated with lightning (10,000 to 60,000 degrees F); and
4. The sudden power surge that can damage electrical and electronic equipment.

Over the past ten years Bayfield County has incurred major damage to antennas, lines, and radio equipment at tower sites on three separate occasions due to lightning strikes to those towers. Insurance statistics show that two out of every 100 farms are struck by lightning or have a fire that may have been caused by lightning each year. It is estimated that there are between two and five lightning-caused fires per million acres of forested lands every year. Based on those statistics Bayfield County projects damage due to lightning to homes and/or communications infrastructure once every three years.

Hail is a product of strong thunderstorms. A hail storm is a weather condition where atmospheric water particles form into rounded or irregular masses of ice that fall to earth. Hail normally falls near the center of a moving storm along with the heaviest rain; however, the strong winds at high altitudes can blow the hailstones away from the storm center, causing unexpected hazards at places that otherwise might not appear threatened.

Hailstones normally range from the size of a pea to that of a golf ball, but sizes larger than baseballs have occurred with the most severe storms. They form when subfreezing temperatures cause water in thunderstorm clouds to accumulate in layers around an icy core. When strong



underlying winds no longer can support their weight, the hailstones fall earthward. Hail tends to fall in swaths that may be 20-155 miles long and 5-30 miles wide. The swath is not normally a large, continuous bombardment of hail, but generally consists of a series of hail strikes that are produced by individual thunderstorm clouds traversing the same general area. Hail strikes are typically one-half mile wide and five miles long. They may partially overlay, but often leave complete undamaged gaps between them.

Hail storms are considered formidable among the weather and climatic hazards to property, crops and forested areas because they dent vehicles and structures, break windows, damage roofs and batter crops and trees to the point that significant agricultural losses result as well as increasing the risk of forest fire due to damaged trees. Those agricultural losses, both crops and forested areas, have a major economic impact on Bayfield County.

HISTORY AND OCCURRENCES

The following chart compiles information received from the National Weather Service of Duluth and summarizes hailstorms in Bayfield County since 1965.

Table 25: Hail Storms

YEAR	DATE	SIZE/INCHES	AREA	YEAR	DATE	SIZE/INCHES	AREA
1965	15-Jul	1	County Wide	2010	22-Jun	1.75	Drummond
1971	21-Jul	1.75	County Wide	2010	22-Jun	1.75	Namakagon
1975	12-Aug	2.5	County Wide	2010	22-Jun	1.25	Namakagon
1979	26-Jun	1	County Wide	2010	22-Jun	1.25	Namakagon
1985	8-Jun	1.75	County Wide	2010	22-Jun	1	Namakagon
1989	23-May	1	County Wide	2010	10-Jul	0.88	Cable
1991	26-Mar	1.75	County Wide	2010	10-Jul	1	Drummond
1992	16-Sep	1	County Wide	2010	10-Jul	0.88	Drummond
1995	22-Jun	0.75	Iron River	2010	27-Jul	1	Iron River
1995	6-Sep	1.75	Catawba	2010	27-Jul	1.75	Ino
1995	6-Sep	0.75	Prentice	2010	27-Jul	1.75	Iron River
1996	10-Sep	0.88	Washburn and surrounding area	2010	27-Jul	2.75	Ino
1998	23-Aug	1.75	Iron River and surrounding area	2010	27-Jul	1	Mason
1999	5-Jun	0.75	Cable and surrounding area	2011	30-May	1.5	Namakagon
1999	14-Jul	1.75	Namakagon and surrounding area	2011	3-Jun	0.88	Bayfield
1999	30-Jul	1	Cable, Drummond, Iron River and surrounding areas	2011	3-Jun	1	Bayfield
2000	1-Jul	0.75	Bayfield and surrounding area	2011	1-Jul	1.75	Herbster
2001	30-Jul	0.75	Grand View and surrounding area	2011	30-Jul	0.88	Barnes
2002	31-Jul	0.88	Washburn and surrounding area	2011	30-Jul	1	Barnes
2002	1-Sep	1	Port Wing and surrounding area	2011	12-Sep	0.75	Iron River
2003	20-Jul	1.5	Bayfield and surrounding area	2011	12-Sep	1.5	Cable
2004	18-Apr	3	Namakagon and surrounding area	2011	12-Sep	1	Namakagon
2004	23-Oct	0.75	Washburn and surrounding area	2011	12-Sep	0.75	Cable
2006	9-May	1	Cable	2011	12-Sep	1	Grand View
2006	3-Oct	1	Drummond area	2011	12-Sep	0.88	Namakagon
2006	17-Jun	0.75	Washburn	2012	28-May	1	Herbster
2006	28-Jul	0.88	Port Wing	2012	28-May	0.88	Port Wing
2006	28-Jul	1	Ino	2012	28-May	1.25	Port Wing
2006	28-Jul	0.75	Port Wing	2012	6-Jun	0.75	Iron River
2006	30-Jul	1.75	Grandview	2012	19-Jun	1	Cornucopia
2006	3-Oct	1	Drummond	2014	24-Jun	1.5	Washburn
2007	14-May	0.88	Ashland area	2014	29-Jun	2	Red Cliff
2007	26-Jun	1	Drummond	2014	29-Jun	1	Dula
2007	26-Jul	0.75	Iron River	2014	29-Jun	1	Namekagen
2007	21-Sep	1	Herbster	2017	16-May	1.75	Port Wing

long period. Within the affected area approximately 12,000 acres of trees were nearly 100% down and another 30,000 acres were moderately affected with up to 40% of trees mortally damaged. This damage had serious consequences for a number of reasons. The downed trees created immediate debris problems on area roads as well as a severe long-term fire hazard. Other long-term effects include the spread of tree diseases that could affect the value of timber as an economic resource. Other economic losses include lost tourism, increase expenses for clearing debris and increase expense for firefighting activities.

In October 2005 several towns within Bayfield County again experienced damaging winds that blocked federal and county highways for several hours with long term right-of-way debris removal created. Town roads were blocked for several days in some communities with widespread power outages lasting several days. The damage to the infrastructure of local electrical companies was again significant with power lines, poles and transformers destroyed. According to the National Weather Service “A large area of significant damaging thunderstorm winds swept across northwestern Wisconsin.” The damage path was from southeast of Minong in northeast Washburn County through Nelson Lake of northwest Sawyer County then near Cable through Drummond to Ashland. Heavy damage in the Chequamegon-Nicolet National Forest forced the closure of campgrounds and bike trails.”

The economic impact resulting from decreased tourism due to damage to the transportation infrastructure as well as damage to campgrounds and other scenic areas would be felt throughout Bayfield County. Long term power outages resulting from damage to poles, lines and transformers may affect our communications infrastructure as well as damage personal property.

The following chart compiles information received from the National Weather Service of Duluth and summarizes thunderstorm / damaging wind occurrences:

Table 28: Thunderstorm / Damaging Winds

Year	Date	Wind Speed (MPH)	Area Effected	Comments
1969	28-Aug	No Data Available	Namakagon area	Thunderstorm Wind
1970	7-Jul	No Data Available	Bayfield	Thunderstorm Wind
1973	13-Jul	No Data Available	Namakagon area	Thunderstorm Wind
1976	19-Jul	No Data Available	Port Wing area	Thunderstorm Wind
1977	16-Jul	No Data Available	Namakagon area	Thunderstorm Wind
1977	30-Jul	No Data Available	Port Wing area	Thunderstorm Wind
1980	10-Jul	69	Bayfield	Thunderstorm Wind
1982	17-Jul	No Data Available	Port Wing area	Thunderstorm Wind
1982	17-Jul	No Data Available	Port Wing area	Thunderstorm Wind
1983	3-Jul	No Data Available	Port Wing area	Thunderstorm Wind
1983	3-Jul	No Data Available	Washburn area	Thunderstorm Wind
1984	26-Jun	No Data Available	Drummond area	Thunderstorm Wind
1986	21-Jun	No Data Available	Bayfield	Thunderstorm Wind
1986	21-Jun	No Data Available	Drummond area	Thunderstorm Wind
1986	21-Jun	No Data Available	Port Wing area	Thunderstorm Wind
1988	24-Jun	No Data Available	Port Wing area	Thunderstorm Wind
1990	13-Sep	No Data Available	Port Wing area	Thunderstorm Wind
1991	27-May	No Data Available	Drummond area	Thunderstorm Wind
1991	27-Jun	No Data Available	Port Wing area	Thunderstorm Wind
1991	27-Jun	No Data Available	Port Wing area	Thunderstorm Wind
1992	16-Sep	No Data Available	Bayfield	Thunderstorm Wind
1995	23-Jun	59	Dulu	Thunderstorm Wind
1995	23-Jun	No Data Available	Mason	Thunderstorm Wind
1995	13-Jul	No Data Available	Red Cliff	Thunderstorm Wind
1995	13-Jul	No Data Available	Bayfield	Thunderstorm Wind
1995	6-Sep	No Data Available	Washburn	Thunderstorm Wind

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1996	7-Aug	50	Port Wing area	Numerous trees blown down; wind speed is estimated.
1997	18-Sep	50	Port Wing area	Thunderstorm winds flattened a pole barn and uprooted trees.
1998	15-May	50	Iron River area	Large trees blown down.
1998	15-May	60	Bayfield area	Many large trees blown down, some damaging houses and taking down power lines. Four sailboats were tipped over in their cradles and damaged.
1998	1-Jun	55	Iron River area	Power lines blown down.
1998	1-Jun	50	Washburn area	Trees blown down; power lines damaged.
1999	6-Jun	50	Countywide	Eight-inch diameter trees and power lines blown down.
1999	4-Jul	50	Bayfield area	Trees blown down.
1999	5-Jul	50	Iron River area	Trees blown down.
1999	5-Jul	50	Barnes area	Trees blown down.
1999	5-Jul	50	Drummond area	Trees and power lines blown down; an eleven-year-old boy was killed when struck by a falling tree as he was heading for shelter at the Chequamegon Boy's Camp.
1999	5-Jul	50	Namakagon area	Trees and power lines blown down.
1999	25-Jul	50	Moquah/Pilsen area	Large trees blown down.
1999	30-Jul	50	Grand View	Trees and power lines were blown down. The wind speed is estimated.
2000	14-Aug	50	Barnes area	Twelve inch diameter trees blown down.
2001	8-Aug	52	Bayfield area	Numerous trees blown down throughout the area.
2002	25-Jun	50	Northern county	Trees blown down.
2005	9-Aug	60	Southern county	Trees down throughout area
2005	13-Sep	52	Southern county	Straight-line winds knocked down trees and power lines from the Sawyer County line through Cable, Drummond, Grand View, Lincoln and Kelly.
2007	18-Jun	60	Bayfield	Trees and power lines down.
2007	26-Jul	59	Port Wing	Damaging winds.
2007	26-Jul	59	Port Wing	Damaging winds.
2007	26-Jul	66	Port Wing	Damaging winds and large hail.
2007	26-Jul	60	Washburn	Large tree limbs downed
2007	27-Aug	60	Port Wing	Trees and limbs downed.
2008	13-Jun	58	Drummond	Trees downed.
2008	1-Jul	58	Port Wing	Damaging winds.
2008	11-Jul	60	Dulu	Trees and power lines downed.
2008	2-Sep	58	Iron River	Trees downed.
2010	22-Jun	60	Barnes	Damaging winds, large hail, and funnel clouds.
2010	22-Jun	58	Drummond	Damaging winds, large hail, and funnel clouds.
2010	14-Jul	60	Barnes	Trees downed.
2010	27-Jul	60	Iron River	Trees downed trapping a camper, tornadoes, large hail, and structural damage.
2010	27-Jul	60	Ino	Structural damage, including shingles off and barn down, tornadoes and large hail.
2010	27-Jul	58	Benoit	Roof blown off barn, structural damage, including shingles off and barn down, tornadoes and large hail.
2010	27-Jul	58	Ino	2' diameter tree downed, structural damage, including shingles off and barn down, tornadoes and large hail.
2010	26-Oct	53	Bayfield	Tornadoes and large hail, power outages county-wide.
2011	1-Jul	70	Mason	Trees downed, straight line wind damage.
2011	1-Jul	81	Mason	Trees downed, straight line wind damage.
2011	17-Jul	60	Grand View	Trees downed, huge hail.
2011	17-Jul	60	Drummond	Trees downed, huge hail.
2011	8-Aug	58	Herbster	Trees downed.
2012	28-May	58	Herbster	75' tall, 2' diameter pine snapped off near base.
2012	2-Jul	58	Iron River	Sporadic wind damage along most roads.
2012	2-Jul	58	Drummond	Sporadic wind damage along most roads.
2013	26-Aug	52	CABLE	Many trees and power lines were blown down near Cable.
2013	26-Aug	52	DRUMMOND	Sporadic wind damage was reported along most roads.
2014	22-Jul	52	IRON RIVER	Multiple 4 to 5 inch diameter tree limbs were knocked down and corn was flattened.
2014	22-Jul	61	SAND BAY	Several large trees were down on Little Sand Bay Road.
2014	22-Jul	52	SALMO	A 5 to 6 inch diameter tree was broken.
2016	23-May	52	IRON RIVER	There were several trees down in Iron River. A few of the trees fell onto U. S. Highway 2.
2016	25-Jun	61	BENEDIT	There were several large trees down on Highway 2, south of Moquah.
2016	11-Jul	52	WASHBURN	Large trees were blown down as well as large wash outs throughout the county
2016	21-Jul	70	OULA	A trailer home was destroyed by the straight-line winds. The trailer was in the middle of an open field. There were trees down along the tree line.
2016	21-Jul	70	IRON RIVER	There were numerous trees down.
2016	21-Jul	78	MOQUAH	Groves of trees were flattened to the west-northwest of Birch Grove Campground near Forest Road 437.
2016	21-Jul	70	BARKSDALE	There were numerous trees down at the Birch Grove Campground, which trapped some campers. Four campers sustained non-life-threatening injuries.
2016	21-Jul	70	SAND BAY	There were numerous trees down on Sand Island.
2016	21-Jul	70	LEONARDS	There were numerous trees down along Sunset Road west of Cable.
2016	21-Jul	70	WASHBURN	There were 8 to 9 diameter trees down and the power was out. There were other trees damaged.

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2016	21-Jul	51	TOPSIDE	The multi-bow derecho caused extensive damage across the region from widespread straight-line winds of 60 to 80 mph. There were some isolated higher gusts to around 90 mph.
2016	24-Jul	56	BARNES	Many large pine trees were uprooted or snapped near the intersection of County Highway N and Barnes Road. The largest trees were approximately 12 in diameter.

Source: NOAA

PROBABILITY

Bayfield County has a 100% probability of experience lightning events on an annual basis. The severity of the event can greatly vary.

Based on the information received from the National Weather Service of Duluth it is probable that Bayfield County will experience at least one hail storm a year or is 100% vulnerable to a minimum of one hail storm in the county annually. The impact of these hail storms includes damage to county and federal forest lands, damage to agricultural crops, damage to roofs of city, county, town, tribal and village governmental buildings as well as damage to emergency and other public safety vehicles that might be unsheltered and/or responding to emergencies at the time of the occurrence.

According to the statistics gathered through the National Weather Service/Duluth it appears that Bayfield County has a 100% probability of experiencing damaging winds annually in some portion of the county. The chart above does not indicate damaging winds during 2003 and 2004 and yet damaging hail was experienced in both those years indicating accompanying strong thunderstorms. The impact of these thunderstorm winds is felt most keenly in resulting power outages due to the resulting destruction to power lines, power poles and transformers significantly impacting local and county infrastructure with no back-up power.

VULNERABILITY: MEDIUM

Bayfield County experiences ten to twelve thunderstorm days per year and is at high risk for damage due to strong thunderstorms and accompanying damaging winds, hail, lightning and heavy rains. The resulting power outages will significantly impact infrastructure with no back-up power. This includes emergency services access to vehicles and communications.

MAGNITUDE

The atmospheric conditions, warm/cold fronts, and current condition of a geographic area can dictate the magnitude of a storm.

DURATION

Generally severe storms with lightning, hail and damaging winds are short lived to a few minutes to a few hours.

FREQUENCY

Bayfield County can expect a frequency of severe storms on an annual basis.

AREA AFFECTED

Storms could be greatly localized to a specific part of the County or a storm could be very large and affect a multi-county region.

POTENTIAL ECONOMIC IMPACT

Severe storms can have a wide array of negative economic impacts on Bayfield County. Lightning could potentially start a wildfire or can strike antennas and structures. Hail can greatly damage crops, forests,

buildings and vehicles. Lastly powerful winds can uproot trees and leveling farm fields resulting in damages.

POTENTIAL POPULATION EFFECTED

Significant public safety concerns can arise from severe thunderstorms. Storm impact can vary from a local area to a multi-county region.

CRITICAL FACILITIES AT RISK

Critical infrastructure can be damaged through hail events or even lightning striking essential buildings or communications infrastructure.

3.8 *Erosion; Inland*

HAZARD DESCRIPTION

Inland erosion involves bank slumping, and the general erosion of inland land characteristics. Agriculture operations can be severely impacted by inland erosion, as land rich in nutrients for crop growth can be eroded into streams and rivers. The erosion of inland features can occur during heavy rainstorms and ice melts. When land is eroded from these events, it can wash downstream and clog culverts and other stormwater routing mechanisms. This can lead to further stormwater problems, such as ponding and flooding.

HISTORY AND OCCURRENCES

Inland erosion occurs every year, specifically as it relates to ice melt and heavy rain events. However, these events do not typically cause significant threats to injury or sickness, nor significant damage to businesses, homes, or people. What they do impact, however, is roads - which can create accessibility concerns, primarily for access to key businesses. Inland erosion generally corresponds with flooding events. For example the 2016 and 2018 flood events resulted in extensive erosion throughout the County.

VULNERABILITY: MEDIUM

The low vulnerability ranking of inland erosion is primarily due to the low potential impact to homes, people and businesses. The primary concern is if land erodes to the point where it is clogging culverts, such that water begins to cover roadways and make travel hazardous. Even then, quick actions, even if they are temporary solutions, can often be taken to restore the normal function of the culvert or other tool malfunctioning. Agricultural communities are at a greater vulnerability as land erosion impacts the acreage available for pasture and cropland. Risk to buildings is minimal, however dollar losses in acreage damaged could be several hundred thousand.

MAGNITUDE

Inland erosion is dependent upon the movement of water in lakes, rivers, creeks and watersheds. There is what is considered normal erosion that continually happens. But main concerns are around massive erosion events that take place after large rainstorms or during snowmelt in the spring.

DURATION

Generally erosion events follow a rainstorm. A flood event that leads to inland erosion can happen in a short span of time (minutes/ hours), fast flowing water that leads to optimum erosion conditions can last for several days.

FREQUENCY

Bayfield County can always expect small amounts of erosion on the banks of flowing water. But the frequency of large inland erosion events is likely to happen at least once of year.

AREA AFFECTED

Erosion could be greatly localized to a specific water body or an erosion event could be very large and affect many different shorelines in a vast array of waterbodies.

POTENTIAL ECONOMIC IMPACT

Severe storms can have a wide array of negative economic impacts on Bayfield County. Lightning could potentially start a wildfire or can strike antennas and structures. Hail can greatly damage crops, forests,

buildings and vehicles. Lastly powerful winds can uproot trees and leveling farm fields resulting in damages.

POTENTIAL POPULATION EFFECTED

Significant public safety concerns can arise from severe thunderstorms. Storm impact can vary from a local area to a multi-county region.

CRITICAL FACILITIES AT RISK

Critical infrastructure can be damaged through hail events or even lightning striking essential buildings or communications infrastructure.

3.9 Erosion; Coastal

HAZARD DESCRIPTION

The Wisconsin Coastal Management Program has identified the erosion of coastal bluffs, banks and beaches as a primary type of natural hazard affecting Wisconsin's Great Lakes shores. Temporary fluctuations in water levels due to storm events or storm-induced surges producing elevated wave activity are the principal cause of coastal bluff erosion. The level of shoreline recession is dependent upon many factors, including nature of the substrate, stabilizing vegetative cover, and shoreline alteration.

Demand for coastal property in Bayfield County, among many other northern Wisconsin counties is constantly high. However, the real estate market has dropped from the initial plan was written. Pressure to convert existing undeveloped land in the cities of Bayfield and Washburn as well as the county to residential/ recreational uses is very high. Coastal development threatens the sensitive natural environment by destroying fragile habitats, reducing habitat connectivity (fragmentation), disrupting coastal processes, creating more impervious surface cover, and adding pollutants to the system. Development of the coastal environment also detracts from the natural setting and aesthetic qualities, which attract tourist and vacationers to Bayfield County.

Highly erodible sand and red clay soils are characteristic of much of the southern Lake Superior basin and are responsible for the greatest impact to water quality within the Lake Superior Watershed. Land use practices within the basin that increase peak flows of water off the landscape increase instream erosion through channel incising and slumping of destabilized streambanks, resulting in bank erosion and downstream sedimentation. Disturbed soils coupled with high volume and velocity of water flowing off the landscape creates a severe instream erosion hazard, especially following major rainfall events and in the spring snowmelt. Instream sedimentation, as well as sediment accumulation in Lake Superior, poses a threat to native plant and animal life. As the sediment builds up in the basin, it impedes the natural function of the system inhibiting fish spawning and restricting plant growth. Guidelines have been developed since the last writing of this plan by the Wisconsin DNR and partners for Wisconsin's portion of the Lake Superior basin to identify and/or modify land use practices that accelerate runoff rates and increase peak water flows that accelerate the instream erosion process, contribute to increased sedimentation. Some of the methods include forest management, managing vegetation composition, harvesting forest products, protecting headwaters, managing stable slopes, managing aspen and beaver, designing and installing forest roads and stream crossings. For more information, please see "Managing Woodlands on Lake Superior's Red Clay Plain - Slowing the Flow of Runoff".

Managing and protecting coastal resources requires the use of engineering practices and land management tools such as setbacks and construction best management practices.

The following methods for coastal erosion hazard reduction were listed in the 1990 National Research Council's report entitled "Managing Coastal Erosion":

- *Beach Nourishment* - A practice involving the excavation of sand from one location and deposition in another.
- *Sand Bypassing* - Coastal features such as harbors and navigation channels can disturb the movement of sediment. Sand bypassing restores the natural flow of sediment downdrift of human-constructed barriers through the use of fixed or floating pumping systems.

- *Dune Construction* - Dunes act as erosion barriers by holding reserve sands to protect shoreline from wave and flood events. The construction of artificial dunes to replicate this process can reduce the impact of these coastal hazards.
- *Groins* - Constructed structures aligned perpendicular to the shoreline. Designed to minimize the sediment transport along the shore.
- *Seawalls* - Physical structures constructed on eroding shorelines.
- *Breakwaters* - Offshore structure designed to absorb wave energy while promoting sediment disposition on the protected side. Additional building and land use management tools may be implemented as part of a public coastal protection policy or implemented on a voluntary basis by shoreland owners. These tools include:
 - *Setbacks* - Placement of structures at sufficient distance from the shoreline in order to preserve the physical stability of the shore and to protect the structure from loss to erosion.
 - *Vegetative Cover (shoreline buffer)* - Vegetative zones provide a “cushion” between the land and water. Vegetation provides erosion protection by stabilizing shorelines and banks and provides habitat for wildlife.
 - *Shoreland Septic Systems* - Location of shoreland septic systems is critical as soil and water conditions near the shore may impact the ability of the system to effectively treat effluent causing damage to the environment and posing a health risk to humans.
 - *Development of Landscape Plans* - Site plans designed to assist landowners with property development. Plans identify steep slopes, local drainage patterns, existing vegetative cover, locations for development (building footprints, driveway), well sites, natural features and wildlife habitat.
 - *Bluff Stabilization Techniques* - Techniques to limit runoff from high bluffs and prevent bluff slumping due to erosion of the underlying soil. These techniques include retaining vegetative cover and limiting the amount of impervious cover (road, driveways, sidewalk). Both practices serve to reduce runoff velocity, thereby limiting soil erosion. Outletting rain gutters and diverting surface runoff away from the bluff will also serve to limit erosion.
 - *Lawn Care and Maintenance* - Lawn and gardens within the shoreland zone must be properly planned and maintained in order to prevent contamination of surface waters. Slope problems (sloping to the water) and existing impervious cover at the site should be considered when establishing new lawns and gardens. Also the use of pesticides and fertilizers should be minimized.

HISTORY AND OCCURRENCES

A study conducted in 2001 by the Wisconsin Coastal Management Program indicated the significant impact that the coastal erosion process has had along a portion (28 miles) of Lake Superior shoreline in Bayfield County. The results of this 2001 study reaffirm results of studies conducted during the 1970’s indicating that coastal erosion processes have had a significant impact on the coastline of Bayfield County. According to this 2001 study, an estimated five million cubic yards of shoreline were lost from 1938 to 1990. This loss translates into an annual loss of nearly 3,600 cubic yards per shoreline mile per year, which is equivalent to at least 257 dump truck loads.

Like much of the south shore, portions of the Bayfield County Lake Superior shoreline are receding. Annualized recession rates vary from about 0.50 feet per year to 10+ feet per year in isolated locations.

Erosion of road along Lake Superior in Herbster, WI: Photo by Dennis Fawver (October 2017)



The October 27-28, 2017 Lake Superior wave event led to accelerated erosion to Wisconsin’s Lake Superior shore. During this event, Lake Superior’s record wave height was recorded at 28.8ft at the Granite Island buoy, which is North of Marquette, MI.

VULNERABILITY: HIGH

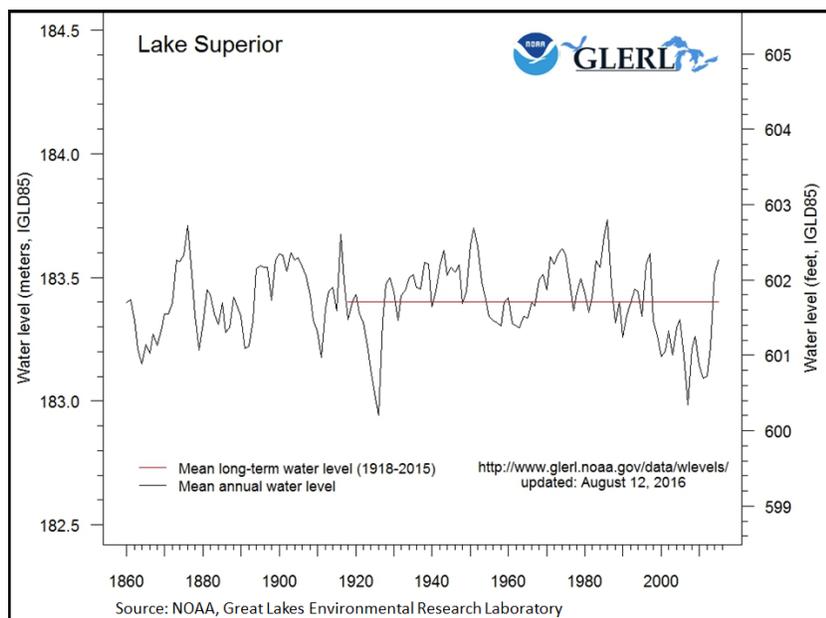
Coastal erosion is a high risk throughout Bayfield County, with the highest risk area identified as the shoreline of Lake Superior. The economic impact of coastal recession alone is notable. The fact that coastal erosion is a slow moving hazard and few immediate actions are needed to protect the public is the determining factor in ranking the vulnerability to coastal erosion as low.

The clay bluffs of Bayfield County’s Lake Superior shoreline varies from low incidence to Moderate incidence of erosion. Coastal erosion is a natural geologic process that may occur slowly over a period of thousands of years or dramatically as with landslides and severe storms. Coastal erosion is closely linked with lake levels; the higher the water, the greater the wave impacts which erode away shoreland bluffs. Other factors influencing coastal erosion include water currents, groundwater flow, freeze/thaw cycles, soil types, bank composition, and shoreline vegetation. Erosion rates are particularly high along clay bluffs, sand plains, and high bluffs composed of till, with short-term erosion rates of 3 to 15 feet per year having been recorded along sand plains and 2 to 6 feet per year along high bluff lines. This natural process is not particularly problematic unless human development is threatened.

Lake Level Change

Water level change is both a seasonal and long-term phenomena affecting the Great Lakes. During the dry winter months, lake levels are usually at their lowest points of the year. Water levels typically rise during the spring and summer months, due to precipitation and snowmelt. Water level fluctuations can pose environmental and economic hazards for coastal communities. In addition to the added risks of coastal flooding and erosion associated with high lake levels, low water levels can expose coastal hazards and impact major resting and feeding areas and nesting areas for migrating ducks, geese, swans, and other water birds. Low water levels also impact critical fish and wetland habitats in the shallow shoreline areas.

Figure 4: 1860 to 2016 Superior Water Levels



Low lake levels significantly impact the profitability of the commercial shipping industry. Low lake levels reduce cargo loads, which can be transported by ship due to reduced draft (clearance) in the shipping channels. A 1,000-foot long vessel must sacrifice 270 tons of cargo for each one-inch reduction in draft.

Water levels of Lake Superior can greatly affect waves which ultimately increase coastal erosion. Historic Lake Superior water levels are depicted in Figure 5. Extremely high levels occurred in the early 1950s, the early 1970s, and July mid-1980s. Lake levels reached all-time highs in 1986, causing significant damage. The chart datum water level is 602.2 feet and the highest all-time recorded lake level was 602.86 feet above sea level in 1876.

MAGNITUDE

Coastal erosion is dependent on several factors. Some areas of the Coast have only natural erosion or no erosion. But in some areas of the coast where conditions are ideal, there could be a loss of 10 feet of coast in a single event such as the October 2017 event.

DURATION

Coastal erosion is generally limited to large scale events such as flooding, wind events and seasons of high lake water levels. These events could be limited to a few hours to a season such as spring when there is a large influx of snowmelt.

FREQUENCY

Lake Superior experiences seasonal lake fluctuations that can effect coastal erosion. Another factor that can cause coastal erosion is heavy rainstorms that lead to erosion. Bayfield can expect to always have coastal erosion, but the rate at which erosion occurs throughout the coast varies.

AREA AFFECTED

Affected area is limited to coastal shoreline which is approximately 86 miles of mainland shoreline on Lake Superior.

POTENTIAL ECONOMIC IMPACT

Nearly 1,200 coastal land parcels exist in Bayfield County. Although these parcels comprise only one percent of the total land area in the County they account for nearly ten percent of the county's total private land value. The loss of land and potentially structures in these areas reduces the overall county tax base. In addition, costly remediation procedures place overwhelming economic burdens on local governments.

POTENTIAL POPULATION EFFECTED

Like previously stated above, there are nearly 1,200 coastal land parcels in the County. There are also various businesses, roads and infrastructure in close proximity of the shoreline.

CRITICAL FACILITIES AT RISK

While critical facilities are unlikely to be affected to a great degree, public infrastructure and shoreline structures could be damaged due to erosion.

3.10 Public Health Emergency

HAZARD DESCRIPTION

Infectious diseases include epidemics, pandemics and human disease outbreaks. The Bayfield County Health Department monitors for and investigates disease outbreaks affecting the county's population. Of particular concern in Bayfield County is the possibility of a pandemic flu outbreak. Pandemic flu occurs when a new influenza virus emerges in the human population and causes a global outbreak of the disease, resulting in serious illness as it spreads through the population.

HISTORY AND OCCURRENCES

Pandemic flu and other illnesses have occurred naturally throughout history. There have been several pandemics in the last 100 years:

- 1918 - 1919: "Spanish flu"
- 1956 - 1958: "Asian flu"
- 1968 - 1969: "Hong Kong flu"
- 2009 – 2010: "Swine Flu" or H1N1
- 2013 – 2017: "Avian Flu" or H7N9
- 2014 - 2016: "Ebola Haemorrhagic Fever"

HAZARD HISTORY - WISCONSIN

- 1500s-1830s Smallpox deaths were widespread among American Indians tribes in Wisconsin.
- 1830s Malaria affects military camps in Wisconsin.
- 1832-1834 Cholera epidemics swept across Wisconsin.
- 1840s Mumps, measles and whooping cough outbreaks occur across Wisconsin with the influx of European immigrants.
- 1849 – 1854 Cholera epidemics again plagued Wisconsinites.
- 1918 "Spanish flu" or "La Gripe" influenza outbreaks closed schools and public meetings across the state of Wisconsin.
 - On October 10, 1918, Cornelius Harper, the state health officer, consulted with Governor Philipp and issued an order instructing all local boards of health "to immediately close all schools, theaters, moving picture houses, other places of amusement and public gatherings for an indefinite period of time," (WisContext, 2018).
 - More than 100,000 people were infected in Wisconsin by the Spanish Flu.
 - Declared by the State Board of Health the most "disastrous calamity that has ever been visited upon the people of Wisconsin," (Wisconsin Historical Society, 2019).



Wisconsin Historical Society, 1918. A sign displayed at an Industrial Harvester Company plant in 1918 directs workers on ways to avoid influenza infection.

- 1936 Scarlet Fever epidemic across Wisconsin. 18,642 reported cases of illness.
- 1950s Polio epidemic spread across the nation and state of Wisconsin.

PROBABILITY

The specific probability that pandemic flu will occur in Bayfield County cannot be predicted, however most health experts agree that a future pandemic event is inevitable. There are many factors that play into the probability of a pandemic affecting Bayfield County, but with a larger global population, closer housing, increased international travel and frequency of travel, it becomes a very serious threat.

VULNERABILITY: LOW TO HIGH

Specific populations are at a greater risk, including people with underlying health conditions or weakened immune systems and the very young or old. Nutritional factors also play a role and may influence the severity of a pandemic event.

The risk of pandemic flu is serious. The H5N1 strain has become well established in large parts of Asia, increasing the risk for more human cases. The strain has also spread to poultry and wild birds in new areas, expanding the opportunities for human transmission. While the specific probability that pandemic flu will occur in Bayfield County cannot be predicted, it can be assumed that the expansion of the H5N1 virus has increased the probability and risk locally.

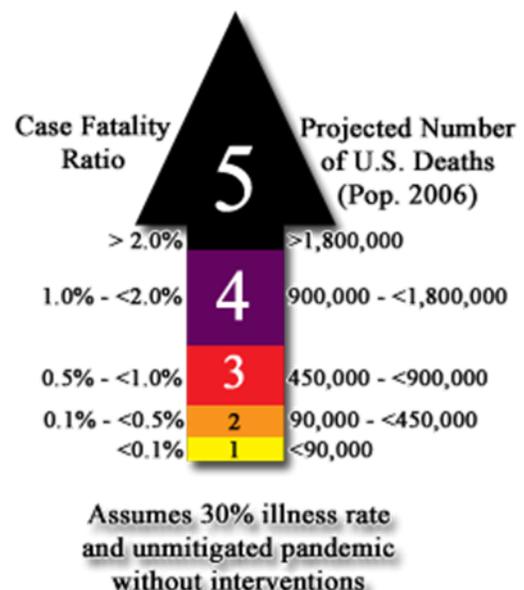
MAGNITUDE

The severity of a pandemic event can be evaluated from two perspectives: that of the individual who has been infected and from the broader population level, or how many complications and deaths might be expected as a whole. The most common measure of severity is the case-fatality rate (CFR).

According to the World Health Organization (WHO), there are several factors which determine the severity of a pandemic influenza outbreak.

Virus Properties: The inherent virulence and contagiousness of the virus influences the severity of a pandemic’s impact, Pandemics usually have a concentrated adverse impact within specific age groups. Concentrated illnesses and deaths in a young, economically productive age group will be more disruptive to societies and economies than when the very young or very old are most severely affected, as seen during epidemics of seasonal influenza.

Subsequent Waves of Spread: Cases of illness in a pandemic occur in waves of six to twelve weeks for up to a year or longer. The Influenza Pandemic occurred in three waves in the United States throughout 1918 and 1919. Virus mutation and the emergence of more virulent strains can influence the severity of subsequent waves.



CDC

U.S. Gov.

Population Vulnerability: Specific populations are at a greater risk, including people with underlying health conditions or weakened immune systems and the very young or old. Nutritional factors also play a role and may influence the severity of a pandemic event.

Capacity to Respond: The quality of health services available influences the impact of any pandemic. A virus that causes only mild symptoms in communities with strong health systems can be devastating in other communities where health systems are weak. Vaccine shortages and distribution problems can also impact the ability to respond to a pandemic event.

DURATION AND FREQUENCY

It is difficult to predict how long a pandemic would affect Bayfield County or how frequently they would occur. Based on statistics from the U.S. Department of Health and Human Services, it is likely that a pandemic wave could last for three to four months, with community outbreaks lasting from six to eight weeks.

POTENTIAL ECONOMIC IMPACT

A pandemic flu event would likely have severe economic repercussions, with significant costs associated with hospitalization and care for those afflicted. Broader economic impacts associated with lost productivity and wages could also be expected. In general, most economic functions would be challenged by the high rate of absenteeism associated with a pandemic.

CRITICAL FACILITIES AT RISK

A pandemic outbreak could severely impact local health care services. Pandemic flu could overburden health care facilities through an increasing patient load and reduction of staffing of hospitals, clinics and palliative care services. Local health care organizations and systems may also be impacted in the event of pandemic flu by national medical supply shortages, including insufficient medications and vaccines to treat patients or protect residents.

3.11 Fog

HAZARD DESCRIPTION

Fog is a collection of liquid water droplets or ice crystals suspended in the air at or near the Earth's surface; essentially a cloud at ground level. Fog can occur any time the air temperature reaches the dew point, or the point at which the air becomes saturated with water vapor. The main hazard associated with fog is visibility. Dense fog can reduce visibility to ¼ mile or less creating potentially hazardous driving conditions. Low visibility conditions may also disrupt aviation and rail traffic. While most fog events are generally short-lived and last less than 24 hours, extended periods of fog can occur. The most commonly-occurring forms of fog in Bayfield County include radiation fog, advection fog, ice fog, freezing fog and evaporative fog.

Radiation fog forms at night under clear skies with calm winds when heat absorbed by the earth's surface during the day is radiated into space. As the earth's surface continues to cool, provided a deep enough layer of moist air is present near the ground, the humidity will reach 100% and fog will form. **Advection fog** often looks like radiation fog and is also the result of condensation. However, the condensation in this case is caused not by a reduction in surface temperature, but rather by the horizontal movement of warm moist air over a cold surface. This means that advection fog can sometimes be distinguished from radiation fog by its horizontal motion along the ground. **Ice fog** forms when the air temperature is well below freezing and is composed entirely of tiny ice crystals that are suspended in the air. Ice fog will only be witnessed in cold Arctic/Polar air. Generally the temperature will be 14°F or colder in order for ice fog to occur. **Freezing fog** occurs when the water droplets that the fog is composed of are "supercooled". Supercooled water droplets remain in the liquid state until they come into contact with a surface upon which they can freeze. As a result, any object the freezing fog comes into contact with will become coated with ice. The same thing happens with freezing rain or drizzle. **Evaporation fog** forms when sufficient water vapor is added to the air by evaporation and the moist air mixes with cooler, relatively drier air. The two common types are steam fog and frontal fog. Steam fog forms when cold air moves over warm water. When the cool air mixes with the warm moist air over the water, the moist air cools until its humidity reaches 100% and fog forms. This type of fog takes on the appearance of wisps of smoke rising off the surface of the water and is very common near the lakes and rivers of Bayfield County.

HISTORY AND OCCURANCES

There is little information available on past fog events affecting Bayfield County. Between 1994 and 2017, there were 57 motor vehicle crashes where fog was identified as the weather condition present (WisTransportal, 2017). The County can expect to have between 2 and 3 motor vehicle accidents a year in foggy conditions.

PROBABILITY

Probability of annual occurrence is near 100 percent.

VULNERABILITY: LOW

Areas specifically around water are at greater risk of experiencing fog. But because the County is in such close proximity to Lake Superior, fog events can be more frequent and severe.

MAGNITUDE

The magnitude of a fog event can be characterized by the duration and reduction in visibility. The National Weather Service issues a **Dense Fog Advisory** when widespread dense fog reducing visibility to less than 1/4 mile.

DURATION

Most dense fog events last less than 24 hours, but may persist for several days, especially during the snowmelt period of late winter through early spring.

FREQUENCY

According to National Weather Service data, Price County experiences 20.5 to 25.4 heavy fog days per year. As shown in figure 5, Bayfield County is located within a region of Wisconsin, which on average, experiences 25.5 to 30.4 heavy fog days per year. This is over twice the national mean of 13 heavy fog days per year.

AREA AFFECTED

Fog can be widespread, encompassing the entire county or localized in valleys and along bodies of water.

POTENTIAL ECONOMIC IMPACT

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

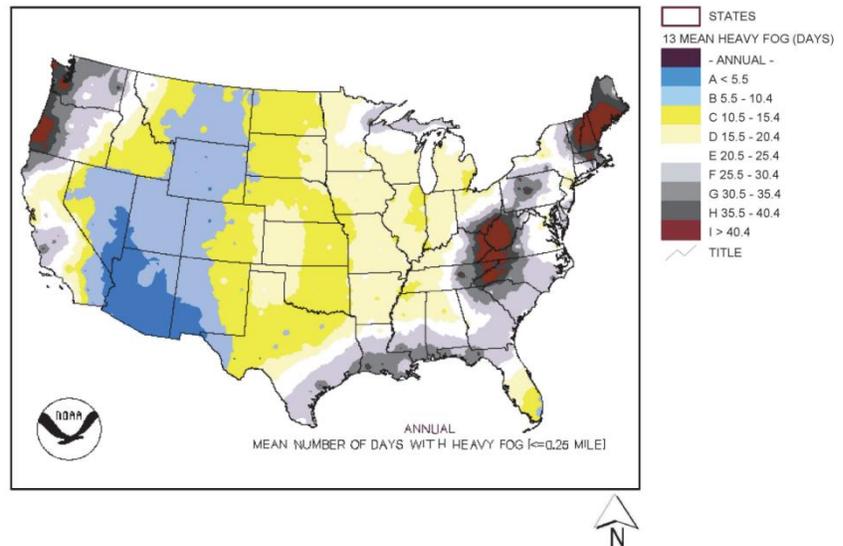
POTENTIAL POPULATION AFFECTED

Hazard risk affects all citizens of Bayfield County.

CRITICAL FACILITIES AND INFRASTRUCTURE AT RISK

Generally, critical facilities and community infrastructure is not at great risk due to fog hazards. Although emergency services and response may be impacted due to reduced visibilities, physical structures are not at risk.

Figure 5: Mean Number of Days with Heavy Fog

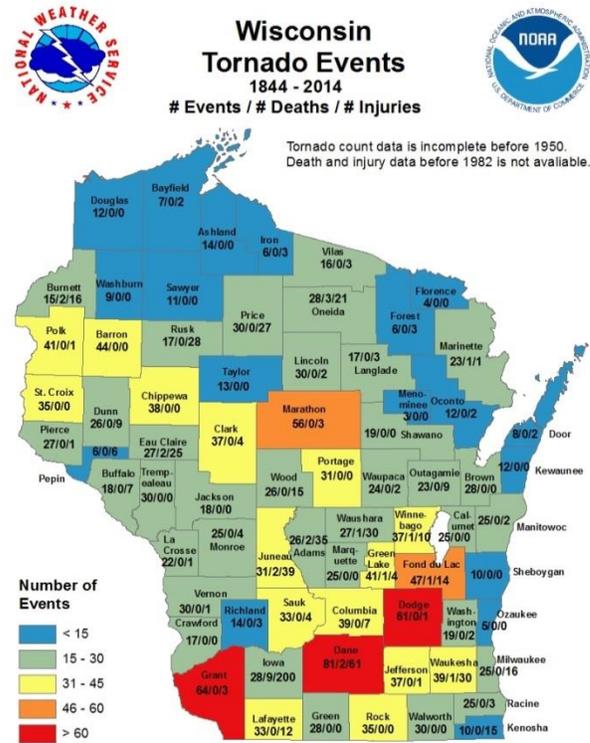


3.12 Tornadoes

HAZARD DESCRIPTION

A tornado is a relatively short-lived storm 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 are estimated between 100 and 200 miles per hour. The following National Weather Service definitions are included for standardization:

- 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.
- Downburst - a strong downdraft, initiated by a thunderstorm, which induces an outburst of straight-line winds on or near the ground. They may last anywhere from a few minutes in small-scale micro-bursts to period of up to 20 minutes in larger, longer macro-bursts. Wind speeds in downbursts can reach 150 miles per hour, in the range of a tornado.



A tornado path averages four miles, but may reach up to 300 miles in length. Widths average 300-400 yards, but severe tornadoes have cut swaths a mile or more in width, or have formed groups of two or more funnels traveling together. On the average, tornadoes move between 24 and 45 miles per hour, but speeds over land of up to 70 miles per hour have been reported. Tornadoes rarely last more than a couple of minutes over a spot or more than 15 to 20 minutes in a ten-mile area, but their short periods of existence do not limit their devastation of an area.

The destructive power of a 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. Since tornadoes are generally associated with severe storm systems, they are usually accompanied by hail, torrential rain and intense lightning. Depending upon their intensity, tornadoes can uproot trees, down power lines and destroy buildings. Flying debris can cause serious injury and death.

Table 29: Tornado Damage (Enhanced Fujita Scale)

Tornado Damage Scale (Enhanced Fujita Scale)		
Scale	Wind Speeds	Damage
EF0	65 to 85 mph	Some damage to chimneys, TV antennas, roof shingles, trees and windows.
EF1	86 to 110 mph	Automobiles overturned, carports destroyed, trees uprooted
EF2	111 to 135 mph	Roofs blown off homes, sheds and outbuildings demolished, mobile homes overturned
EF3	136 to 165 mph	Exterior walls and roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests and farmland flattened.
EF4	166 to 200 mph	Few walls, if any standing in well-built homes. Large steel and concrete missiles thrown far distances.
EF5	> 200 mph	Homes leveled with all debris removed. Schools, motels and other larger structures have considerable damage with exterior walls and roofs gone. Top stories demolished.

Tornadoes are classified according to the Enhanced Fujita scale - by the documented wind speed and/or the damage they cause as follows: Downbursts are characterized by straight-line winds. Downburst damage is often highly localized and resembled that of tornadoes. 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, including veering right and left or even making a U-turn.

Table 30: Bayfield County Tornado History

Year	Date	Damage Scale	Injuries	Damage
1968	30-Jun	F2	2	\$250,000
1983	3-Jul	F1	2	\$250,000
1983	3-Jul	FO	0	\$250
1984	27-Apr	FO	0	\$25,000
1998	13-Aug	F1	0	\$250,000

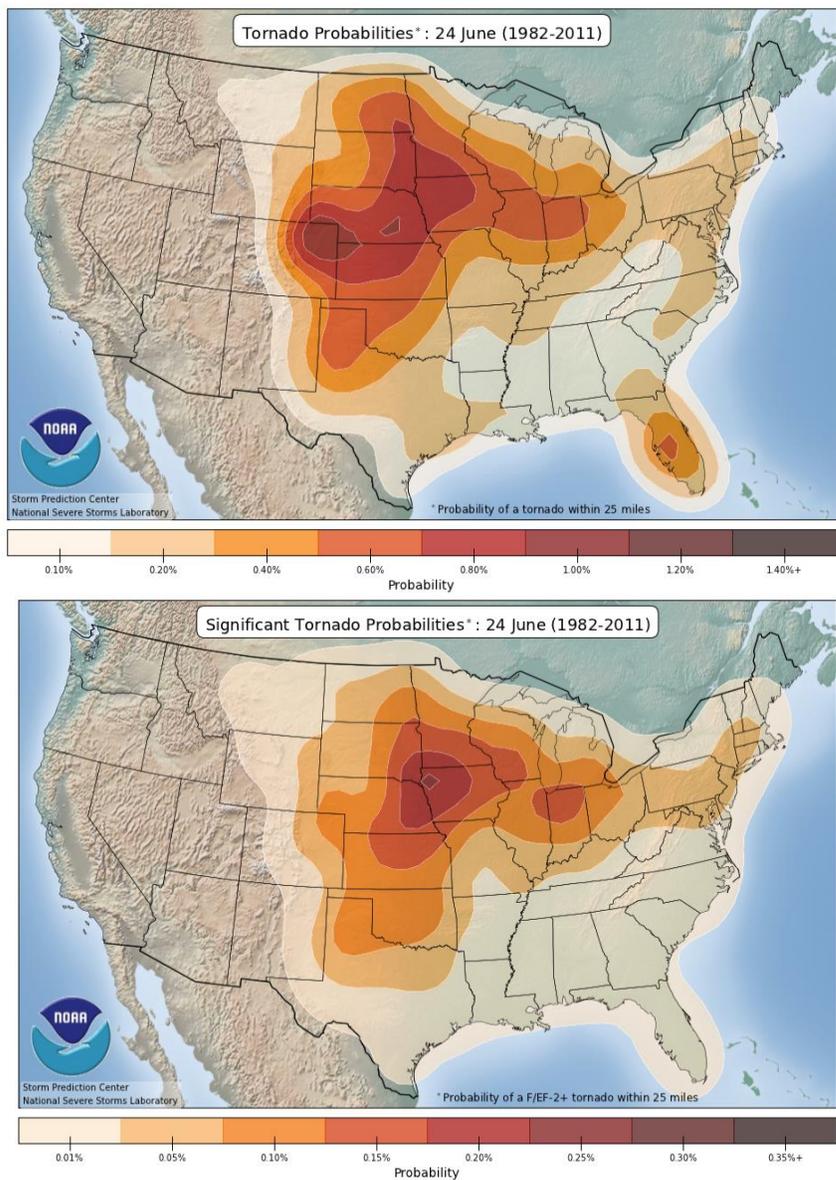
Source: NOAA

HISTORY AND OCCURRENCES

The National Weather Service of Milwaukee has documentation for seven verified tornadoes in Bayfield County between 1844 and 2017. Little information was available related to those tornadoes as this plan was under development. During public meetings with town officials detailed information related to the 1926 tornado was reported available. That information was researched through the Bayfield County Historical Society and is highlighted here.

July 16, 1926 - The July 22, 1926 issue of the Washburn Times had this to say: “For velocity the storm was one of the fiercest that has every visited Northern Wisconsin, and while the path of the storm was not wide, yet the damage it did where it hit is almost unbelievable for sturdy barns and homes were laid flat and trees more than a foot in diameter were twisted and broken like so many pieces of straw.” The Ashland Daily Press of July 17, 1926 reported as follows: “Houses were lifted from their foundations, carried into the air and dropped, and spread broadcast, over the surrounding land, while barns were razed completely, silos were twisted, trees were torn up by the roots and

Figure 6: Estimated Tornado Probabilities



carried for many yards, telephone and telegraph wires were rendered useless, cattle sheep, horses chickens and other farm animals were killed or injured so seriously that it was necessary to kill them, railroad traffic was interrupted, a bridge was town out, orchards were destroyed, and havoc in general was wrought by the storm.”

The first reported damage from the storm in Bayfield County was near Port Wing. Both John Gidmark and Frank Fay, area farmers, “lost their fine barns, but other loses in that locality were reported to be slight”. “Making another jump, the cloud again descended in the vicinity of the Brink farm on the Barrens where it cut a path several feet wide through the brush and timber wrecking a school building in the west portion of the Town of Washburn.”

Table 31: Tornado Activity in the WI Northwest Region (1950-2015)

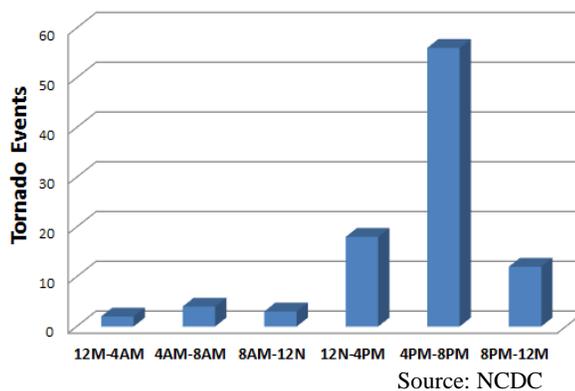
County	Number of Tornadoes	Property Damage	Crop Damage	Injuries	Deaths
Price	18	\$ 26,390,000	\$ 515,000	26	0
Burnett	12	\$ 12,560,000	\$ -	25	3
Rusk	13	\$ 26,270,000	\$ -	34	0
Ashland	9	\$ 328,000	\$ -	0	0
Douglas	9	\$ 856,000	\$ 100,000	0	0
Sawyer	6	\$ 277,500	\$ -	0	0
Taylor	7	\$ 4,206,000	\$ 10,000	3	0
Washburn	8	\$ 2,780,000	\$ -	0	0
Bayfield	5	\$ 775,250	\$ -	4	0
Iron	7	\$ 588,566	\$ -	3	1
TOTAL:	91	\$ 75,031,316	\$ 625,000	95	4

Source: NOAA National Climate Data Center

The Washburn Times continued - “The Galligan farm

is surrounded by a fine stand of oak and maple timber, some measuring as much as two feet in diameter and here the trees were laid flat in every direction, some torn up by the roots, while others were snapped and twisted. The twister passed over the Galligan garage, leaving that building intact, while it laid flat the barn, chicken coop and other buildings and when it arrived at the house it performed a most peculiar stunt, tearing the main part of the house from the kitchen addition and leaving the family, consisting of Mr. and Mrs. Galligan and four children uninjured. (Washburn Times, July 22, 1926) Documentation related to the July 16, 1926 tornado includes the recording of two deaths in Bayfield County and one just into Ashland County. Although injuries are mentioned throughout the documentation there are no specific numbers given.

Figure 7: Tornado Activity in the Northwest Region by Time of Day 1950 - 2012



1960 - In conversation with residents of the Iron River area discussion ensued about the tornado of the early 1960s. It was reported that the tornado damaged several homes along the CTH A corridor and then proceeded to wipe out acres of trees on its path southward. A gravel pit between Drummond and Barnes is now operating at a location that was reported to be heavily wooded before that tornado.

1968 – June 30, 1968 – A F2 magnitude tornado was recorded. It has a total length of 27.6 miles and a width of 300 yards causing a total in \$250,000 in damages.

1983 – July 3, 1983 – A F2 magnitude tornado was recorded in the Barnes area. The tornado had a total length of 3 miles and was about 57 yard wide in total. There were a total of 2 injuries and \$225,000 in damages as a result of the tornado.

1984 – April 27, 1984, A F0 magnitude tornado was recorded in Benoit. The tornado was .3 miles in length and had a total width of 50 yards causing no injuries, but \$25,000 in damages.

1988 – August 13, 1988 – A F1 magnitude tornado was recorded near the Village of Mason causing a total of \$250,000 in damages. The tornado was a total of .1 miles long and 50 yards wide.

Although local folks are referring to the damaging wind event of October 2005 as a tornado, the National Weather Service of Duluth has documented it as downbursts and straight line winds.

2010 - On June 22, 2010, a funnel cloud was spotted several times in the Cable area. Although no damage was determined to be a direct result of this funnel cloud, it was a reminder of the severity and speed at which weather can strike.

Information related to the seven tornado events on record with the National Weather Service was difficult to gather because there had been no central gathering point for information. Ongoing research will continue with the Bayfield County Historical Society and the National Weather Service related to these severe weather events in an attempt to compile concrete documentation for future reference.

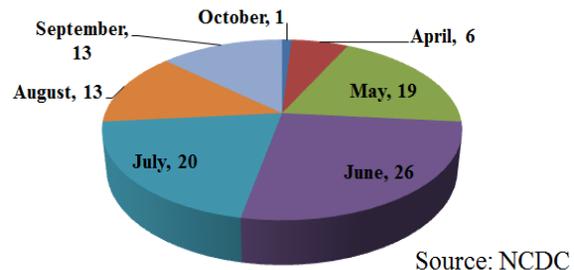
PROBABILITY

The National Weather Service has recorded five tornado events in Bayfield County since 1968. Using those statistics one could predict that a tornado would occur in Bayfield County approximately once every ten years.

VULNERABILITY: MEDIUM

Bayfield County has a medium vulnerability to tornadoes. The vulnerability and level of concern is raised considerably when one considers that resulting damage to the more populated areas of the County would overwhelm resources almost immediately. Damage to our schools, public buildings, and communications towers are only a few of the structures that would create the most severe impact on county infrastructure. Potential loss of life, need for search and rescue, and resulting personal safety concerns throughout the impacted area would add to our vulnerability. And perhaps our level of vulnerability is greatest because local residents do not consider this area at risk for tornadoes, relying on Lake Superior to protect them. Bayfield County successfully received a FEMA grant and completed a storm shelter at the county fairgrounds in Iron River, this shelter reduces the vulnerability of the population when they are attending events at the grounds.

Figure 8: Tornado Activity in the Northwest Region by Month, 1950-2012



Source: NCDC

MAGNITUDE

The magnitude of a tornado is defined primarily by wind speed. According to the NOAA database, five tornados have occurred in the County since 1968. These events ranged in magnitude from EF0 to EF2.

DURATION

Tornados are typically brief events, with long recovery times. However, in rare cases these events can last for several hours.

FREQUENCY

Wisconsin lies along the northern edge of the nation's tornado belt, which extends northeastward from Oklahoma into Iowa. Winter, spring, and fall tornadoes are more likely to occur in southern Wisconsin than in northern counties. Yet, tornadoes have occurred in Wisconsin during every month except February. Based on historical observations, the recurrence interval for a tornado in Iron County is about ten years. This frequency is significantly lower than in the counties of central and southern Wisconsin.

AREA AFFECTED

All locations within the county are equally susceptible to this hazard. The physical area directly affected by a tornado is determined by the total area of the tornado (path length x width). A tornado may touch down only briefly before dissipating, or may stay on the ground for several miles, resulting in a damage path. In urbanized areas, a tornado will leave a path of destruction affecting structures, cars, trees, and utility lines all along a path, while adjacent areas may suffer little or no damage.

POTENTIAL ECONOMIC IMPACT

With limited historical data, estimates of potential damage are hard to determine. The five NOAA documented tornado events have resulted in a combined \$775,250 in damage, or an average of \$155,050 per event. Realistically, an event involving a tornado would *most likely* affect a small portion of the County. If the impacted area was in a developed area, such as the Cities of Washburn or Bayfield, significant structural damage could occur.

POTENTIAL POPULATION EFFECTED

While the risk of tornados is shared equally across the county, the population impacted by a specific event can vary greatly. If a tornado were to strike a populated community such as Washburn or Bayfield, a large number of people could be affected. The population density of rural Bayfield County is generally less than ten persons per square mile. Persons residing in mobile homes or vehicles such as RV's are particularly at risk from tornados. These structures offer little protection and can be easily overturned or destroyed by the violent winds of a tornado. The National Weather Service says that nearly 40 percent of all tornado deaths have historically occurred in mobile homes. A little more than half of the deaths in 2017 (19 of 34) were in mobile homes. In addition to mobile homes, campers are also especially vulnerable because trees can fall into campsites and onto tents.

CRITICAL FACILITIES AT RISK

Tornados pose the same risk to critical facilities as to other structures in the County. While many of these structures do contain "safe-areas" or basements which provide shelter in the event of a storm, the structures themselves may not be able to withstand the winds of a violent tornado. Above ground infrastructure including power and utility lines, pipelines and communications towers are highly vulnerable to tornadic winds. If a tornado were to occur, there is a high likelihood of localized power disruption.

3.13 Dam Failure

HAZARD DESCRIPTION

A dam failure involves the uncontrolled release of stored water due to the breaching of a water control structure, resulting in rapid downstream flooding. A dam can fail because of excessive rainfall or melted snow, poor construction or maintenance, flood damage, weakening caused by burrowing animals or vegetation, surface erosion, vandalism or a combination of these factors.

For emergency planning purposes, dam failures are categorized as either rainy day or sunny day failures. Rainy day failures involve periods of excessive precipitation leading to an unusually high runoff. This high runoff increases the reservoir of the dam and if not controlled, the overtopping of the dam or excessive water pressure can lead to dam failure. Normal storm events can also lead to rainy day failures if water outlets are plugged with debris or otherwise made inoperable. Sunny day failures occur due to poor dam maintenance, damage/obstruction of outlet systems or vandalism. This type is the worst case of failure because the breach is unexpected and there may not be sufficient time to properly warn downstream residents.

The Wisconsin Department of Natural Resources (DNR) regulates dams that are not regulated by the federal government. The federal government has jurisdiction over most large dams in Wisconsin that produce hydroelectricity. Bayfield County dams do not produce hydroelectricity and therefore are regulated by the DNR with 39 dams listed on the Dam Safety Program database.

The Wisconsin DNR assigns hazard ratings to large dams within the state. When assigning hazard ratings, two factors are considered: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property downstream should the dam fail. A high hazard indicates that a dam failure would most probably result in the loss of life. A significant hazard indicates a dam failure could result in appreciable property damage. A low hazard exists where dam failure would result in only minimal property damage and loss of life is unlikely. This hazard rating has nothing to do with the physical attributes, quality or strength of the dam itself but rather on the potential for loss of life or property should the dam fail. Three dams in Bayfield County are assigned the hazard rating of significant. Of those three dams, Emergency Action Plans are in place for one.

A dam with a structural height of over six feet and impounding 50 acre-feet or more, or having a structural height of 25 feet or more and impounding more than 15 acre-feet is classified as a large dam. Of the 39 dams listed in Bayfield County nine dams are considered large. All others are classified as small.

A dam failure analysis identifies the hydraulic shadow or the area of land downstream from a dam that would be inundated by water upon failure of the dam. This information may be used to develop an Emergency Action Plan (EAP) for the dam. This EAP includes provisions for notifying emergency authorities for assistance and warning affected downstream residents if the potential for failure exists.

A listing of Bayfield County dams and specifics of each, including size, type, owner, hydraulic and structural heights, impoundment surface area and maximum impoundment as well as hazard ratings follows as Table 23.

HISTORY AND OCCURRENCES

“On the night of September 1, 1985, a vicious flood nearly overtopped the 66 foot tall Orienta Falls electrical power-generating dam on the Iron River in Bayfield County. The events were chronicled the next morning in photographs taken by employees of Northern State Power (NSP) who circled helplessly in a helicopter, watching as the raging waters overwhelmed the earth embankment and bulldozed away the dam’s powerhouse walls. It wasn’t just the dam that was destroyed, according to The Evening Telegram, a local newspaper. At least three bridges came down as well, including the one at the mouth of the Iron River on Highway 13, where it joined Lake Superior. Telephone service was cut, many road and culverts were washed away and though no one died, two families downstream were evacuated for fear the whole dam would go. The flood brought down the Orienta Dam, but changing times prevents its repair. NSP couldn’t justify spending half a million dollars to rebuild a dam that generated only meager profits. The river was returned to its natural state and as a result improved trout fishing. However, some residents long for the scenic beauty of the flowage or small lake the dam had provided.” (Katherine Esposito, Wisconsin Natural Resources Magazine, April 1999.)

PROBABILITY

Based on the currently available information related to dam inspections, Bayfield County projects that there will be one dam failure every ten years. But the severity of the failure greatly depends on the size of the impoundment. With the current trend of larger flood events the likelihood of dam failures from rainy day failures is likely to increase.

VULNERABILITY: LOW

Most dams in Bayfield County are not of significant risk. There are very few structures downstream that would be impacted by a dam failure. Those structures downstream are mostly small cabins that are not inhabited year around. Therefore the vulnerability to dam failure is ranked as low. Our vulnerability is increased somewhat because of the undefined location of many of the privately owned dams.

Hazard Potential (right side of table)

H= High (loss of life likely should dam fail)

S=Significant (significant property damage is likely)

L=Low

Table 32: Bayfield County Dams (WI DNR)

Town/ Location	Official Name (Popular Name)	Size	Type	Owner	Hydraulic Height (feet)	Structure Height (feet)	Impoundment surface area (acres)	Max Impound (acres/ft)	Hazard Potential
Bayfield	Birch Run	Small	Public	WDNR	6.0	12.0	1.0	8.0	Low
	Fish Hatchery	Small	Public	WDNR	4.0	7.0	1.0	5.0	Low
	Carlson, Carl	Small	Private	Carlson					
	McCutcheon	Small	Private	Frank McCutcheon Jr. & Ruth	6.0	8.0	1.0	5.0	
	Olson, Ed	Small	Private	Stanford Stephenson	5.0	8.0	1.0		
	Williams	Small	Private	R.M. Williams	11.0	13.0	1.0	5.0	
Barksdale	Bretting	Small	Private	Tad Bretting	4.5	5.5	0.1	0.1	Low
	Demboski	Small	Private	Jessie Demboski	13.0	25.0	1.0	5.0	

Bayfield County Hazard Mitigation Plan

Barnes	Middle Eau Claire Lake	Large	Public	Bayfield County	16.0	16.0	902.0	6000.0	Significant
	Morrison Family	Small	Private	Morrison Family Trust	4.0	16.0	2.0	10.0	
	Upper Eau Claire Lake (Big Robinson Lake)	Large	Private	Scott Lundberg	3.0	6.1	1030.0	4000.0	Low
Clover	Bratley No 1	Small	Private	Alvin E. Bratley	7.0	11.0	2.0	13.0	
	Bratley No 2	Small	Private	Alvin E. Bratley	12.0	17.0	1.0	4.0	
Delta	Carsons Pond	Small	Private	Hazel Hills Corp			6.0		
	Delta Lake	Small	Public	Bayfield County	3.0	4.0	59.0	250.0	Low
	Don Johnson	Small	Public	WDNR	7.0	8.0	10.0	40.0	
	Murray (Eagle or Flynn Lake)	Large	Public	Bayfield County	9.5	13.0	650.0	22000.0	Low
Drummond	Bearsdale North (Bearsdale Lower)	Small	Public	USDA - Forest Service	5.0	5.0	2.0	10.0	Low
	Bearsdale South (Bearsdale Upper)	Small	Public	USDA - Forest Service	3.0	6.0	10.0	20.0	Low
	Drummond (Rust Flowage)	Large	Public	WI DOT	19.0	24.0	62.0	450.0	Significant
	Drummond Lake	Large	Public	Bayfield County	12.0	17.0	112.0	1500.0	Low
	Johnson Springs	Small	Public	USDA - Forest Service	4.0	11.0	11.0	45.0	Low
	Lake Owen (Lake Owen Outlet)	Large	Public	USDA - Forest Service	9.0	12.0	1323.0	4900.0	Low
	Shunenberg	Small	Public	USDA - Forest Services	4.2	6.7	3.0	37.0	Low
Eileen	Pavich	Small	Private	Steve Pavich	4.0	6.0	1.0	3.0	
	Tutor	Small	Private	Clayton Tutor	7.0	9.0	1.0	3.0	
Hughes	Iron Lake	Small	Public	Town of Hughes	1.0	2.0	248.0	2000.0	low
Iron River	Brost	Small	Private	Louis J. Brost	10.0	12.0	1.0	1.0	
	Iron River Light and Power (Iron River)	Large	Public	Town of Iron River	23.0	29.0	76.0	1891.0	High
	Upson (A.R. Antanson)	Small	Private		6.0	12.0	2.0	5.0	Low
Keystone	Koval.	Small	Private	George Koval, Jr.	6.0	8.0	1.0	2.0	
	Susienka	Small	Public	Town of Keystone	4.0	8.0	2.0	10.0	
Lincoln	Walther, Gerald	Small	Private	Walther, Gerald	8.0	10.0	1.0	1.0	
Mason	Skaj	Small	Private	Martin P. Skaj	8.0	9.0	1.0	2.0	
Namakagon	Johnston Dam (Johnston Surprise)	Large	Public	USDA - Forest Service	5.0	10.0	15.0	120.0	Low
	Namakagon	Large	Public	Town of Namakagon	4.0	9.0	3208.0	19700.0	Significant
Pilsen	Johanik, Thomas	Small	Private	Thomas Johanik	2.0	8.0	1.0	2.0	

Bayfield County Hazard Mitigation Plan

Port Wing	Johnson, Robert (Evens, Michael)	Small	Private	Michael Evens	8.0	9.0	1.0	3.0	
Red Cliff	Red Cliff	Small	Private	Red Cliff band of Lake Superior Chippewa	6.6	8.6	6.1	29.0	Low
Tripp	Raivala, Arnie	Small	Private	Arnie Raivala	8.0	12.0	1.0	6.0	

MAGNITUDE

Failure of a “high hazard” dam would probably cause loss of human life. Failure of a “significant hazard” dam would probably cause significant property damage but would probably not cause loss of human life. Failure of a “low hazard” dam would probably not cause significant property damage or loss of human life.

DURATION

Short term

FREQUENCY

Minor dam failures do occur periodically; however, significant dam failures occur much less frequently. No reliable historical record of dam/levee failure exists for Bayfield County.

AREA AFFECTED

The area affected due to a dam failure is potentially large. Dam failure analysis has not been conducted for dams in Bayfield County, thus hazard analysis parameters such as affected area and loss estimates are unavailable.

Three dams in Bayfield County have drainage areas impoundment surface area larger than 1000 acres in size which are the Namakagon, Lake Owen and Upper Eau Claire Lake Dams.

Several dams in Bayfield County have been assigned Hazard Rating Codes by WDNR. Of the 39 dams rated by WDNR, 1 was rated as HIGH (Iron River) and 3 were rated as SIGNIFICANT (Namakagon, Middle Eau Claire Lake and Drummond).

H= High (loss of life likely should dam fail)

S=Significant (significant property damage is likely)

L=Low

These ratings only assess the potential for downstream damages and loss of life, if failure were to occur rather than assessing the actual potential for the dam to fail.

POTENTIAL ECONOMIC IMPACT

There was insufficient information to generate a dollar estimate of potential losses resulting from dam and levee failure. Potential losses will be estimated as more information and technology becomes available.

If a dam in Bayfield County were to fail, a flash flood would move quickly downstream, threatening life and property below the dam. The hydraulic energy released in a mass of water would be devastating to

structures, roads, bridges and other infrastructure. The potential economic impact of a dam failure is directly related to the level of downstream development. Because the affected area has a relatively low development density (in Bayfield County), losses would likely be significantly less than if such a failure were to occur in a populated area. Downstream communities and counties may experience flooding and increased water flows.

POTENTIAL POPULATION EFFECTED

Unknown. Downstream communities from dams would be effected, but to what magnitude is unknown

CRITICAL FACILITIES AT RISK

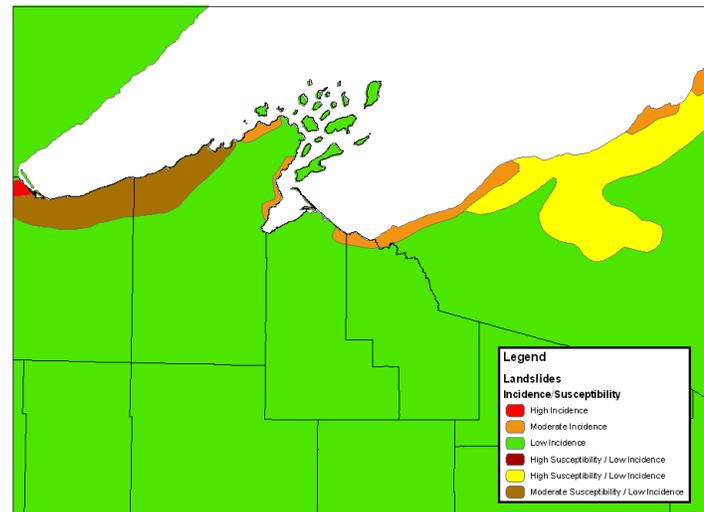
Unknown. It would be suspected infrastructure such as roads would be flooded and potentially damaged.

3.14 Landslides

HAZARD DESCRIPTION

Landslides are geologic hazards which have the potential to cause significant damage and loss of life. These hazards are characterized by the sudden downhill movement of soil, mud and rock caused when stresses placed on the slope exceed the slope's strength. Landslides can be triggered once slope material becomes saturated from precipitation or rapid snowmelt. Landslides can also be caused by erosion, and the undercutting of cliffs and banks by waves or rivers. Human activities can also trigger landslides and influence their severity. Activities such as grading for construction and roads, mining, alteration of natural drainage patterns and vegetation removal can greatly contribute to landslide potential.

Figure 9: Landslide Incidence and Susceptibility



Source: U.S. Geological Survey

Landslide risk in Bayfield County is greatest along the Lake Superior coastline (Figure 4). The high clay bluffs present in this area are particularly vulnerable gravitational processes of creep, slumping, and occasional landslides. This hazard can also be attributed to coastal hazards.

HISTORY AND OCCURANCES

There is no historical record of significant landslide events in Bayfield County. While physical evidence indicates that landslides have occurred, only 1 structural damage incident and no injuries have been documented.

Regionally, coastal landslides have been problematic as evidenced by the recent event in the Village of Oliver (Douglas County). 2002 - A massive landslide impacted several homes along the St. Louis River. Hazard Mitigation Grant Program funds were used to acquire and demolish three of the seven affected properties.

June 2018 – There was a significant mudslide that ended up damaging a house on County Highway H.

There was a landslide Mitigation project on County Trunk A where Geofoam was used and the bank was engineered to minimize erosion and landslide events.

There are properties on the Lake Superior Coastline that have experienced significant coastline loss and will encounter structural damage or loss in the future with continual coastline bank loss.

PROBABILITY

While it is likely that landslide events will occur, the statistical probability is unknown. Landslide monitoring has not occurred in the past and little, if any, data is available to estimate future probability. The probability of bluff failure and coastal erosion is 100 percent.

VULNERABILITY: MEDIUM

Bayfield County has a medium vulnerability to landslide hazards. The vulnerability and level of concern is raised considerably when one considers that resulting damage to the more populated areas of the county would overwhelm resources almost immediately. But generally the landslides are likely to happen next onto roadways or by residential structures.

MAGNITUDE

The hazard may range from a slow creep of the bluff to complete bluff failure and collapse. Magnitude is partially dependent upon the height and angle of the slope or bluff. In general, the higher the bluff or slope, the greater the risk of a landslide hazard. Similarly, the steeper the slope, the easier it is for gravity to pull the slope away, resulting in a landslide.

DURATION

Some landslides begin as slow creep movements until a threshold is exceeded resulting in total slope failure and a landslide. The creep process may occur over a period of years while the actual landslide event may occur within minutes.

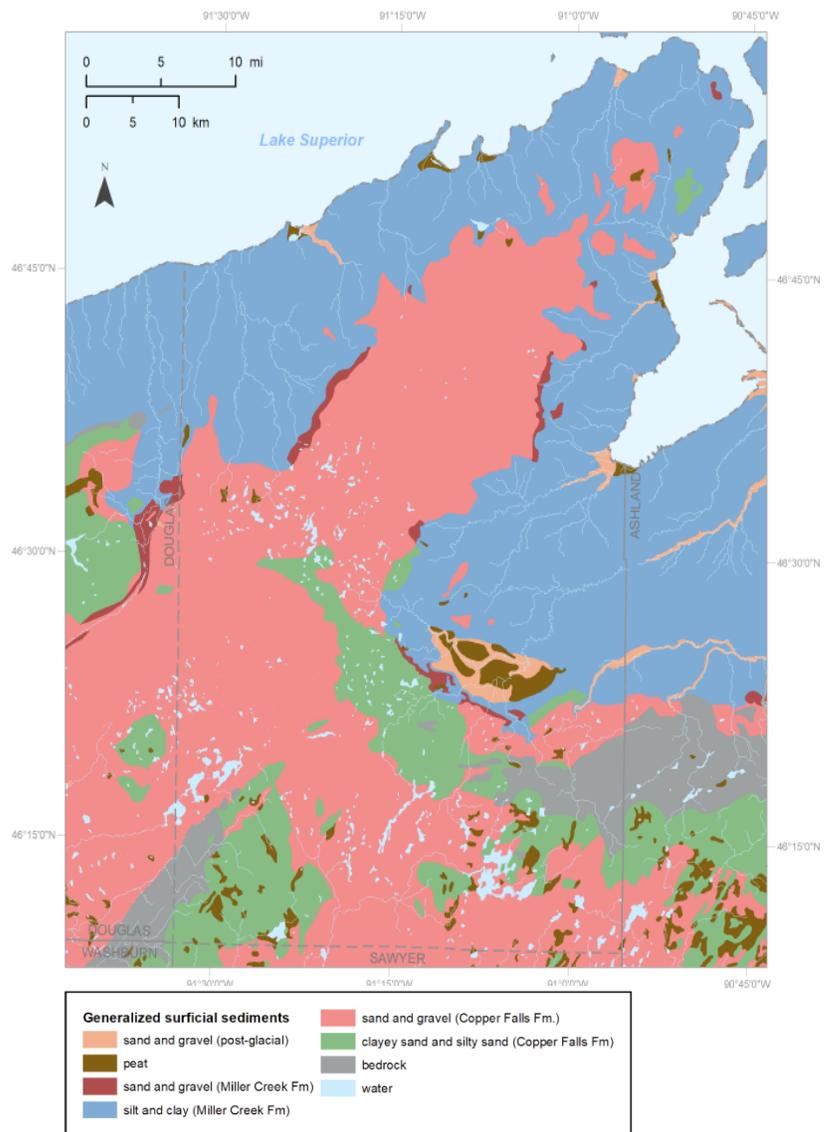
FREQUENCY

Minor landslides are a relatively common occurrence within the clay plain; however, the statistical frequency to which these events occur is unknown.

AREA AFFECTED

This hazard would most likely impact Bayfield County’s coastal area, where, according to the USGS¹, there exists moderate landslide susceptibility. The coastal area is situated along a lacustrine clay plain which is particularly vulnerable to erosion and slumping. The primary concern, relative to this hazard, includes development along coastal bluffs, stream banks, and slopes within the clay plain.

Surficial Geologic Deposits in Bayfield County



Source: Wisconsin Geological and Natural History Survey

¹ USGS http://landslides.usgs.gov/HTML_files/landslides/nationalmap.national.html

POTENTIAL ECONOMIC IMPACT

Because the identified area by USGS contains a large portion of the County's structures, the risk to the built environment is relatively high. By cross-referencing the county structure database with the mapped risk area, structures were identified and the taxable improvement value for each structure was used. It is estimated that a total structure value of about \$320,000,000 exists within the risk area of the county. But in the instance of this hazard, a landslide event would likely be localized and effect several structures at once, not many. One thing to note is coastal properties are generally "high value" the estimated per-structure loss value is assumed to be higher than for those non-coastal structures.

POPULATION AFFECTED

These events are usually localized, the population affected is likely to be very small and many of the structures are for seasonal and/or recreational use.

CRITICAL FACILITIES AT RISK

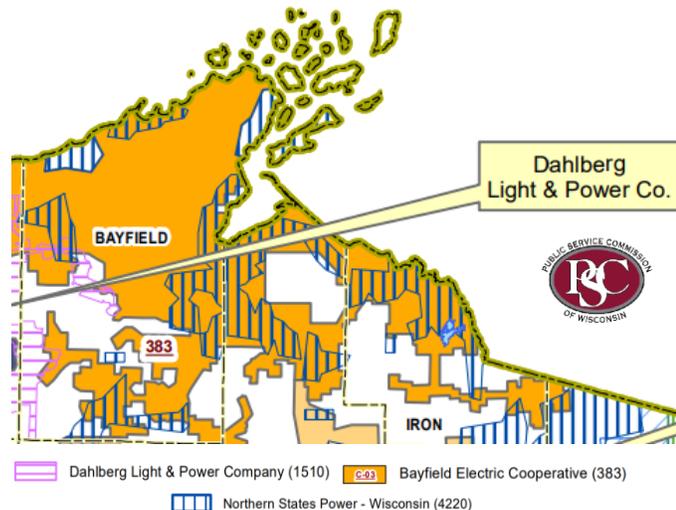
Unknown

3.15 Energy Emergencies

Figure 10: Bayfield County Electric Providers

HAZARD DESCRIPTION

Energy emergencies include short-term shortages of electricity, heating oil or gasoline. Shortages in petroleum-derived fuels may result from economic or political issues, oil embargos, terrorism, or breakdowns in the processing/supply/distribution system. Electrical energy shortages may result from natural causes, such as severe storms and solar anomalies. The electrical energy supply may also be disrupted during periods of peak usage.



Energy disruption may have both economic and human health consequences. Extended disruptions would certainly impact local government and businesses that rely on energy to conduct business and commerce. Some residents would be unable to heat or cool their homes, resulting in a potentially dangerous situation for those who are home-bound, children and the elderly.

The increasing cost of energy is also a concern. If energy prices were to increase beyond the consumer’s ability to pay for it, the situation is essentially the same as a supply disruption. In light of the current global energy situation, political instability and current market trends, the cost factor is certainly of the utmost concern.

HISTORY AND OCCURANCES

Short-term electrical disruptions occur infrequently in Bayfield County as a result of natural weather events. Most power outages are short-term, lasting less than 24 hours and the effects are generally localized. Occasional major weather events such as floods and ice storms can result in power disruption which lasts from days to a week or more.

The supply of petroleum-derived fuels and heating oil has historically been relatively stable, save the Arab oil embargo of 1973-74 and Iranian oil embargo of 1979. During these periods, gasoline was in short supply, resulting in rationing and long lines at filling stations.

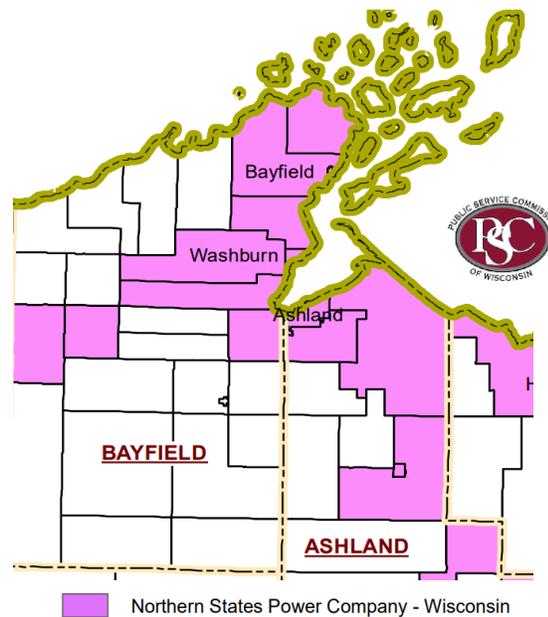
In the summer of 2012, Wisconsin Governor Scott Walker declared an energy emergency for 7 counties in northeastern Wisconsin following the shutdown of a major fuel pipeline between Green Bay and Chicago. While this event didn’t directly impact Price County, it does demonstrate that rural populations are susceptible to this hazard.

The winter season of 2013-2014 was the year of the “Polar Vortex”. Going into the heating season, there was already a deficient supply of propane and the extremely cold weather compounded the issue and



created a shortage in several Midwestern states, Wisconsin being one of them. There were several issues with the propane shortage. In some instances, citizens would run out of propane before more could be delivered. Prices of propane also spiked. At the beginning of December 2013 the average state price was \$1.87 per gallon and by the end of January 2014 the average price was \$4.86 per gallon. Wisconsin Governor, Scott Walker declared a state of Emergency due to the shortage of propane and the severely cold weather. The picture above is a price summary published by the Milwaukee Journal Sentinel during that heating season.

Figure 11: Bayfield County Natural Gas Providers



PROBABILITY

The probability of a short-term energy supply disruption is high. Current global oil and gas supplies are dwindling and becoming increasingly expensive. In this regard, it can be assumed that in the absence of viable alternative energy supplies that an oil and gas crisis is probable in the future.

VULNERABILITY: LOW TO HIGH

This crisis can be exacerbated in the northwest region of the state due to its rural nature. A large percent of citizens have petroleum based heating fuel and is generally transported in. For example, approximately 68% of Bayfield County’s residential structures are reliant on utility gas, fuel oil or LP gas for heating which makes over 2/3 of the residents susceptible to heating shortages. In the more populated areas, local gas delivery lines can play a critical factor in distribution of energy. The Village of Mason and the City of Bayfield both have backup generator capabilities at their Fire Departments.

MAGNITUDE

Magnitude depends on the nature and length of the emergency.

DURATION

An oil crisis may impact the county for an extended period of time. Oil supply problems resulting from geopolitical issues, war or terrorism may last for years. A crisis resulting from the declining availability of oil could reasonably be expected to last until alternative viable energy sources are exploited. Energy emergencies resulting from electrical supply disruption are generally short term, lasting from a few hours to a few days. The 2012 energy emergency declaration in northeastern Wisconsin was in place for 10 days.

FREQUENCY

The County can expect to experience some degree of electrical supply disruption nearly every year. Current trends in the oil/gas market related to supply/demand and geopolitical tension could result in an oil crisis in the foreseeable future. Oil refinery maintenance or shutdowns due to accidents, weather, etc. could have notable impacts on market fuel prices as well as available supply. The refinery shutdowns in the Midwest during the late spring of 2013, caused immediate gasoline price spikes across

the north-central US, including Price County. It is possible that these regional price spikes will become increasingly more frequent without significant investment in the nation's refining capacity and distribution networks.

AREA AFFECTED

A national oil crisis, similar to those experienced during the 1970s, would affect all of Bayfield County. A major fuel crisis may develop in the future as a result of geopolitical issues, war, terrorism, or a decline in global oil supplies. Current instability in the oil market, international tension and concerns related the future availability of oil play into the complex global energy equation. Minor weather-related disruptions in electrical energy supply are fairly common and tend to affect localized areas. Isolated power outages resulting from high winds, falling trees, ice storms, flooding or lightning occur within the county nearly every year. The affected area may include an entire Town, or more, or may only affect a few customers.

POTENTIAL ECONOMIC IMPACT

An extended energy emergency could have severe economic consequences. High gasoline costs could make automobile travel difficult. Costs for basic necessities such as food and clothing would also escalate as a result of the higher production and transportation costs. As a result of the high energy costs, the public would likely turn to local natural resources such as wood for heating and solar and wind for electricity.

POTENTIAL POPULATION AFFECTED

An petroleum crisis may affect the entire population of Bayfield County, whereas an electrical supply disruption may only impact a few customers.

CRITICAL FACILITIES AT RISK

High energy costs or lack of a reliable energy supply would likely impact the ability of local government to provide basic services to citizens.

The Wisconsin Interoperable System for Communications (WISCOM) is a shared system that first responders in communities across the state will use to communicate during a major disaster or large-scale incident. WISCOM will support up to four simultaneous conversation paths during an incident, dramatically increasing the current capacity available with statewide mutual aid channels and allowing responders from any area of the state to assist another community without losing communication capabilities.

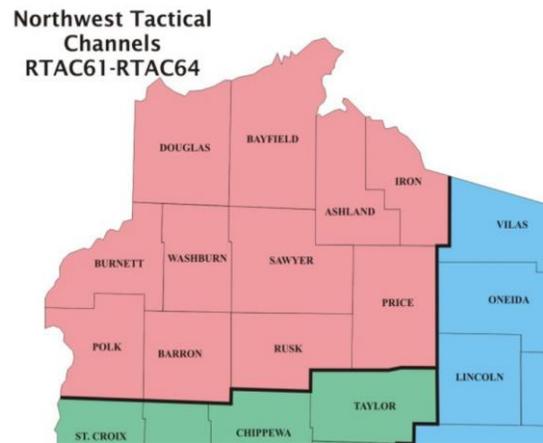
Emergency Alert System (EAS) Radio Stations	
WHBM-90.3 Park Falls	Sawyer & Ashland Co
WQJB-88.9 Hayward	Sawyer & Ashland Co
WWSA-89.9 Brule	Bayfield & Douglas Co.
KBJR-102.5 Duluth	Bayfield & Douglas Co.

In July of 2018, Norvado installed geo-diverse fiber for the Bayfield County Courthouse. This upgrade will allow the facility to stay running and be more resilient to disruptions. This service could also be used for WISCOM or any other service that needs connectivity of services. (Iron River station)(Ashland Station)

HISTORY AND OCCURANCES

There is no detailed record of historical incidents of communications systems disruptions in Bayfield County. The county does experience periodic, minor communications system disruptions due to severe weather, loss of power or accidents; however no comprehensive record of these occurrences exists. In the past, major geomagnetic storm events have impacted telecommunications and electric power systems in Midwest, including areas of Wisconsin.

Figure 12: Northwest Tactical Channels



PROBABILITY

Unknown. There are no records that systematically track the occurrence of disruption of communication systems. Without records, it is difficult to assess the potential or likelihood of communications system disruptions. Large-scale communication disruption is not common but small disruptions commonly occur that can usually be considered inconvenient, but not life threatening. There are periods of time, typically during a disaster, where both communication and availability of power is crucial to protecting lives. Telephone and data lines are critical for communicating messages to exposed populations for precautionary measures or possible evacuations. It is during those times where the loss of communication can potentially become a disaster.

VULNERABILITY: LOW

Bayfield County emergency services rely heavily on communications to be able to assist members of the community. Communication infrastructure is relatively resistant to damage and storms. But they do encounter difficulties and emergency responders turn to alternative communications.

MAGNITUDE

The magnitude of a communications system disruption is a function of the cause of the disruption, area impacted, services affected and the duration of the service disruption. Primary concerns with physical infrastructure communication disruption include the impacts of destruction of critical infrastructures such as dispatch centers, towers, key electrical substations, back-up generators and transformers. A hazard event that damages or destroys several key items at one time can seriously degrade the system for an extended period of time. A communications disruption may be a secondary impact of a natural

hazard, such a tornado, ice storm or electrical storm. Loss of communications systems in the wake of a natural disaster could greatly hinder emergency response efforts.

DURATION

Unknown. Downtime can be caused by failure in hardware (physical equipment), software (logic controlling equipment), interconnecting equipment (such as cables, facilities, routers, etc.), wireless transmission (wireless, microwave, satellite), and/or capacity (system limits). The failures can occur because of damage, failure, design, procedural (improper use by humans), engineering (how to use and deployment), overload (traffic or system resources stressed beyond designed limits), environment, scheduled downtime (outages designed into the system for a purpose such as software upgrades and equipment growth), other (none of the above but known), or unknown.

FREQUENCY

Unknown. There are no records that systematically track the occurrence of disruption of communication systems. Without records, it is difficult to estimate the frequency of communications system disruptions.

AREA AFFECTED

Varied. Communications system disruptions could affect individual facilities or neighborhoods or the entire county. It is also possible that large-scale disruptions could impact the entire region or state. A key idea to consider is that while a communications system disruption may impact a specific area of the county, service delivery to outlying areas may also be impacted.

POTENTIAL ECONOMIC IMPACT

An estimate of potential losses was not calculated. There is little risk to structures and property from a communications system disruption. The potential risk to human lives is high. Expected annualized losses will be less \$1,000 in income related losses due to disruptions in business and commerce.

POTENTIAL POPULATION AFFECTED

The entire population of Bayfield County is at some degree of risk in the event of a communications system disruption. In the event of a natural disaster, communication among emergency manager and response personnel is critical. A disaster that disrupts communications can leave populations isolated and vulnerable.

CRITICAL FACILITIES AT RISK

There is little risk to structures and property from a communications system disruption, including critical facilities. It is the essential services that these facilities provide that could be at greatest risk in the event of a communications system disruption.

3.17 Cyber Security Threat

HAZARD DESCRIPTION

According to the U.S. Federal Bureau of Investigation, cyber-terrorism is any "premeditated, politically motivated attack against information, computer systems, computer programs, and data which results in violence against non-combatant targets by sub-national groups or clandestine agents." Cyber-terrorism is a relatively new concept of the digital information age which poses a serious potential threat to security. Attacks on digital information systems can result in widespread disruption, damage and possible loss of life. Computer systems vital to utilities, transportation, energies, financial systems or other government services are generally the highest-risk targets. The effects of a cyber-attack may be localized or widespread and may reach far beyond the initial point of attack.

State of Wisconsin Cybersecurity Strategy (WI-DOA Division of Enterprise Technology)

Priority 1: Utilize enterprise collaboration to optimize security capabilities

Priority 2: Protect the State of Wisconsin from cyber incidents

Priority 3: Improve the awareness of cyber risks Statewide

Priority 4: Protect critical infrastructure across the State

Priority 5: Improve the resiliency of our workforce and citizens

National Institute of Standards and Technology (NIST) Framework				
Identify	Protect	Detect	Respond	Recover
<ul style="list-style-type: none"> * Asset management * Business environment * Governance * Risk assessment * Risk management strategy 	<ul style="list-style-type: none"> * Access Control * Awareness and Training * Data Security * Information protection processes and procedures * Maintenance * Protective technology 	<ul style="list-style-type: none"> * Anomalies and events * Security continuous monitoring * Detection processes 	<ul style="list-style-type: none"> * Response planning * Communications * Analysis * Mitigation * Improvements 	<ul style="list-style-type: none"> * Recover planning * Improvements * Communications

HISTORY AND OCCURANCES

Unknown. Cyber security and cyber threats happen on a continual basis and are not tracked.

PROBABILITY

The probability of a single device cyber-attack is almost certain. But the probability of a large scale (county-wide) cyber-attack is less likely.

VULNERABILITY: LOW

Vulnerability of cyber security greatly varies throughout the County. All citizens with electronic devices can be targeted. Small scale hackers focus efforts on elderly citizens because they are considered easier targets to collect valuable information from. Governments and municipalities are more likely to be targeted with a large effort looking for information or to cause disruption

MAGNITUDE

Cyber security can be as small as the hacking of a single computer to an entire network of grid system. Essentially the magnitude can vary from minor to catastrophic

DURATION

The events themselves are relatively short. But the recovery of data, information and processes can be a long and strenuous effort afterwards.

FREQUENCY

Cyber-attacks are extremely frequent events that an individual who continually works on a computer will encounter. The frequency of a large cyber-attack can vary greatly and government, employers and individuals can take measures to reduce their risk of being affected by a large cyber-attack.

AREA AFFECTED

The event can be isolated to a single device, to a network or to a regional area such as an electrical grid.

POTENTIAL ECONOMIC IMPACT

The economic impact can vary from the loss of a device and information to a complete utility shutdown affecting commerce as well as the wellbeing of citizens.

POTENTIAL POPULATION AFFECTED

The potential population affected greatly depends on the scale of the cyber-attack

CRITICAL FACILITIES AT RISK

- County and local governments
- Electrical and fuel providers
- Municipal water and sewer providers
- Service providers of internet, phone and TV service

3.18 Municipal Utility Disruption

HAZARD DESCRIPTION

It is important to note there are two different water source types in Bayfield County. The first is a private well, which serves single homes. The second water sources type is a municipal water utility. A Municipal Utility Disruption is a disruption to a Municipality's utilities such as water and sewer services. The disruption could be caused by a broken pipe; contaminated water and pump failure are a few.

WATER CONTAMINATION

Clean, safe drinking water is one of the most important elements of good health. Testing well water on an annual basis is one of the easiest things a private well owner can do to take care of their health and the health of their loved ones.

It is important to note that the Wisconsin Geologic Survey will be developing a Hydrologic Atlas for Bayfield County near the beginning of 2019. Referencing the Hydrologic Atlas will be important to help determine contamination or disruption of water and sewer services.

Total Coliform (Bacteria) and E-Coli Testing

Total coliforms are indicator organisms used to detect bacterial contamination in drinking water. Their presence indicates that a pathway for contamination exists and organisms that cause disease may be present, even though total coliforms themselves typically do not cause disease in healthy individuals. However, one species of total coliform (E. coli) is found in the feces of warm blooded animals. The presence of E.coli in a drinking water sample is an indication of fecal contamination of the water supply.

Bayfield County Water Lab

Bayfield County Health Department is now offering drinking water laboratory services to local municipalities and Bayfield county residents. Our laboratory services include basic Coliform bacteria, fecal and E-Coli bacteria testing for well water, as well as surface water coliform/E-Coli bacteria counts.

To help residents comply with the new water sampling requirement for real estate transactions, we have also partnered with UW-Oshkosh to have their homeowner test kits for nitrate, arsenic, and general chemistry available for pick up at our office.

The Wisconsin DNR recommends you test your private well at least once a year for coliform bacteria contamination and any time you notice a change in how the water looks, tastes or smells. Even if your water looks, tastes, and smells good, it can contain harmful bacteria and viruses. A change in color or taste can also indicate possible contamination. Wells can become contaminated if the well cap is damaged or broke off, if flooding covers the top of your well, enters a well pit, or recent plumbing repairs if the system was not disinfected adequately.

Testing your water is simple and inexpensive. A basic bacteria test for fecal coliform and E-Coli is \$20. Test kits can be picked up at the Bayfield County Health Department, located at 117 E. Sixth St. in Washburn. Test kits are time sensitive and must be dropped off at the lab within 24 hours of taking your water sample. Our lab can accept samples Monday thru Wednesday from 8:00 AM – 4:00 PM. Additional drop off times can be arranged with one of the Environmental Health staff ahead of time.

Nitrates

High nitrate levels in drinking water pose a risk to infants. Infants under six months of age who are fed water or formula made with water that is high in nitrate can develop a condition called methemoglobinemia or “blue baby syndrome.” State and federal laws set the maximum allowable level for nitrate-nitrogen in public drinking water at 10 milligrams per liter (ppm).

Other Contaminants

There are a variety of other contaminants that can make their way into your water supply. Inorganic chemicals, volatile organic compounds, pesticides, and heavy metals such as lead or arsenic can all cause severe health effects. If you suspect your water has been contaminated or would like further testing, the Wisconsin State Lab of Hygiene has a variety of tests available for homeowners.

HISTORY AND OCCURANCES

Disruptions happen on a frequent basis. But the period of time and severity vary greatly

PROBABILITY

The probability of a utility disruption on an annual basis is likely to happen. The probability of a large scale disruption to affect the entire community for an extended period of time is much less likely.

VULNERABILITY: LOW

Bayfield County has a medium vulnerability to municipal utility disruptions. The vulnerability and level of concern is raised considerably when one considers that resulting damage to the more populated areas of the county would overwhelm resources almost immediately. The Village of Mason, City of Bayfield and the City of Washburn all have backup generator capabilities to continue to run their sewer and water systems in the incidents of a power outage.

MAGNITUDE

Varies from a few buildings to an entire municipality.

DURATION

The disruption could be a few short hours to a few days.

FREQUENCY

Small utility disruptions are generally a common occurrence.

AREA AFFECTED

A disruption could affect a few buildings to an entire municipality depending on the severity of the disruption.

POTENTIAL ECONOMIC IMPACT

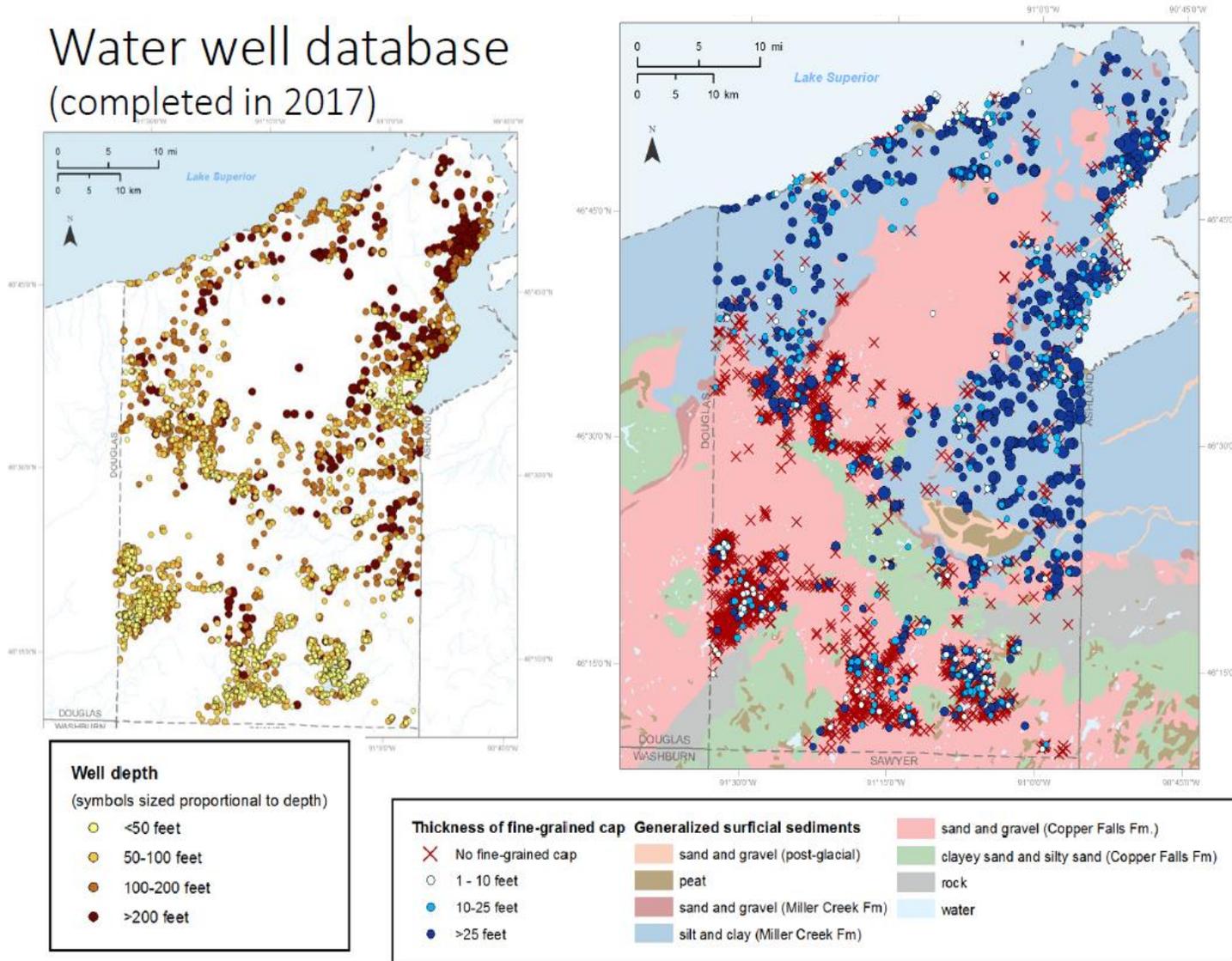
Varied. A municipal utility disruption could simply affect a few buildings for a short period of time or an entire municipality and all of its business

POPULATION AFFECTED

A small population to the entire municipality's population.

Bayfield County Water Well Database

Water well database
(completed in 2017)



Source: UW-Extension and the Wisconsin Geological and Natural History Survey

CRITICAL FACILITIES AT RISK

In Bayfield County, access to water for household use is primarily granted through the use of a private well system.

MUNICIPAL SEWER, WATER AND SANITARY DISTRICTS

Sanitary districts are created by a town, village, city, and tribal government or by the Department of Natural Resources for the purposes of constructing and operating public water supply, sewage treatment, storm sewers, drainage improvements, and solid waste disposal facilities. These districts have the power to acquire property, levy special assessments, and collect charges for services.

City of Washburn (Municipal Sewer System, Water Supply)

- System: Activated sludge treatment plant
- Serves: City of Washburn

City of Bayfield and Pikes Bay Sanitary District (Municipal Sewer System, Water Supply)

- System: Activated sludge treatment plant – Sanitary District
- Serves: City of Bayfield, Town of Bayfield, Port Superior Marina and Goldridge Condominium Development

Town of Bell (Sanitary District)

- System: Collection and treatment –Sanitary District
- Serves: Cornucopia and adjacent rural areas

Town of Cable (Sanitary District)

- System: Collection and stabilization ponds, spray irrigation system
- Serves: Unincorporated area of Cable

Town of Clover (Sanitary District)

- System: Stabilization pond system, collection, and treatment.
- Serves: Unincorporated community of Herbster

Town of Drummond (Sanitary District, Water Supply)

- System: Stabilization pond followed by peat bog treatment
- Serves: Unincorporated community of Drummond 9-4

Town of Grand View (Sanitary District)

- System: Aerated lagoon treatment plant
- Serves: Unincorporated community of Grand View

Town of Iron River (Sanitary District, Water Supply)

- System: Stabilization ponds and constructed wetlands
- Serves: Unincorporated Town of Iron River

Village of Mason (Municipal Sewer System)

- System: Stabilization ponds and spray irrigation system
- Serves: Village of Mason

Bayfield County Hazard Mitigation Plan

Town of Port Wing (Municipal Sewer System, Water Supply)

- System: Stabilization pond system
- Serves: Unincorporated community of Port Wing

Red Cliff – Town of Russell (Sanitary District, Water Supply)

- System: 2-lagoon system
- Serves: Red Cliff Reservation

Northern Great Lakes Visitor Center

- System: Sewer line to the City of Ashland treatment facilities
- Serves: Visitor Center

Other Private Facilities in Bayfield County

Telemark Resort – Town of Cable

- System: Activated sludge treatment facility
- Serves: Telemark Resort, several single residents

3.19 Hazardous Materials Incident

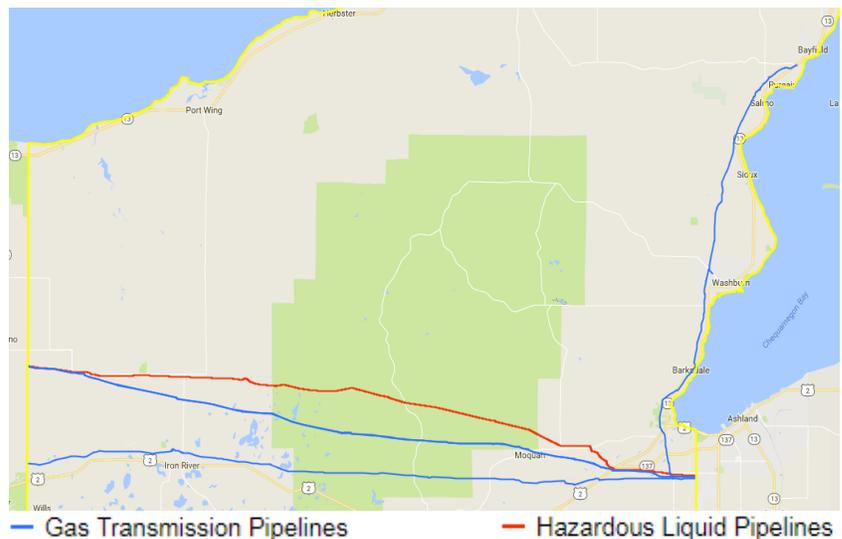
HAZARD DESCRIPTION

According to the Federal Code of Regulations (49 CFR 171.8), a hazardous material is, "a substance or material, which has been determined by the Secretary of Transportation, to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce." These materials include various forms of flammable, combustible, poisonous and radioactive substances. Hazardous materials represent a public health and safety threat if they are unintentionally released due to transportation or chemical facility accident.

HISTORY AND OCCURANCES

Between 2002 and 2017, there were 37 pipeline-related incidents on lines which run through northwestern Wisconsin (Table 34). While none of these events occurred within the county, there is a possibility that such an event could occur in the future. It can be concluded that the magnitude of a pipeline incident in Bayfield County could be similar to the historical 37 incidents in northwestern Wisconsin. Bayfield County has four pipelines in total: one Hazardous Liquid Pipeline and three Gas Transmission Pipelines.

Figure 13: Pipelines in Bayfield County



Source: National Pipeline Mapping System

Table 34: 2002-2017 Significant Pipeline Incidents in Northwestern Wisconsin

Date	City	Operator	Cause	Fatal	Inj.	Property Damage	Net Barrels Lost	Gross Barrels Spilled
1/20/2002	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	0	1	10
4/3/2002	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	0	1	1
11/28/2002	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	0	1	2
1/24/2003	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	\$3,431,955	50	4500
6/19/2003	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	CORROSION	0	0	N/A	2	2
11/10/2003	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	NATURAL FORCE DAMAGE	0	0	N/A	0.48	0.48
12/20/2003	HAYWARD	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MATERIAL/WELD/EQUIP FAILURE	0	0	N/A	1	15
4/2/2004	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	\$11,873	0	2
4/15/2004	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.26	0.5
5/13/2004	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	CORROSION	0	0	\$97,081	2	40
6/3/2004	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	0.5
6/9/2004	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.5	0.5
10/3/2005	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	3
2/2/2007	EVELAND	ENBRIDGE ENERGY LIMITED PARTNERSHIP	EXCAVATION DAMAGE	0	0	\$4,889,786	2066	4800
3/26/2007	SUPERIOR	NORTHERN NATURAL GAS COMPANY	CORROSION	0	0	\$220,481	N/A	N/A
1/24/2008	HAYWARD	WISCONSIN GAS CO	MAT'L/WELD/EQUIP FAILURE	0	0	\$547,180	N/A	N/A
3/30/2008	STONE LAKE	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MATERIAL/WELD/EQUIP FAILURE	0	0	N/A	1	5
8/25/2008	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	CORROSION	0	0	\$53,106	7	115
3/22/2009	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	ALL OTHER CAUSES	0	0	N/A	0.12	0.12
4/25/2009	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.5	1
5/21/2009	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	INCORRECT OPERATION	0	0	\$120,095	14	154
10/21/2009	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.12	0.12
1/6/2010	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	NATURAL FORCE DAMAGE	0	0	N/A	0.48	0.48

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3/11/2010	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.75	0.75
4/4/2011	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	CORROSION	0	0	\$122,647	0	0
9/25/2011	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	\$120,100	0	15
8/6/2012	SUPERIOR	PLAINS MARKETING L.P.	MAT'L/WELD/EQUIP FAILURE	0	0	\$34,500	0	114
11/6/2013	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0.24	0.24
12/3/2014	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	INCORRECT OPERATION	0	0	N/A	0	5.95
1/13/2015	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	5	5
1/21/2015	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	2	2
3/2/2015	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	4.76
7/22/2015	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	NATURAL FORCE DAMAGE	0	0	N/A	13.9	13.9
8/15/2015	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	0.71
2/1/2016	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	ALL OTHER CAUSES	0	0	N/A	0	104
2/13/2017	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	0.83
11/14/2017	SUPERIOR	ENBRIDGE ENERGY LIMITED PARTNERSHIP	MAT'L/WELD/EQUIP FAILURE	0	0	N/A	0	1.76
Source: PHMSA Pipeline Safety Program				0	0	\$9,648,804	2170.35	9921.6

PROBABILITY

Based on historical records, there is a high likelihood that at least one minor hazardous materials incident will occur during any given year. An issue is likely to occur through a pipeline break, auto accident or business related spill.

VULNERABILITY: MEDIUM

Bayfield County has several highways in which hazardous materials are hauled on a regular basis. The County also contains several pipelines at which breach could occur.

MAGNITUDE

Most historic events have been minor. A Regional Response Team may be activated for an incident involving a hazardous materials spill, leak, explosion, injury or the potential of immediate threat to life, the environment, or property. The Regional or "Level A" Teams respond to the most serious of spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies. The regional response team serving Bayfield County is based in Superior.

DURATION

Hazardous materials incidents can occur anytime and without warning. Most incidents are handled well before becoming a disaster. Clean-up time is variable, depending on the nature of the incident. Serious incidents may require long-term environmental remediation.

Table 35: Soil and Groundwater Contamination Cleanup Sites, 1989-2015, Bayfield County

Municipality	AC	ERP	SPILL	LUST
Bayfield Tn/Cty	-	-	-	5
Bell Tn	-	-	-	1
Cable Tn	-	-	-	2
Cornucopia Tn	-	-	-	1
Drummond Tn	-	-	-	2
Grand View	-	-	-	2
Herbster	-	-	-	1
Iron River	-	-	-	5
Mason	-	-	-	3
Namakagon	-	-	-	1
Oulu	-	-	-	2
Port Wing	-	-	-	2
Washburn Tn/Cty	-	-	-	7
Total:	0	0	0	34

***Abandoned Container (AC)**, an abandoned container with potentially hazardous contents has been inspected and recovered. No known discharge to the environment has occurred. **Leaking Underground Storage Tank (LUST)**, a LUST site has contaminated soil and/or groundwater with petroleum, which includes toxic and cancer causing substances. **Environmental Repair (ERP)**, ERP sites are sites other than LUSTs that have contaminated soil and/or groundwater. **Spills**, a discharge of a hazardous substance that may adversely impact, or threaten to impact public health, welfare or the environment. Spills are usually cleaned up quickly.*

Data Source: Wisconsin DNR, BRRTS

FREQUENCY

There have been 34 hazardous materials incidents in Bayfield County between 1989 and 2015, or slightly over 1 incident per year on average.

AREA AFFECTED

Historically, hazardous materials incidents in Bayfield County have affected a relatively small area (<40 acres). These events do have the potential to affect a significantly larger area or even an entire community, depending on the nature of the event. An incident resulting in the release of toxic agents into the air or water has the potential to impact large areas of the county. Several past incidents have occurred on or near public roadways, with the highest frequency occurring on high volume highways (USH 2 and STH 13) and within the county's populated communities. The Resources regulates the transport of hazardous materials in Wisconsin. DNR requires transporters of hazardous materials to obtain a license to haul the materials and the company must meet strict documentation requirements. DNR does not, however, track the specific date/time of the transport or the route of transit.

A hazardous materials incident involving any of the major gas and oil transmission lines in the county has the potential to adversely affect localized areas along the line corridors. The Bayfield County Groundwater Contaminant Susceptibility Map can be a helpful guide to display areas of high groundwater susceptibility in the occurrence of a hazardous materials spill.

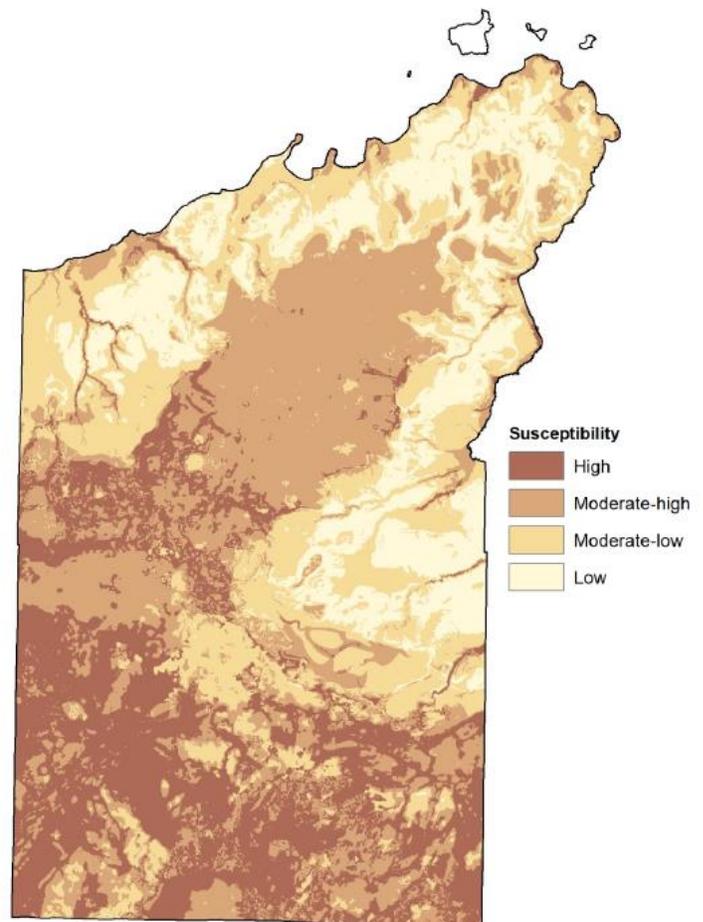
POTENTIAL ECONOMIC IMPACT

The potential economic impact associated with a fixed facility or transportation-related incident is unknown.

POPULATION AFFECTED

The population affected by a future transportation-related incident will be dependent on several factors including, location of incident, nature of chemicals released and environmental factors. Based on historical evidence, it is assumed that there is a high probability of incident containment before significant population impact.

Bayfield County Groundwater Contaminant Susceptibility



Source: UW- Extension and Wisconsin Geological and Natural History Survey

2014 Multi-County Commodity Flow Study and Responder Hazardous Materials Training Assessment
The following table compares, by county, the percentages of Tier II chemicals observed, to the total number of chemicals observed traveling on highways during random observations.

County	EPCRA Tier II HM	Observed Tier II HM	Non-Tier II HM or Unkn.
Ashland County	16	6 (37%)	5
Bayfield County	7	5 (71%)	4
Douglas County	41	7 (17%)	19
Sawyer County	12	4 (25%)	5

It is noted that the majority of the chemicals that appear on any county’s Tier II list were not observed on the highway, with the exception of Bayfield County. Therefore, it appears that the majority of the Tier II chemicals were either unobserved, or being transported in quantities below which a placard is required. The other possibility is that the shipping company chose not to placard the shipping unit.

The most common DOT controlled materials observed in all counties were gasoline, or gasoline product (such as ethanol blend), placard number 1203. Other common observations included L.P. gas (propane), placard numbers 1075 or 1978, containers carrying a ‘HOT’ product (usually asphalt material) placarded either ‘HOT’ or 3257, and gaseous products requiring the general “Flammable” and/or “Non-Flammable” placards, such as welding gases.

POTENTIAL ECONOMIC IMPACT

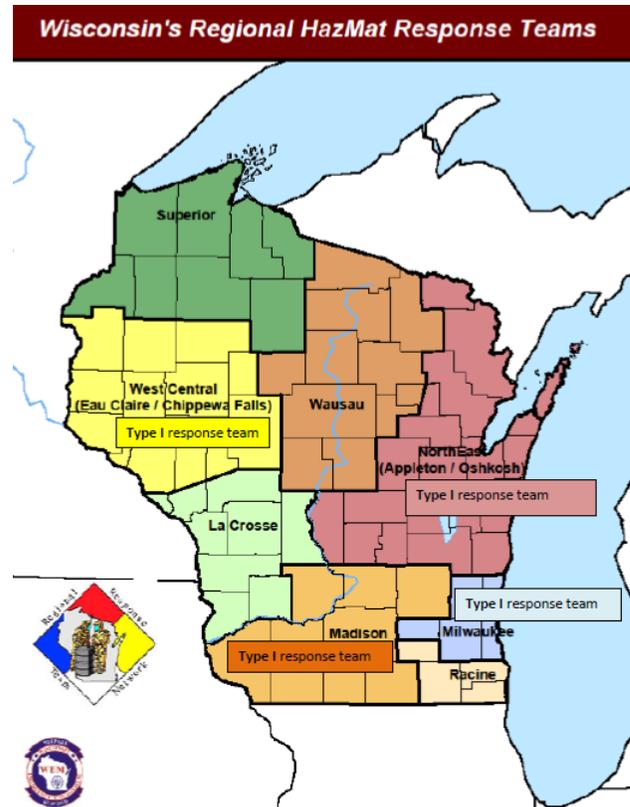
An incident could potentially cause disruptions to transportation infrastructure, utility function and the environmental health of the directly affected area. The potential economic impact associated with a fixed facility or transportation-related incident is unknown.

POTENTIAL POPULATION AFFECTED

The population affected by a future transportation-related incident will be dependent on several factors including, location of incident, nature of chemicals released and environmental factors. Based on historical evidence, it is assumed that there is a high probability of incident containment before significant population impact.

CRITICAL FACILITIES AT RISK

- Transportation infrastructure
- Gas and hazardous materials pipelines
- Municipal utilities



3.20 Mass Casualty Incident (MCI)

HAZARD DESCRIPTION

For the purposes of this plan, a mass casualty incident can be a bombing, terrorist attack, active shooter or a large casualty transportation incident. Any of these events can lead to an overwhelming of emergency medical services and resources. Mass casualty incidents are so widely varied, so are the potential targets and occurrences.

HISTORY AND OCCURANCES

There have been no recorded mass casualty incidents in Bayfield County.

PROBABILITY

Because there have been no historical activities in the county, the probability is unknown.

VULNERABILITY: MEDIUM

Because mass casualty incidents occur sporadically throughout the United States, it is unknown how vulnerable a population is until occurs.

MAGNITUDE

Minor to catastrophic

DURATION

Depending on the nature of the event, terrorism actions may be very short or instantaneous, as in the case of a bombing, or may last much longer. The recovery time for major events is often very long (weeks to months), with permanent psychological impacts.

FREQUENCY

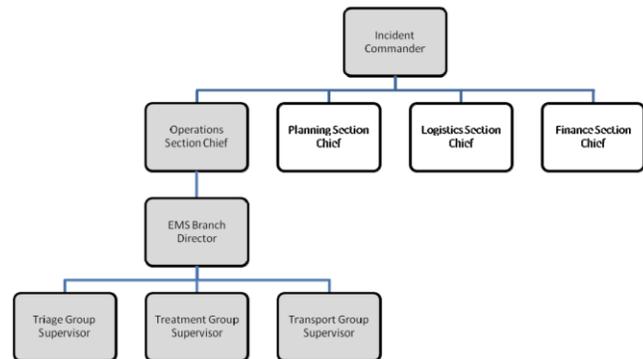
Unknown. There have been no documented terrorism activities in Bayfield County.

AREA AFFECTED

In theory, virtually any public facility, utilities and infrastructure or gathering place could be a target for terrorist and harmful activity. In addition, certain types of businesses and governmental institutions may be more prone to harmful activities due to the specific nature of their business or size. In particular, businesses such as banks, financial institutions, health care facilities or businesses engaging in controversial activities are at the greatest risk. Local, state and federal government facilities, public schools and colleges/universities are also potential targets.

POTENTIAL ECONOMIC IMPACT

It is highly unlikely that a terrorism event would impact all at-risk facilities, but rather a single facility. Facilities such as oil and gas pipelines could have severe economic repercussions, both locally and nationally.



Source: Wisconsin Emergency Management

it

POPULATION AFFECTED

The population impacted will be dependent on numerous factors, including the nature of the event, location and time of day. The likelihood that any individual will be affected by this hazard in Bayfield County is very low.

CRITICAL FACILITIES AT RISK

- County Annex/Courthouse
- Schools
- Virtually any community event/gathering

4.0 Mitigation Strategies

Hazard analysis and risk assessment help communities to determine and make decisions regarding those hazards that present the most risk to impact their communities. This also enables communities to determine what actions might be taken to reduce the impact of those hazards, and what resources will be needed.

Hazard mitigation refers to any sustained action or actions taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions. This section describes the mitigation goals and actions planned by Bayfield County and the local jurisdiction participants for each of the hazards identified in the Risk Assessment. The intention is to reduce or avoid long-term vulnerability to identified hazards. These mitigation strategies were developed, reviewed, and prioritized by the LEPC. Each mitigation action was assigned a priority rating by LEPC members, with 1 being low, 2 being medium, and 3 being high. A total score was then determined for each action.

The hazards are presented in the order given in the Risk Assessment of this plan. This list does not preclude other natural or man-made hazards that can occur in the County.

Costs and effort included with the actions contained in this plan are general estimates based on information available at the time of plan development. In addition, the LEPC weighed estimated costs versus projected benefits when prioritizing the action items. These estimates should be considered useful for preliminary planning purposes and may change with action implementation.

This plan update includes the mitigation strategies that were in the previous edition of the plan. Strategies that have been completed are identified by using italicized text.

Several new mitigation strategies deserve discussion. Throughout LEPC discussions, it was identified that, of all the hazards, public information is key. That being said, several projects were identified to further the County's mitigation efforts. Implementation of these projects will hinge significantly on available funding. Many of the action items that only require staff time will be taken up at the committee level in the next year or two. Other prioritized action items will be to address vulnerable populations, including elderly and visiting populations who are unfamiliar with the unique weather patterns of the area, and to address large vulnerable populations, such as campgrounds and county fairgrounds for emergency shelters.

First, the Town of Bell is spear-heading a coordination effort with several other townships in the area to look at potentially purchasing a road compactor. Several roads that have been reconstructed in recent years have been compacted prior to paving. Compaction has caused them to hold-up to heavy rain events and avoid washouts much better than similar roads that were not compacted.

The Town of Bell encompasses several miles of Lake Superior shoreline. The Siskiwit River flows into the Siskiwit Bay and the Cornucopia-Bell Marina in Lake Superior. When the area receives heavy rain events, runoff will collect at the mouth of the river and make the harbor impassible due to large silt deposits. For this reason, the Town would like to see silt catchments installed in the Siskiwit River to avoid the problems rain events cause in the harbor. The Town of Bell has had to dredge the harbor and mouth of the river twice in the last two years, and seven times in the last ten years. These can run from \$126,000 to \$178,000, while routine dredging, which should occur every 3-5 years, is approximately \$30,000 to

\$50,000. A dredging done with a hydraulic dredge could be a potential 20-year solution, but would cost an estimated \$400,000.

Several roads throughout Bayfield County were closed this June due to floods. State Highway 13 in the Town of Bell floods very easily. Some local residents joke that this will flood “from a heavy dew.” The Towns of Bell and Clover (Highway 2) would like to complete culvert assessments to identify where improvements can be made such to mitigate the road closures.

Several communities, as well as Bayfield County, are interested in exploring storm shelters in local parks and the Bayfield County Fairgrounds. For most of the communities looking to do this, consideration is being given to incorporating safe-room features into restrooms or other facilities to make them multi-purpose.

Several other new mitigation strategies that Bayfield County is considering are:

- First Call Notification System
- High wave warning notification system additions to other beaches.
- Back-up generation for highway/courthouse. Connect annex generator to courthouse phone system.
- Improved secondary notification system for Firefighters and EMS.
- Purchase of a sand-bagging machine.
- Back-up paging and dispatch system.
- Mobile Command Unit access (via shared or regional agreement)

**Bayfield County Pre-Disaster Mitigation Plan
Mitigation Strategies – Table 4.1 [Last update: August 2018]**

GOAL	MITIGATION ACTION	PRIORITY	ESTIMATED COST	MANAGEMENT AGENCY	TIME TABLE	COMMENTS	
ALL HAZARDS							
<i>Risk Rating:</i> HIGH							
1. TIMELY AND ACCURATE	A. Promote use of NOAA weather radios by all citizens.	HIGH	Within budget	Emergency Management	Ongoing		
	B. Training for county departments in use of NOAA radios	HIGH	Within budget	Emergency Management	Annual	In conjunction with severe weather public information campaign	
	C. Mailing to municipal officials encouraging adoption of NOAA radio as warning mechanism	HIGH	Within budget	Emergency Management	Annual	In conjunction with severe weather public information campaign	
	D. Training for county dispatchers in notification of NWS	HIGH	Within budget	Emergency Management, Sheriff's Department	Ongoing	In conjunction with severe weather week and tornado drill	
	E. Ensure local media providers have capabilities for an Emergency Alert System warning override.	HIGH	Unknown	Emergency Management.	2018, Annual	Norvado receives and transmits all EAS alerts for 4 different radio stations covering Bayfield, Sawyer, Douglas and Ashland Counties	
	F. Research and purchase telephone emergency notification system with capabilities that can contact citizens by township	MEDIUM	\$5-10,000	Emergency Management, local partners	2018 and ongoing	Multiple uses countywide, schools, etc.	
	G. Explore warning capabilities of Red Cliff public access radio and television	MEDIUM	Unknown	Red Cliff Tribal Admin, Bayfield Co Emergency Management	Annual	In conjunction with severe weather public information campaign and planning. This may require an override capability.	
	H. Develop a survey system for the public to help participate in damage reporting	MEDIUM	\$1,000	Emergency Management	2018 and ongoing		
	I. Develop a inventory/list of evacuation/ storm shelters throughout the county	LOW	Staff Time for identification.	LEPC, Emergency Government and Local Governments	2018 and ongoing	Norvado headquarters in Cable could serve as a Southern staging location in the County.	
	J. Explore unique warning challenges within the casino.	LOW	Within budget	Red Cliff Public Safety Committee	Ongoing	Has a paging system, but is always looking for new and innovative options	
	K. Explore Emergency Notification Systems – Daily Press Alerts, weather channel alerts, County website, social media and Code-Red. Campaign – for more info – public kiosk, etc.	LOW	Staff Time for identification.	LEPC	Ongoing		
	L. Develop storm shelters.	COMPLETED					Storm shelter completed at County Fairgrounds 2015.
	M. Explore warning capabilities of City of Washburn public access radio and television	COMPLETED					In conjunction with severe weather public information campaign and planning.
	N. Siren evaluation for City of Washburn	COMPLETED					No siren is warranted at this time.
2. PUBLIC EDUCATION/ NOTIFICATION	A. Develop capability to use county website related to types of hazards, including prevention and preparedness actions. To include active links to NWS and other warning and information sources.	HIGH	\$500	Emergency Management, Information technology	Ongoing	County website used 2016 with July storms.	

Bayfield County Hazard Mitigation Plan

	B. Take advantage of various workshops whenever possible to help community members, public officials and response personnel better understand and respond to emergencies.	HIGH	Staff Time	Emergency Management, Fire Association, EMS, LEPC, Highway Dept. Elected officials	Ongoing	There are continually workshops and programs that individuals that can take advantage of to help individuals get a better understanding of emergency situations.
	C. Participate in community meetings to present prevention and preparedness information	HIGH	\$1,500	Emergency Management	Ongoing	LCD projector required.
	D. Increase fire department participation in fire prevention and safety public education	HIGH	\$1,000	Fire Association	Annual	Efforts and outreach done every year
	E. Increase ambulance personnel accessibility to public education resources and increase prevention public education efforts	HIGH	\$1,000	EMS Council	Ongoing	Work in conjunction with current Injury Prevention efforts in DHFS and RTAC
	F. Develop a brochure describing local hazards and personal/family prevention and preparedness activities	MEDIUM	\$1,200	LEPC	Ongoing	Make application through HMEP program for possible grant funds
	G. Develop preparedness programs for Red Cliff and City of Washburn public access radio and television	MEDIUM	Within budget	Emergency Management	Ongoing	
	H. PIPELINE MAPPING – EMERGENCY RESPONDERS MAP BOOKLET	<i>COMPLETED</i>				Continue to update.
	I. Develop display boards	<i>COMPLETED</i>				Conduct annually. Community Storm Shelter/Safe Room. Remember the storms
	J. Develop handout to include with tax statements related to personal/family preparedness	<i>DELETED</i>				Easier and more cost effective to use social media outlets
3. POLICY DEVELOPMENT	A. Develop and update a template that contains procedures for requesting mutual aid.	HIGH	Time	LEPC	2018, Ongoing	Uses Wisconsin Rural Water Association materials and information as well as follow required state statutes
	B. Work with local jurisdictions to develop a template for emergency operations plans.	HIGH	Time	Local Jurisdictions, Emergency Management	Ongoing	Continually updating
	C. Encourage emergency service agencies (fire, police, ambulance) to develop emergency contacts for and/or communications capability with local road crews to assure emergency response capabilities	HIGH	Time	Fire Association, EMS Council, Sheriff/Police Chiefs	Ongoing	BAMUN installed in public safety radios; newsletter outreach to elected officials related to BAMUN TOWN and BAMUN Countywide; ongoing outreach needed. <i>2011 – radio frequencies installed.</i>
	D. Research the state public works mutual aid plan for applicability.	LOW	Time	Emergency Management, Public works representatives	2018 and ongoing	Uses Wisconsin Rural Water Association materials and information
4. EMERGENCY OPERATIONS CENTER IMPROVEMENTS	A. Remind fire departments, ambulances and other departments and services to replace batteries of phones and communication devices every 3-5 years to be resilient to power outage emergencies	HIGH	Some time	Specific department or agency	ongoing	Ability to acquire funding to replace batteries
	B. Establish telephone and CAD capability	LOW	\$2,500	Emergency Management, Sheriff's Dept, EMS	2018	
	C. Evaluate expanding generator capability to include EOC air conditioning or purchase room A/C unit. (Large Capacity Generator)	LOW	Unknown	County Administration	Ongoing	
	D. Develop mobile dispatch console to manage communications for/during major events.	LOW	\$20,000	Emergency Management, Sheriff's Dept, EMS	2018	Funding contingent. In July 2018, geo-diverse fiber from Norvado has been installed at the Annex Building
	E. Village of Mason EOC/Village Hall capability for shelter and	LOW	Unknown	Village of Mason	Ongoing	

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	operations					
	F. Continue to develop Unmanned Aircraft Systems (UAS) capabilities in the County through equipment purchases, training seminars and licensing.	LOW	Unknown	Land Records, Fire Departments and Emergency Management	Ongoing	UAS can be used for search and rescue, documentation processes, as well as a safe alternative for collecting information while keeping a safe distance from a hazard.
	G. Purchase/ four big screen TVs and establish TV access	<i>COMPLETED</i>				2 TVs and needed complimentary electrical devices were purchased
	H. Assure radio transmit and receive capability	<i>COMPLETED</i>				
	I. Totally diversify 911 Network.	<i>COMPLETED</i>				

DAM FAILURE							
<i>Risk Rating: LOW</i>							
1. ASSURE WARNING AND RESPONSE COORDINATION	A. Develop Emergency Action Plan (EAP) for the Middle Eau Claire Lake Dam	MEDIUM	\$6,000 - \$12,000	Bayfield County Administration and Emergency Management	2015, every 5 years	Dam Failure Analysis completed in 2015 and updated every 5 years.	
	B. Assure development of EAP for Drummond/Rust Flowage Dam	MEDIUM	Unknown	Emergency Management contact with WDOT	2015, every 5 years	Completed 2015 and resume in 2020.	
	C. Review and exercise EAP for Murray Dam	MEDIUM	Within budgets	Bayfield County Clerk, Emergency Management, Town of Delta	Annually	Review annually to ensure points of contact are updated.	
	D. Review and exercise EAP for Drummond Lake Dam	MEDIUM	Within budgets	Bayfield County Clerk, Emergency Management, Town of Drummond	Annually		
	E. Review and exercise EAP for Namakagon Dam	MEDIUM	Within budgets	Town of Namakagon, Emergency Management	Annually		
	F. Develop EAP for Iron River Dam	<i>Completed</i>					
	G. Develop consistent signage related to symptoms of dam failure and point of contact; post at dams.	<i>Completed</i>					
2. ASSESS SMALL DAM RISKS	A. Work with DNR to assure accurate dam inventory	HIGH	Within budget	Emergency Management, All jurisdictions	Ongoing	Completed Annually	
	B. Include dam location descriptions in inventory	HIGH	Within budget	Emergency Management, All jurisdictions	Ongoing	Completed Annually	

EROSION: COASTAL
<i>Risk Rating: LOW</i> Land Records did some analysis. 50 to 60 structures are close to the edge/Lake Superior shoreline.

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1. PROMOTE NATURAL METHODS TO CONTROL EROSION (Vegetation, ponds, wetlands)	A. Work with the agriculture and logging industries to better address runoff cooperatively.	HIGH	Staff Time	Bayfield County departments and all jurisdictions	Ongoing	Funding availability, staff time and willingness to cooperate
	B. Further develop and implement water retention areas such as retention ponds and wetlands	HIGH	Unknown, depends on project size	Bayfield County departments and all jurisdictions	Ongoing	Funding availability, acquiring land
	C. Expand use of native vegetation (including trees) in critical areas to mitigate flooding and erosion.	HIGH	Unknown, depends on project size	Bayfield County departments and all jurisdictions	Ongoing	Funding availability, public education and awareness
	D. Explore any possible funding source to assist with flood mitigation projects throughout the County	HIGH	Undetermined	Bayfield County departments and all jurisdictions	Ongoing	Funding availability
	E. Identify partners and develop education materials for public.	MEDIUM	\$2,500	Bayfield County and all jurisdictions bordering Lake Superior	Ongoing	Research Coastal Management Grant availability
	F. Review and continue to update ordinance language for erosion control and site planning for all development	MEDIUM	Within budgets	Zoning – Bayfield County, City of Bayfield, City of Washburn, and Red Cliff	Ongoing	
	G. Consider contracting for a regional building inspector and/or engineer to ensure all development is sustainable.	<i>DELETE</i>				
2. PROTECT COASTAL RESOURCES: Gully erosion and slumping	A. Discourage land uses that negatively impacts the quality and quantity of coastal waters and/or wetlands	HIGH	Within budgets	Bayfield County, City of Bayfield, City of Washburn and Red Cliff Zoning	Ongoing	
	B. Restrict or limit development in areas with sensitive coastal wetlands	HIGH	Within budgets	Bayfield County, City of Bayfield, City of Washburn and Red Cliff Zoning	Ongoing	
	C. Riprap shorelines and other highly erodible areas where there is no other solution to issue	HIGH	Depending on project size and scale	All jurisdictions and departments	Ongoing	
	D. Evaluate the need for the use of engineering practices and land management tools.	LOW	Unknown	Bayfield County Zoning and all jurisdictions bordering Lake Superior	Ongoing	Research Coastal Management Grant and other grant resources for possible funding
	E. Evaluate developing a buy-out program for structures in or around floodplains, and other deteriorating structures.	LOW	Time	Bayfield County, local jurisdictions, LEPC	2018 – Ongoing if developed.	
	F. Better Develop Lake Superior shoreland protections for when water levels are higher than average	LOW	Unknown	Bayfield County, City of Bayfield, City of Washburn and Red Cliff Zoning	Ongoing	Larger emphasis is placed on a "Buy Out" of property rather than developing measures to protect threatened property.
	G. City of Washburn – Evaluate effectiveness of rock walls in prevention of erosion, look at below points	<i>Currently being completed.</i>				
3. ENFORCE COASTAL BUILDING SETBACKS	A. Adhere to the four setback sections relating to Lake Superior, streams, decks and building and greater setback	MEDIUM	Staff Time	Red Cliff Tribal Zoning / Administration	2012 - ongoing	

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Chapter 37.6.10 (Red Cliff)	B. Continue to protect the Lake Superior shoreline within Red Cliff Tribal boundaries with "protected" status.	LOW	Unknown	Red Cliff Tribal Zoning / Administration	Ongoing	
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EROSION: INLAND						
<i>Risk Rating: MEDIUM</i>						
I. PROTECT RESOURCES, Land Slumping	A. Old US 2 near Fish Creek – prevention of slumping banks.	HIGH	Undetermined	Town of Pilsen	2018	
	B. Siskiwit River – property damage and sediment control.	HIGH	Undetermined	Town of Bell	2020	
	C. Culvert Assessments to determine blocked and/or damaged culverts	HIGH	Undetermined	BAHWY, BA Land Conservation	Ongoing	
	D. Red Cliff – Blueberry Rd slumping of banks	HIGH	Undetermined	Red Cliff Band of Lake Superior Chippewa	2020	
	E. Fish Creek - Identify problem areas throughout creek and find mitigation solutions	HIGH	Undetermined	Areas in Fish Creek watershed	Ongoing	Funding complications
	F. Field erosion – Education for area farmers related to field planting design to decrease erosion	MEDIUM	Undetermined, DATCAP grant funding	Extension, Land Conservation, etc.	2018	Farm field / town road project site in the Town of Kelly
	G. Village of Mason – Re-evaluate impact of erosion on the White River throughout Village. (apply for grant funding to conduct study)	MEDIUM	Undetermined	Village of Mason Officials	2018-2019	Funding complications
	H. County Hwy D – extensive erosion that will need to be addressed	MEDIUM	Undetermined	County Highway Department	2018	
	I. Ondossagon Rd – prevention of slumping of banks	<i>COMPLETED</i>				
	J. Red Cliff – Rowley Rd where it crosses the Raspberry River slumping/erosion of banks around existing culverts.	<i>COMPLETED</i>				Project work 2016.
	K. Engineer and repair N Altamont Rd slumping in Town of Lincoln	<i>COMPLETED</i>				

EXTREME TEMPERATURES						
<i>Risk Rating: MEDIUM</i>						
I. INCREASE PUBLIC AWARENESS	A. Coordinate efforts with hospital and public health related to media information on heat waves	MEDIUM	Within budget	Public Health Department	Ongoing	
	B. Coordinate efforts with hospital, public health and others related to media information on hazards associated with extreme cold	MEDIUM	Within budget	Public Health Department	Ongoing	
	C. Identify and/or develop cooling locations the public may access during times of extreme heat/humidity	MEDIUM	Time for Identification	Public Health Department	Ongoing and updates continually	Initial work completed 2016. Ongoing implementation and identification of potential centers.

Bayfield County Hazard Mitigation Plan

	D. Participate in Heat Awareness Day campaign	LOW	Within budget	Public Health Department	Ongoing	
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FLOODING						
<i>Risk Rating:</i> HIGH Based on Land Records information 300 properties are within the flood plain.						
1. DECREASE IMPACT OF FLOODING	A. Conduct inventory and analysis of ground water conditions.	HIGH	Grant dependent	Bayfield County Public Health and Administration	2018	Currently being done (Geologic atlas, completed by the end of 2018) There will also be an interactive map produced.
	B. Incorporate floodplain management into comprehensive planning.	MEDIUM	Within budgets	All jurisdictions	Ongoing	
	C. Evaluate current floodplain zoning ordinances and revise as necessary	MEDIUM	Within budgets	Bayfield County Zoning	Ongoing	
2. EVALUATE LAND USE ACTIVITIES IN JOINT PLANNING EFFORTS	A. Driving through flooded roads - tell members of the public not to drive through flooded roads. If it is an essential road (US 2), having authorities continually inspect road integrity is needed.	HIGH	Within budgets	Bayfield County Emergency management, highway department, Sheriff's Department	Ongoing	Ensuring flooded roads have personnel on site
	B. Schedule periodic town/city/regional "planning summit" to identify, discuss and resolve infrastructure issues that impact Lake Superior	MEDIUM	Within budgets	Emergency Management City of Bayfield, Towns of Bayfield and Russell, Red Cliff Tribal	Ongoing	Specific date set in 2018?
	C. Identify impact of land use activities on neighboring municipalities	MEDIUM	Within budgets	City of Bayfield, Towns of Bayfield and Russell, Red Cliff Tribe, Zoning, Land Conservation Dept.	Ongoing	Develop a mechanism to share county zoning maps and information relating to floodwater and runoff to jurisdictions, looking into impervious surfaces. Once the maps are created and need to be looked at and sent to all jurisdictions within a 1.5 mile buffer.
	D. Work cooperatively with jurisdictions adjacent to Lake Superior to control and reduce stormwater runoff	MEDIUM	Within budgets	City of Bayfield, City of Washburn, Towns of Bayfield, Bayview and Russell, Red Cliff Tribe, Zoning	Ongoing	Potential projects identified may require engineering and additional funding
	E. Review county permitting process to include impacts of building and clear-cutting on adjoining communities that border Lake Superior	MEDIUM	Within budgets	Bayfield County Zoning Committee with input from area communities	Ongoing	
3. FUTURE INFRASTRUCTURE / EQUIPMENT NEEDS	A. Identify locations and study condition of existing water and sewer systems	HIGH	Within budgets	All jurisdictions bordering Lake Superior, WDNR, regional planning agency	Ongoing	NWRPC completed an infrastructure study. Next steps would be to look into private sewer systems as well as well location to prevent well contamination)
	G. Purchase a compactor to be shared among communities in order to compact the surface of existing roadways.	HIGH	\$20,000	Town of Bell, Bayfield County Highway Departments	2018	
	C. Examine existing sewer systems for breaches and resiliency to infiltration of too much water during rain events	MEDIUM	Unknown	All jurisdictions, WDNR	Ongoing	Engineering may be required
	B. Analyze impact of projected development on existing water and sewer systems	MEDIUM	Unknown	All jurisdictions bordering Lake Superior, WDNR, regional planning agency	Ongoing	Engineering may be required, previous studies have been done and is an ongoing subject

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	F. Develop a hydrology/soil study for the areas adjacent to Lake Superior to determine concerns	<i>COMPLETED</i>				Information will be made available to the public as the data becomes refined
	D. Develop a stormwater management plan for the City of Bayfield	<i>COMPLETED, every time a project is looked at stormwater assessments are conducted</i>				
	E. Evaluate and revise stormwater management plan for the City of Washburn	<i>COMPLETED, Washburn requires new requirements</i>				
	H. Warning signs – road closed, detour, etc. to augment local sign availability.	<i>COMPLETED</i>				Impact of the 2016/2018 flooding identified this need. Highway Dept applied for grant funding for signs and received it.
4. REDUCE POINT SOURCE POLLUTION	A. Develop alternatives and provide public education related to practices that negatively impact water quality	HIGH	Unknown	Bayfield County and all jurisdictions	Ongoing	Joint effort with public education related to use of natural vegetation and erosion control
	B. Continue participation in the Northwest Household Cleansweep Program	HIGH	Currently budgeted	Bayfield County Administration, Emergency Management, Extension	Ongoing	Look further into Wisconsin Emergency Management's structure buyout program
	C. Increase capacity of Bell Sanitary District in order to prevent contaminated waters entering Lake Superior.	MEDIUM	Grant Dependent	Bell Sanitary District #1	2020	
	D. Develop a work group to identify regional threats to Lake Superior water quality	MEDIUM	Within budgets	Bayfield County, WDNR, jurisdictions bordering Lake Superior, NPS, USCG, and private marina operators	2018	WDNR regulates private marina.
	E. Encourage review of work practices and environmental policy agreements at marinas to reduce likelihood of public health hazards.	MEDIUM	Unknown	Bayfield County Public Health, WDNR, and all jurisdictions	Ongoing	WI-DNR regulates private marinas. Public education campaign saying to fill boats responsibly
	F. Consider need for on-land containment system for cleaning of boats at local marinas for invasives and other containments	MEDIUM	Unknown	Private and public marina owners/operators, WDNR	2018-ongoing	WDNR regulates private marinas.
	G. Evaluate need for policy to prevent discharge of household hazardous chemicals into waterways	LOW	Unknown	All jurisdictions	Ongoing	
	H. Establish and maintain a mercury reduction program	<i>COMPLETED</i>				Continue to maintain program
5. ENHANCE HYDROLOGY DATA	A. Work with FEMA to upgrade Flood Insurance Rate Maps (FIRM).	HIGH	Time	Bayfield County and all jurisdictions	Ongoing, study to be completed by 2020 then the county map is completed a year later	Wave run-up study, incorporate relevant flood map materials and studies
	B. Acquire information from the Northwest Regional Planning Commission's Regional Flood Study when completed in late 2018.	HIGH	None	Emergency Management, Zoning, Highway Dept, LEPC, Land and Water Conservation Department	End of 2018	

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	C. Develop a comprehensive culvert database for the entire County. The database can entail age, size, location, scheduled replacement and additional notes for problems or occurrences associated with it. This will help departments and road crews identify if culverts are undersized or will be an issue in the future.	HIGH	Will take several days of employee time for each jurisdiction/department	Emergency Management, Highway Dept., Local jurisdictions. Potentially hiring interns may speed up the process as well as make it more cost effective.	Ongoing	Employee time, funding. The County Highway Department last updated their list in 2003.
	D. Install larger culverts where current culverts are undersized and are causing issues such as pooling and blowouts.	HIGH	Undetermined, the cost could be great due to many culverts being undersized	Emergency Management, Highway Dept., Local jurisdictions.	Ongoing	Culvert projects would need to meet DATCAP and DNR engineering requirements. The largest challenge faced is if it will meet FEMA's cost benefit analysis threshold.
	E. Assess problems in designated floodplains to determine what steps can be taken to minimize current and future problems.	MEDIUM	Unknown	All jurisdictions. Land conservation is applying for grants that relate to soil loss and some equipment for the study	Ongoing	Use data and information from the Wisconsin Geologic Survey and information from NWRPC's Regional Flood Study that has a completion date of October 2018.
6. SPECIFIC PROJECTS	A. Continual dredging of Cornucopia harbor	HIGH	\$400,000	Town of Bell	Ongoing	Hydraulic dredge is a 20-year solution. There are small scale dredging's every year
	B. Reroute Siskiwit River to original pathway to decrease impact of flooding on the Cornucopia Harbor.	HIGH	Grant dependent	Town of Bell	Ongoing	Town of Bell is pursuing grant dollars
	C. Explore mitigation options on the Big Brook to reduce flood damages to structure at 43255 Big Brook Rd Address	MEDIUM	Grant dependent	Town of Cable, Emergency Management	Ongoing	Culverts on Big Brook are undersized causing water to backup, then threatening only 1 residence on the Brook.
	D. Emil Rd / Red Cliff – no solution identified.	LOW	Undetermined	Red Cliff Band of Lake Superior Chippewa	Ongoing	Repeated flooding. Engineering will be required.
	E. Evaluate developing a buy-out program for structures in or around floodplains, and other deteriorating structures.	LOW	Time	Bayfield County, local jurisdictions, LEPC	2018 – Ongoing if developed.	Look further into Wisconsin Emergency Management's structure buyout program
	F. LIDAR (Light Detection and Ranging) maps for entire county.	COMPLETED				Completed in 2016. Equipment can perform maintenance on data. Update as continually as possible (10-15 years)
	G. City of Bayfield – Replace stormwater collection system/culvert that passes under State Highway 13.	COMPLETED				Stormwater infrastructure and collection systems have been updated and are in good working condition. But is always a continual project to update
	H. Rowley Rd / Red Cliff – Bridge construction on Rowley Rd and Raspberry River: clear ditches and install riprap.	COMPLETED				

SEVERE THUNDERSTORMS / DAMAGING WINDS / HAIL / LIGHTNING / TORNADOES						
<i>Risk Rating:</i> HIGH						
I. REDUCE DAMAGE, LOSS	A. Participate in Tornado Awareness Week	HIGH	Within budget	Bayfield County Emergency Management, Dispatch	Ongoing	

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OF LIFE, AND DESTRUCTION OF PROPERTY	B. Provide information to the public emphasizing personal responsibility for planning for self and family	HIGH	\$1,000	Bayfield County Emergency Management, LEPC, media, Extension and Public Health	Ongoing	Develop pamphlets, presentations and news release
	C. Provide annual access to SKYWARN weather spotter training	HIGH	Within budget	Bayfield County Emergency Management, NWS	Annually	
	D. Post consistent materials at campgrounds that identify local radio stations/access to weather information and general safety reminders	HIGH	\$1,000	Bayfield County Emergency Management and Tourism	Ongoing	Work with campground hosts and review annually to ensure information is most up to date
	E. Restore/preserve county courthouse dome	HIGH	\$60,000	Bayfield County Administration/Board	Ongoing	
	F. Encourage access to back-up power for access to emergency vehicles in case of power outages	HIGH	Variable	Bayfield County Emergency Management, all jurisdictions	Ongoing	
	G. Encourage identification of shelter areas in public buildings	MEDIUM	Within budgets	Bayfield County Emergency Management, Schools	Ongoing	Norvado headquarters in Cable could serve as a Southern staging location in the County.
	H. Evaluate need for shelter plans in public facilities (need by need basis)	MEDIUM	Within budget	Bayfield County Emergency Management, facilities	Ongoing	Schools, libraries, local government buildings
	I. Work toward generator back-up power at all county radio towers	<i>COMPLETED</i>				
2. REDUCE IMPACT OF LONG-TERM POWER OUTAGES	A. Identify emergency fuel sources	HIGH	TIME	LEPC	Ongoing	County shops? Washburn IGA? Genex-Ashland/Sanborn?
	B. Encourage each jurisdiction provide generator back-up to at least one building	HIGH	VARIABLE	Emergency Management, Local Jurisdictions	Ongoing	Shelter? Access to emergency/town vehicles?
	C. Identify fresh water sources to be used by the public during power outages	HIGH	TIME	PD/Sheriff's Dept., EMS, Emergency Management, local jurisdictions	Ongoing	Continued and constant improvements. (Municipal wells have backup generators)
	D. County Courthouse Generator	HIGH	Funding	Emergency Management, Sheriff's Department	Ongoing	Initial completion in 2016. But more capacity is needed
	E. Identify sites needing generator power and work to establish.	HIGH	Unknown	LEPC, Emergency Management	Ongoing	Norvado may be able to provide generators and lighting units if they are not needed or a greater need is presented
	F. Expand generator capacity throughout the County to more local and county buildings	HIGH	Funding	LEPC, Emergency Management, local governments	Ongoing	
	G. Purchase and install generator at County highway department	MEDIUM	\$100,000	Highway Department	Ongoing	Grant dependent.
3. PROVIDE SHELTER	A. Explore requirements for Great Lakes Visitors Center to incorporate HVAC into generator back-up in order to provide a reception center during power outages	HIGH	UNKNOWN	BAEM, USFS	Ongoing	
	B. Identify potential "charging" areas for electronic devices during long term power outage.	HIGH	TIME	LEPC	2018, ongoing	Charging areas are dependent on locations with generators
	C. Encourage American Red Cross update of shelter facilities throughout the county.	HIGH	TIME	BAEM / LEPC	2018, ongoing	

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	D. Educate members of the public by distributing a list of Designated Shelter areas throughout the County. (Shelters may vary depending on emergency type)	High	Staff Time	Emergency management, LEPC, community leaders	2018, ongoing	
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WILD FIRE

Risk Rating: HIGH

1. REDUCE HAZARDOUS FUELS	A. Encourage removal of tree debris from July 2016 storms.	HIGH	Unknown	WDNR, USFS, County Forestry, Private contractors	Ongoing	Tree and debris to reduce hazardous fuels risk has been removed from County Lands.
	B. Work with power companies to improve powerline right-of-way maintenance to include right-of-way	MEDIUM	Unknown	WDNR, USFS, Bayfield County Forestry	Ongoing	
	C. Work with Town of Barnes to mitigate large fuel loading in the Town.	MEDIUM	Unknown	WDNR, USFS, Town of Barnes, County Forestry	Ongoing	Consider fuels reductions at each township, not just Barnes, as the fuel loading exists in many townships
2. IDENTIFY FIRE PRONE PROPERTY	A. Form a Home Ignition Zone working group among towns, WDNR and USFS	MEDIUM	Within budgets	WDNR, USFS	Ongoing	
	B. Develop an education plan for homeowners	MEDIUM	Unknown	WDNR, USFS	Ongoing	
	C. Conduct Home Ignition Zone Assessments for privately owned parcels	LOW	Unknown	WDNR, USFS	Ongoing	Additional personnel may be required
	D. Complete structure point mapping for entire county	COMPLETED				
3. IMPROVE DRIVEWAY ACCESS	A. Encourage countywide and/or town specific driveway ordinance	HIGH	Within budgets	Bayfield County Zoning, Fire Departments, Towns	Ongoing	Marking of driveways may assist homeowners in value of an ordinance
	B. Encourage towns to develop driveway ordinances that allow for access of emergency vehicles	MEDIUM	Staff time	Local officials	Ongoing	
	C. Consider marking accessible driveways for easy identification during wild fire events ?????	NOT UNDER CURRENT CONSIDERATION				Consider highlighting properly designed and constructed driveways. This task would require continuous maintenance and re-visits.
4. EDUCATION PROGRAMS FOR CHILDREN	A. Work with School District Administrations to develop activity oriented curriculum for annual fire education program.	HIGH	\$2,500, fire prevention grants	Fire Departments, WDNR, USFS	Ongoing	
	B. Integrate wildfire prevention education into "Fire Prevention Week" outreach efforts	HIGH	Within budgets	Fire Departments	Ongoing	Consider promoting Wildfire Prevention Week which is the third week of April each year (National)
5. EDUCATION PROGRAMS FOR ADULTS	A. Identify existing or develop adult education initiatives	MEDIUM	Within budgets	WDNR	Ongoing	
	B. Provide educational materials with the WDNR hazard assessment packets.	MEDIUM	Within budgets	WDNR	Ongoing	WDNR has many available and free to the public. These are ongoing and are being updated with current information regularly
	C. Continue to seek opportunities for presentations at adult group meetings.	MEDIUM	Within budgets	WDNR	Ongoing	

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6. STATE FOREST FIRE LAWS	A. Continue aggressive enforcement of state forest fire laws.	HIGH	Within budgets	WDNR	Ongoing		
	B. Continue aggressive origin and cause determination	HIGH	Within budgets	WDNR	Ongoing		
	C. Explore further restrictions on burning permits.	MEDIUM	Within budgets	WDNR	Ongoing	This would be better suited for Townships, as they have the ability to be more restrictive within their jurisdiction	
	D. Provide origin and cause determination training to local fire departments	MEDIUM	Within budgets	WDNR, local fire departments	Ongoing		
7. PROVIDE EFFECTIVE AND SAFE SUPPRESSION	A. Identify local fire department equipment and training needs.	HIGH	Variable	All jurisdictions	Ongoing	Volunteer Fire Assistance Grants Forest Fire Assistance Grants	
	B. Increase availability of water sources by improving existing water points and/or installing dry hydrants	HIGH	\$20,000	Fire Departments, WDNR, USFS	Ongoing	Explore grant possibilities for partial funding through Fire Association and WDNR	
	C. Establish fire breaks for developing housing	HIGH	Unknown	Red Cliff Band of Lake Superior Chippewa	2018, Ongoing		
	D. Continue to establish forest roads in Barnes for fire fighting.	HIGH	Unknown	WDNR, Bayfield County Forestry	2018, Ongoing		
	E. Develop plans for pre-suppression strategies	MEDIUM	Within budgets	Fire departments, WDNR, USFS	Ongoing		
	F. Review structural protection zone mapping and <i>revise emergency responder map book as necessary.</i>	COMPLETED					
	G. Improve communications infrastructure by installing paging and radio repeater on the existing Drummond Xcel tower	COMPLETED					

WINTER STORMS						
<i>Risk Rating: HIGH</i>						
1. REDUCE DEATH AND PROPERTY DAMAGE	A. Increase public awareness of winter storm hazards and available warning systems.	HIGH	Within budgets	Emergency Management and all jurisdictions	Ongoing	
	B. Recommend that individuals and families to prepare emergency supplies for both homes and automobiles	HIGH	Within budgets	Bayfield County Emergency Management and all jurisdictions	Ongoing	
	C. Continue to clear roadways as quickly as possible for emergency response purposes	HIGH	Variable between the county and local jurisdictions	Bayfield County Highway and jurisdictional road crews	Ongoing	
	D. Encourage citizens not to travel in winter storm conditions	MEDIUM	Within budgets	Local media, Bayfield County Highway, Emergency Management and Sheriff's Departments	Ongoing	
	E. Participate in annual winter awareness campaign	MEDIUM	Within budget	Bayfield County Emergency Management	Ongoing	

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	F. Educate members of the public about general winter snow plow safety when driving. (also use WisDOT materials)	MEDIUM	Within budget	Bayfield County Emergency Management, Highway department and local jurisdictional road crews	Ongoing	
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5.0 Plan Maintenance and Approval Process

5.1 Plan Adoption

The Bayfield County All-Hazard Mitigation Plan will be considered to be in effect upon its approval and adoption by the Bayfield County Board of Supervisors, and its approval by Wisconsin Emergency Management (WEM) and FEMA. The plan will also be reviewed and adopted by the Cities of Bayfield and Washburn, the Village of Mason, and the Red Cliff Band of Lake Superior Chippewa. The record of these adoptions and copies of each resolution will be added to this plan as Annex B.

Following adoption by the County Board, the plan will be distributed to each town with a resolution they may use to adopt the plan as well. A list of jurisdictions, as well as the date of adoption will be included in the annex as well.

5.2 Plan Implementation

Bayfield County's Emergency Management Director will work with municipalities and implementation partners to develop detailed implementation strategies, identify required and available resources, assign specific staff roles and responsibilities, and initiate work on each mitigation strategy. Work on the individual strategies will proceed according to their plan priority ranking, available funding, and more detailed cost-benefit analyses. Adopting jurisdictions will be responsible for implementing specific plan elements, as indicated in the plan, and determined through future coordination discussions. As appropriate, adopting jurisdictions will update other existing related plans to reflect elements and strategies of this plan. The plan will be addressed annually by the LEPC, and updates will be provided via the Bayfield County newsletter.

All jurisdictions will utilize local tools and resources to carry out the intent of this plan. Through local ordinances, participating jurisdictions have established policies and programs to prevent development of property that is either located in risky places, or would have negative impacts on the surrounding environment. Significant restrictions include building along shorelines, within wetlands, and near floodplains, as well as on steep slopes. In addition, there are local zoning regulations in place to ensure neighboring land uses are compatible with each other, and work to minimize potential impacts. The local jurisdictions have personnel in multiple departments; each specialized in carrying out responsibilities. When appropriate, these departments will be called upon to carry-out tasks related to hazard mitigation.

In particular, the Cities of Bayfield and Washburn, and the Village of Mason will utilize zoning codes, their stormwater utilities, water and sewer systems, local taxing authority, and applying for grants from FEMA, the WDNR, WEDC, USDA-Rural Development, and other funding agencies to implement the actions presented. They will also utilize planning for scheduling and budgeting for large capital improvements. Capital Improvement Plans (CIPs) may be employed to make budgeting easier. Collaborative purchases and efforts may also be explored as effective yet cost-saving strategies. User fees on water, sewer, and storm sewer systems are also collected and revenues may be utilized to fund improvements to these systems to avoid disasters. Red Cliff will utilize their land use regulations, grants, user fee systems for utilities to implement the action items of this plan.

Tribal Capabilities

Several specific projects have been identified with Red Cliff in the new Mitigation Strategies table. Two road improvements were selected due to the frequency of road washouts, and housing fire breaks will

aid in protecting the people and property that have located at these sites. Other strategies identified within Section 4 of the plan update are priorities a bit lower.

Bayfield County’s Emergency Management Director will work with Red Cliff personnel to develop detailed implementation strategies, identify required and available resources, assign specific staff roles and responsibilities, and initiate work on each mitigation strategy. Work on the individual strategies will proceed according to their plan priority ranking, available funding, and more detailed cost-benefit analyses.

The Red Cliff tribal government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding. This plan will be amended by the Red Cliff tribal government necessary to reflect changes in tribal or Federal laws and statutes as required.

Capability

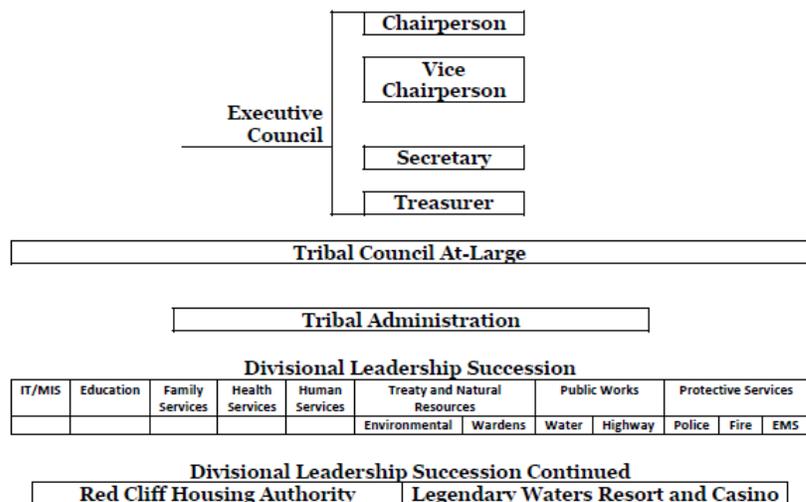
The Red Cliff Band of Lake Superior Chippewa has multiple divisions that are responsible for carrying out specific functions. These individuals assisted in supplying information necessary to complete the drafting of this planning document. The following Red Cliff divisions are responsible for the following actions:

- Treaty and Natural Resources Division, Tribal Historic Preservation Officer - preservation, protection, enhancement, and sustainable management of natural resources.
- Health Services (Jacob Maas) - promote the health and wellness of the community.
- Human Services - provide assistance and guidance to resources available, including FEMA.
- Public Works (Ed Sindelar) - infrastructure maintenance and upkeep.
- Planning (Jeff Benton) - orderly development and management of lands, resources and people.

The following diagram, as offered by Red Cliff, illustrates the chain of command and order of operation within the tribal government.

The identified divisions and agencies are responsible for both ensuring that disasters do not impact local residents, and responding when they do. The fire and ambulance services are shown in maps in Section 3 of the plan. Red Cliff does regulate land use, and has adopted floodplain development regulations that significantly restrict the

development that can occur in flood hazard areas. In addition, those areas that are identified as flood hazard areas are zoned as “Preservation”, further limiting any development that could otherwise have occurred on these properties. Funding for implementing mitigation strategies will likely come from local sources, the Bureau of Indian Affairs (BIA) and FEMA.



Additional tools that the Red Cliff tribal government has at their disposal to help integrate and implement the intent of this plan are local ordinances. Red Cliff has in place a flood damage reduction ordinance. Red Cliff also has a setback

ordinance that requires development to be placed at least 150 feet from lakeshores and at least 150 feet from floodplains. In 2011, the Lake Superior flood stage was determined to be 605 feet. Red Cliff tribal government added five feet to this when determining setbacks to provide added safety- measures.

Throughout the planning process, several references were made during various discussions about the informal networks that existing among individuals, families and communities. When disaster strikes, jurisdictional boundaries begin to fade, and people pull together to respond with resilience. While the Tribe does not have all the tools necessary for any job, they rely on and coordinate extensively with Bayfield County. The Red Cliff Band does not have emergency management staff per se, however they are in regular and direct contact with Bayfield County's personnel.

5.3 Plan Evaluation and Updating

The Bayfield County All-Hazard Mitigation Plan will have a complete review at least every five (5) years to identify and include significant changes that would affect the mitigation strategies identified in the plan. The plan will be evaluated to ensure that increased development, increased exposure to particular hazards and the development of new mitigation capabilities or techniques, as well as changes to federal and/or state legislation are incorporated into the implementation of, and revisions to, the plan.

Although the entire plan will be reviewed every five years, Bayfield County will strive to review individual pieces of the All-Hazard Mitigation Plan more frequently to ensure that the plan reflects existing conditions.

- The Planning Process will be scheduled for review annually by the LEPC to document changes to the planning process.
- The Planning Area information will be updated when new data becomes available, or with updates to area Comprehensive Plans. This will be scheduled for review at least every five years.
- The Risk Assessment section will be reviewed by Bayfield County Emergency Management and the LEPC annually. Revisions will be forwarded to Wisconsin Emergency Management.
- Mitigation Strategies will be reviewed, updated and re-approved annually by the LEPC. If strategies are updated, Wisconsin Emergency Management will be notified and updated.
- The Plan Maintenance section will be reviewed every five years in conjunction with plan revisions.

The plan will also be reviewed by the LEPC following any major public sector damage sustained due to natural disaster or a disaster declaration to revise the plan to identify and document the storm events, as well as to reflect additional mitigation strategies or revisions to priorities identified in the plan.

Throughout the ongoing plan maintenance, the public will have the opportunity to provide input and feedback on the plan. Copies of the plan will be made available to the public electronically. A minimum of one public hearing will be held during each five-year evaluation and update. These hearings will provide the public with a forum for which they may express concerns, opinions or ideas about natural hazard planning and identified mitigation strategies.

Bayfield County Emergency Management will review the plan every five years and will monitor progress of all mitigation projects and will update those strategies in plan updates. Newly identified mitigation needs will be addressed through the development of additional goals, objectives, or strategies, as applicable. If changes in implementation priority are deemed necessary, the rationale will be documented.

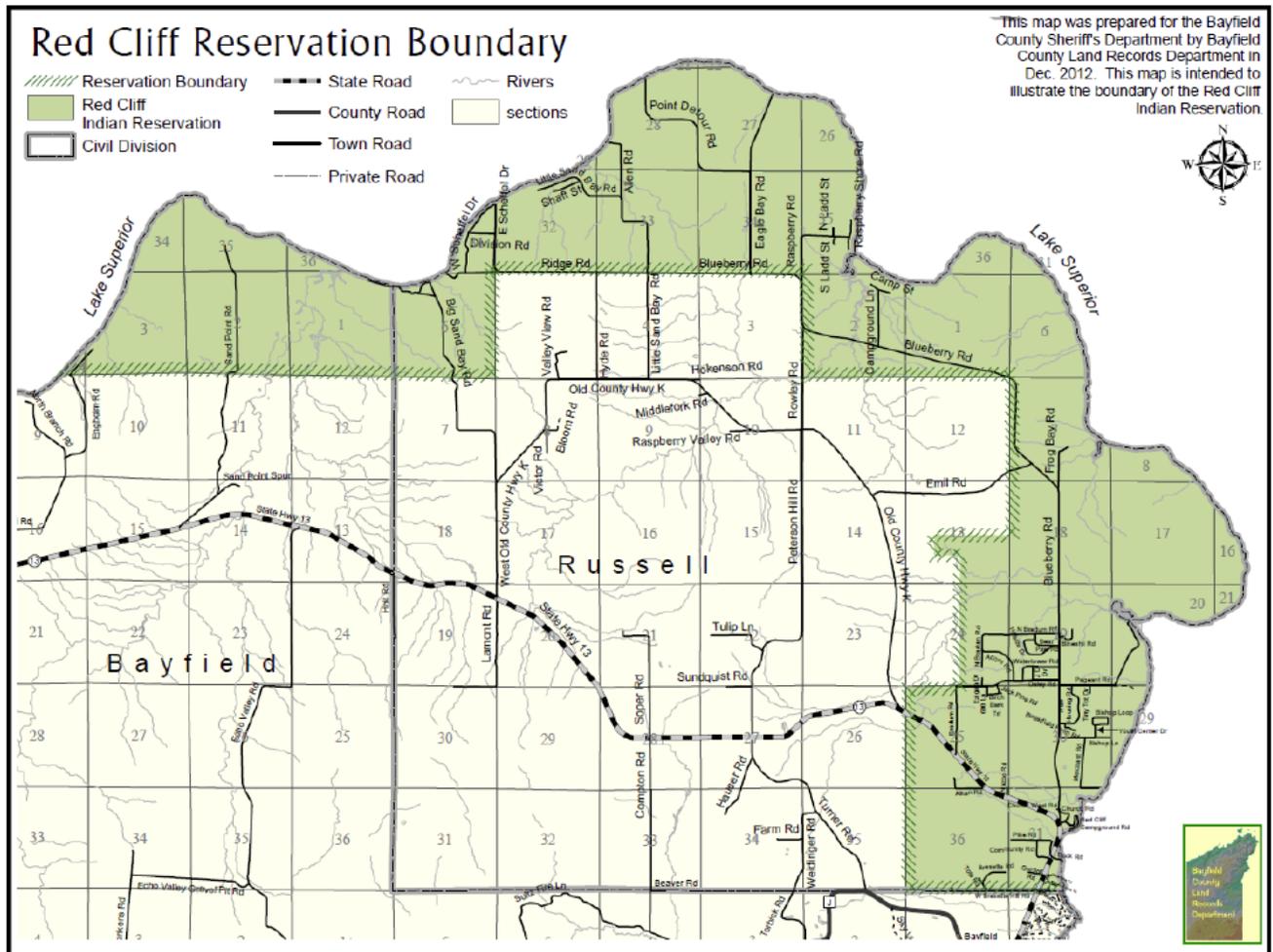
All jurisdictions within Bayfield County are included in the Bayfield County All-Hazard Mitigation Plan. Many of these communities have developed comprehensive plans. This plan provides goals and actions closely related to the goals, objectives and strategies of jurisdiction comprehensive plans. Bayfield County will work with local communities to incorporate recommended mitigation actions through existing programs. Jurisdictions are responsible for implementing their own mitigation actions; however Bayfield County will provide support and assistance for doing so to the extent they are able.

Revisions and updates will be distributed for review and approval to the Bayfield County Emergency Management Department, municipalities, and implementation partners. Plan revisions will be made available to the general public for review and comment during the plan updating process. Public comment on revisions and updates also will be solicited through public outreach efforts that may include open houses, public meetings, press releases, websites or displays at community events. The Bayfield County Local Emergency Planning Committee (LEPC) will have oversight of the Bayfield County All-Hazard Mitigation Plan. As described previously, the LEPC is comprised of representatives from government agencies, including the County, the Cities of Bayfield and Washburn, the Village of Mason, and Red Cliff Band of Lake Superior Chippewa, and various towns located throughout the County. Other LEPC representatives include emergency responders, media representatives, utility representatives, and concerned citizens. LEPC meetings are always posted as announcements at the courthouse and are open, with public attendance and input invited. Committee members may monitor the status of mitigation projects by evaluating implementation actions and processes, identifying those that have worked well, difficulties encountered, and making suggestions for revisions to the mitigation strategies as necessary. This process will require significant coordination with LEPC and other jurisdictions and agencies identified in the mitigation strategies.

The reviewed and updated plan will be submitted to the Bayfield County Board of Supervisors, WEM and FEMA for approval every five years.

Annex A

Red Cliff Band of Lake Superior Chippewa Components



Planning Process

From the onset of the Bayfield County All-Hazard Mitigation Plan update, extra efforts have been made to incorporate information pertaining to the Red Cliff Band of Lake Superior Chippewa (Red Cliff) into the plan. Representatives have been invited and asked to participate in all of the LEPC meetings. When a representative was unable to attend the LEPC meetings, often times one-on-one meetings would be set up and held between the Bayfield County Emergency Management Coordinator (Jan Victorson) and a Red Cliff representative, often times Jacob Maas.

The first county planning committee meeting took place on January 4, 2012 with a defined goal of updating Bayfield County's All Hazard Mitigation Plan. The Local Emergency Planning Committee or LEPC served as the oversight committee for the development of the Bayfield County Hazard Mitigation Plan. The LEPC is a committee appointed by the County Board that includes representation from jurisdictions within the county, including response agencies, elected officials, and community groups. The listing of the membership of the LEPC follows:

Verne Gilles,	Citizen and Committee Chair
Al Krause,	Schools Representative
Ben Dufford,	Bayfield County Conservationist
Ben Garrett,	WDNR Wildland Fire Mitigation
Bob Miller,	Village of Mason
Bryon Daley,	Environmental Health Specialist, Red Cliff Band of Lake Superior Chippewa
Carrie Linder,	Human Services/ADRC
Dennis Pocerlich,	County Board Chair
Gary Victorson,	EMS / Bayfield County Coroner
Jeff Lee,	Norvado Telephone Cooperative
Jennifer Augustine,	Northern Lights Health
Jim Whyte,	Director Of Education at Memorial Medical Center
Mark Abeles-Allison,	Bayfield County Administrator
Mark Scribner,	CenturyTel Phone Company
Mike BeBeau,	Xcel Energy Electric Utility
Nick Fletcher,	Northern Lights Health
Paul Houck,	Bayfield County Information Technology
Paul Susienka,	Bayfield County Sheriff
Sara Wartman,	Bayfield County Public Health
Scott Kluver,	City of Washburn
Tom Kovachevich,	City of Bayfield / Fire

The LEPC reviewed portions of the plan, assisted in development of the risk assessment matrix and finalized the rating of those identified risks. Throughout the course of the past year, the LEPC has met several times, typically at least once per month, to discuss updates to the plan, including demographics, event occurrences, vulnerability and risk assessment modifications, and updating the mitigation strategies.

The All Hazard Mitigation Plan Update was presented about and discussed at several meetings of the Bayfield County Unit of the Wisconsin Towns Association. Several participating towns had recently

completed Comprehensive Plans, and information from these was taken into consideration where appropriate in this plan update. The Towns Association was used to provide ongoing information and updates to elected officials throughout the development of the All Hazards Mitigation Plan and planning process.

As the planning process continued to evolve, individual communities and representatives were sought after for participation and information on matters that directly impacted them. LEPC meeting invitations were widely distributed, and as always, these meetings are open to the public, with input from the public welcome. When these meetings were not convenient for those parties whose information was vital to the plan update, individual meetings or discussions were held to gather this information.

The Bayfield County Fire Association met almost monthly throughout the planning process and provided input related to risk analysis and mitigation strategies. Key representatives also served on the Bayfield County LEPC and provided valuable input to the plan update, particularly as it related to vulnerabilities and mitigation strategies.

Other groups or committees that have offered input throughout the planning process including filling out and/or discussing the risk assessment matrix are EMS service providers, the Sheriff's Department, Emergency Management and Child Support Committee to the Bayfield County Board of Supervisors, Bayfield County Highway Committee, and individual fire and ambulance departments.

Members of the Red Cliff Band of Lake Superior Chippewa have been consulted throughout the update of this plan. Public tribal members include the entire Red Cliff Band of Lake Superior Chippewa members. LEPC meetings were posted and open to the public for comment. In addition, comments and information passed through tribal elders is incorporated into the plan, particularly with regard to sacred places, and potential projects.

Integration

Existing plans were reviewed and incorporated into the All-Hazard Mitigation Plan as appropriate. Part II - Defining the Planning Area - draws on information developed for Comprehensive Plan adopted by the Bayfield County Board of Supervisors in 2012, with additions as necessary. Twenty-eight of the twenty-nine jurisdictions within the county have adopted Land Use Plans. Information from those plans also was integrated into the Mitigation Plan as appropriate. The All-Hazard Mitigation Plan will augment the current County, Town, City and Tribal Land Use Plans already in place. We also look for portions of the Mitigation Plan to be incorporated into other plans as the applicability is identified.

A listing of Red Cliff plans and documents that provided information for the Bayfield County All Hazard Mitigation Plan follows:

- Emergency Operations Plan
- Integrated Resource Management Plan 2006-2016
- Red Cliff Early Childhood Center - Full- Community Assessment, 2011-2012
- Land Use Plan
- Long-Range Transportation Plan

Red Cliff has been completing their Emergency Operations Plan concurrently to the completion of the Bayfield County All-Hazard Mitigation Plan update. This has assisted the integration of these two planning documents.

Additional tools that the Red Cliff tribal government has at their disposal to help integrate and implement the intent of this plan are local ordinances. Red Cliff has in place a flood damage reduction ordinance. Red Cliff also has a setback ordinance that requires development to be placed at least 150 feet from lakeshores and at least 150 feet from floodplains. In 2011, the Lake Superior flood stage was determined to be 605 feet. Red Cliff tribal government added five feet to this when determining setbacks to provide added safety- measures.

During the planning process, Red Cliff and Bayfield County had a meeting with FEMA representative Joan Tweedale, Hazard Mitigation Grants and Planning Group Supervisor, to discuss specific steps to ensure the plan update would meet tribal requirements. In addition, two Red Cliff representatives, as well as Bayfield County Emergency Management attended the Tribal Hazard Mitigation Workshop, hosted jointly by FEMA, Wisconsin Emergency Management (WEM) and Minnesota Homeland Security and Emergency Management (HSEM), which discussed specific elements of tribal mitigation plans. This planning process has been coordinated using FEMA's hazard mitigation guidance, with projects and strategies identified that would be compatible with FEMA's Hazard Mitigation Grant Program.

Throughout the planning process, discussions revolved around utilizing FEMA programs for carrying out potential projects. FEMA programs that were considered include the National Flood Insurance Program, which the Red Cliff Band participates in, FEMA Hazard Mitigation Assistance Grants (HMGP, PDM and FMA), floodplain mapping, and FEMA's Response and Recovery programs. Depending on the projects being considered, the appropriate programs will be reviewed and considered.

Risk Assessment

Red Cliff has many of the same risks as the rest of Bayfield County. Red Cliff representatives were present during the discussions of the natural hazard events that have the potential for impacting the reservation. Recent hazard events that have impacted the reservation have been heavy rain events in May and June of 2012 that closed multiple roads.

Much of the Red Cliff reservation lies along the southern coast of Lake Superior, making it vulnerable to coastal erosion, which has presented itself as a problem throughout the coastline of Bayfield County. In addition, these areas are also within flood hazard zones, along with areas following Raspberry and Sucker Creeks, and Sand River. These areas are all designated as Preserved areas in the Red Cliff Reservation Zoning District Map.

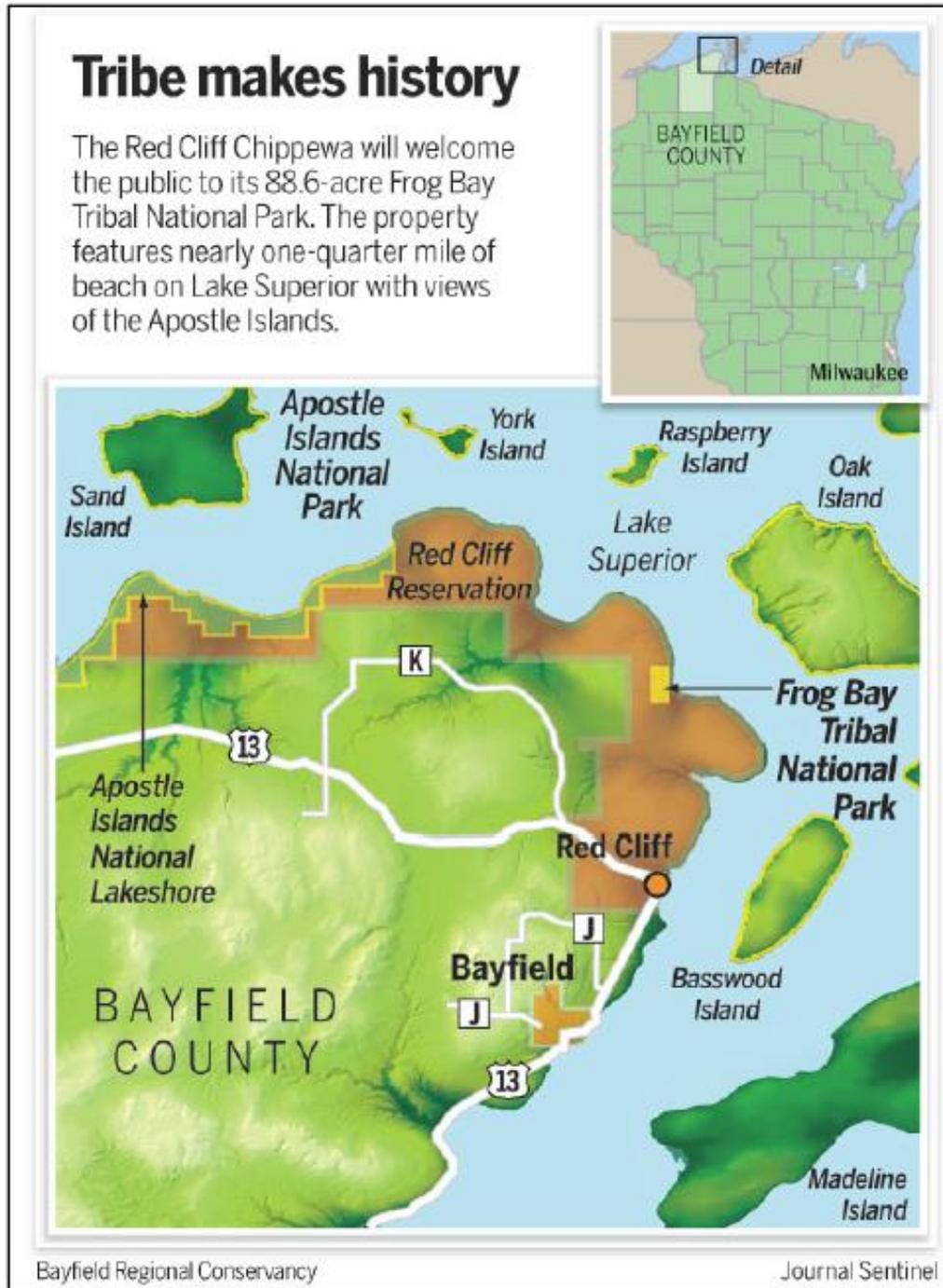
Other hazards, such as those related to temperatures, tornadoes, and precipitation events, have an equal chance of impacting any area within the reservation area.

Members and elders of the Red Cliff Band of Lake Superior Chippewa have several unique cultural beliefs. Members do not like to discuss prior disasters or historical events. Therefore, data at the County-level is available, however, personal experiences that can account for additional hazard events is not available.

The Red Cliff Band of Lake Superior Chippewa have several cultural and sacred sites scattered throughout their reservations. These are historically important, and to some members of the Tribe, considered critical facilities. These sites are not identified within this plan, nor are they routinely identified to non-tribal persons, however information pertaining to their location and significance is

maintained through the Tribal Council. There are also trained tribal observers that ensure these sites are protected and mitigated.

One protected and special area is Frog Bay Tribal National Park. This is the first Tribal National Park in the US. Frog Bay consists of approximately 88 acres and is located just to the northeast of Frog Bay Road. The Bayfield Regional Conservancy holds a conservation easement on the entire property that preserves its forest, beach and ravines by restricting subdivisions, logging and other development.



Vulnerability

Red Cliff is vulnerable to many hazards. However, for the most part, Red Cliff is largely undeveloped amid the areas marked as flood hazard zones. Otherwise, the Tribe is susceptible and vulnerable to the same hazards as Bayfield County.

Mitigation Strategies

Red Cliff representatives were included in the discussions of the hazard mitigation strategies for the plan update. The hazard mitigation strategies have been updated in Section 4 of this plan. In addition, Red Cliff has identified several that are both included in the table in Section 4, but merit further mention here as well.

- Rowley Road - this road has been subject to slumping/in-land erosion due to heavy rain events. As assessment of this facility and the associated stormwater conveyance system should be completed to determine appropriate improvements to eliminate continued slumping.
- Blueberry Road - this road has been subject to slumping/in-land erosion due to heavy rain events. As assessment of this facility and the associated stormwater conveyance system should be completed to determine appropriate improvements to eliminate continued slumping.
- The Red Cliff Band of Lake Superior Chippewa has seen an influx of new housing recently. Reservation lands are heavily wooded, thus having an abundant fuel source for wildfires. To protect the new housing, the tribe would like to work with residents to install fire breaks to protect the investments that are being made.
- One of the ongoing goals that has been, and continues to be implemented, is the protection of land along the Lake Superior coastline. In the 1990's, areas that had not been developed along Lake Superior became "protected" areas and became subjected to strict setbacks. Development is not allowed within these protected areas along the Lake Superior shoreline.

Implementation

The above-referenced specific projects have been ranked as the top priority projects for Red Cliff. The two road improvements were selected due to the frequency of road washouts, and the housing fire breaks will aid in protecting the people and property that have located at these sites. Other strategies identified within Section 4 of the plan update are priorities a bit lower.

Bayfield County's Emergency Management Director will work with Red Cliff personnel to develop detailed implementation strategies, identify required and available resources, assign specific staff roles and responsibilities, and initiate work on each mitigation strategy. Work on the individual strategies will proceed according to their plan priority ranking, available funding, and more detailed cost-benefit analyses.

The Red Cliff tribal government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding. This plan will be amended by the Red Cliff tribal government necessary to reflect changes in tribal or Federal laws and statutes as required.

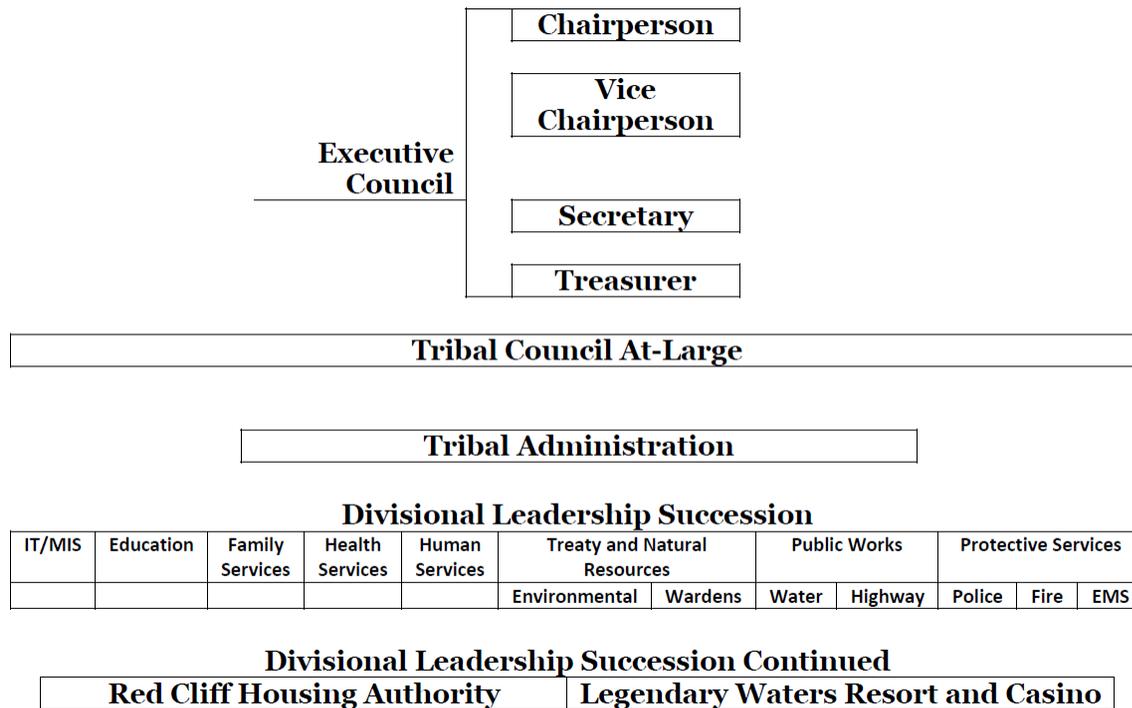
Capability

The Red Cliff Band of Lake Superior Chippewa has multiple divisions that are responsible for carrying out specific functions. These individuals assisted in supplying information necessary to complete the drafting of this planning document. The following Red Cliff divisions are responsible for the following actions:

- Treaty and Natural Resources Division, Tribal Preservation Officer - preservation, protection, enhancement, and sustainable management of natural resources.
- Health Services (Jacob Maas) - promote the health and wellness of the community.

- Human Services - provide assistance and guidance to resources available, including FEMA.
- Public Works (Ed Sindelar) - infrastructure maintenance and upkeep.
- Planning (Jeff Benton) - orderly development and management of lands, resources and people.

The following diagram, as offered by Red Cliff, illustrates the chain of command and order of operation within the tribal government



The identified divisions and agencies are responsible for both ensuring that disasters do not impact local residents, and responding when they do. The fire and ambulance services are shown in maps in Section 3 of the plan. Red Cliff does regulate land use, and has adopted floodplain development regulations that significantly restrict the development that can occur in flood hazard areas. In addition, those areas that are identified as flood hazard areas are zoned as “Preservation”, further limiting any development that could otherwise have occurred on these properties. Funding for implementing mitigation strategies will likely come from local sources. The Bureau of Indian Affairs (BIA), U.S. Department of Transportation (DOT)/Federal Highway Administration, and Emergency Relief for Federally Owned Roads (ERFO) may be available for mitigation projects related to the Red Cliff road infrastructure. The Red Cliff Band of Lake Superior Chippewa contingency funds may be contributed as matching funds to potential grants for identified projects based on Tribal Council approval.

Additional tools that the Red Cliff tribal government has at their disposal to help integrate and implement the intent of this plan are local ordinances. Red Cliff has in place a flood damage reduction ordinance. Red Cliff also has a setback ordinance that requires development to be placed at least 150 feet from lakeshores and at least 150 feet from floodplains. In 2011, the Lake Superior flood stage was determined to be 605 feet. Red Cliff tribal government added five feet to this when determining setbacks to provide added safety- measures.

Throughout the planning process, several references were made during various discussions about the informal networks that existing among individuals, families and communities. When disaster strikes, jurisdictional boundaries begin to fade, and people pull together to respond with resilience. While the Tribe does not have all the tools necessary for any job, they rely on and coordinate extensively with Bayfield County. The Red Cliff Band does not have emergency management staff per se, however they are in regular and direct contact with Bayfield County's personnel.

Should the Red Cliff Band become a recipient of grant funding, the Tribal Council would consider the acceptance of the funding proposed. If funds are to be accepted, the Tribal Council would accept grant funding through adoption of a resolution. Grant administration duties would then be assigned to the appropriate department, based upon where the funds were coming from, and what projects were being funded. As seen in the above Order of Operation Diagram, grant administration duties for potential hazard mitigation grants would likely be assigned to the Health Department, Natural Resources Department, Public Works Department or Protective Services Department.

Maintenance and Monitoring

At some point in the near future, Red Cliff may wish to develop their own All-Hazard Mitigation Plan. In fact, there has been some interest expressed in doing so already. Until that point, they will continue to be a participant in Bayfield County's plan updates. As such, Bayfield County will work with tribal representatives to maintain and update their information when it is warranted. Red Cliff has, and will continue to have an open seat on Bayfield County's LEPC, where their information and input is always welcome and will be considered and incorporated into future plan updates. Bayfield County will continue to maintain their plan as described in Section 5.0.

The Bayfield County All-Hazard Mitigation Plan will have a complete review at least every five (5) years to identify and include significant changes that would affect the mitigation strategies identified in the plan. The plan will be evaluated to ensure that increased development, increased exposure to particular hazards and the development of new mitigation capabilities or techniques, as well as changes to federal and/or state legislation are incorporated into the implementation of, and revisions to, the plan. Although the entire plan will be reviewed every five years, Bayfield County will strive to review individual pieces of the All-Hazard Mitigation Plan more frequently to ensure that the plan reflects existing conditions.

- The Planning Process will be scheduled for review annually by the LEPC to document changes to the planning process.
- The Planning Area information will be updated when new data becomes available, or with updates to area Comprehensive Plans. This will be scheduled for review at least every five years.
- The Risk Assessment section will be reviewed by Bayfield County Emergency Management and the LEPC annually. Revisions will be forwarded to Wisconsin Emergency Management.
- Mitigation Strategies will be reviewed annually by the LEPC, Bayfield County Board of Supervisors, and the Bayfield County Unit of the Towns Association to update strategies and priorities.
- The Plan Maintenance section will be reviewed every five years in conjunction with plan revisions.

The plan will also be reviewed by the LEPC following any major public sector damage sustained due to natural disaster or a disaster declaration to revise the plan to identify and document the storm events, as well as to reflect additional mitigation strategies or revisions to priorities identified in the plan.

Throughout the ongoing plan maintenance, the public will have the opportunity to provide input and feedback on the plan. Copies of the plan will be made available to the public through local libraries and county offices. The plan may also be obtained electronically. A minimum of one public hearing will be held during each five-year evaluation and update. These hearings will provide the public with a forum for which they may express concerns, opinions or ideas about natural hazard planning and identified mitigation strategies.

Bayfield County Emergency Management will review the plan every five years and will monitor progress of all mitigation projects and will update those strategies in plan updates. Newly identified mitigation needs will be addressed through the development of additional goals, objectives, or strategies, as applicable. If changes in implementation priority are deemed necessary, the rationale will be documented.

Revisions and updates will be distributed for review and approval to the Bayfield County Emergency Management Department, municipalities, and implementation partners. Plan revisions will be made available to the general public for review and comment during the plan updating process. Public comment on revisions and updates also will be solicited through public outreach efforts that may include open houses, public meetings, press releases, websites or displays at community events. During this process, Bayfield County will work to ensure that Red Cliff representatives are both involved with the update, as well as ensuring that the representatives are communicating with and gathering input from the public living on the reservation, as well as the Tribal Council. This will likely be done through Tribal Council meetings, as well as community-wide events.

The Bayfield County Local Emergency Planning Committee (LEPC) will have oversight of the Bayfield County All-Hazard Mitigation Plan. As described previously, the LEPC is comprised of representatives from government agencies, including the Red Cliff Band of Lake Superior Chippewa. LEPC meetings are always posted and are open, with public attendance and input invited. Committee members may monitor the status of mitigation projects by evaluating implementation actions and processes, identifying those that have worked well, difficulties encountered, and making suggestions for revisions to the mitigation strategies as necessary. This process will require significant coordination with LEPC and other jurisdictions and agencies identified in the mitigation strategies.

The previous method used for tracking and implementing mitigation strategies seemed to be effective. However, limited funds contributed to only implementing a portion of the projects identified. The implemented projects are identified in Section 4.

Incorporation

The Bayfield County All-Hazard Mitigation Plan was developed while the Red Cliff Emergency Operations Plan was being created. Information from these two separate processes were used to incorporate the plans into each other. In addition, tribal regulations were reviewed during the creation of this plan to ensure that the mitigation plan could be incorporated and adhered to. As other tribal plans are created or updated, appropriate information contained in the Bayfield County All-Hazard Mitigation Plan will be incorporated into the planning procedures of these documents.

Many committees have some personnel overlap within the Red Cliff organization. It will be helpful to have cross-committee representation to discuss and incorporate elements of planning documents into one another.

Committee meetings and Tribal Council members are open to the public. In addition, LEPC meetings where the Bayfield County All-Hazard Mitigation Plan is discussed and developed are all open to the public. Public input at these meetings is appreciated.

Annex B

Meeting Documents

From: Jan Victorson
Subject: LEPC MEETING - AGENDA
Date: Monday, February 26, 2018 5:30:34 PM

LEPC members and Mitigation Plan participants:

The Bayfield County Local Emergency Planning Committee is meeting this week –

Thursday, March 1st

2:30 PM

Bayfield County EOC – 117 E Sixth St, Washburn

Agenda items are as follows:

- Introductions
- Mitigation Plan development process – NWRPC
- Review: Natural hazard identification and assessment matrix
- Independent Study Course – IS 318: Mitigation Planning for Local and Tribal Communities
- Other items as identified by the membership

Please do let me know if you are unable to attend.

(I have already heard from a few committee members.)

Looking forward to working together at revising and strengthening our countywide mitigation plan.

Jan Victorson, Director

Bayfield County Emergency Management

Prepare. Plan. Stay Informed.

Bayfield County
LEPC - Local Emergency Planning Committee
Mitigation Planning Meeting Minutes
March 1, 2018

The meeting was called to order by Verne Gilles, Chair of the LEPC.

In attendance:

Mark Abeles-Allison – Bayfield County Administrator
Jennifer Augustine – Northern Light Health Care
Mike BeBeau – Xcel Energy
Bryon Daley – Red Cliff Band of Lake Superior Chippewa
Ben Dufford – Bayfield County Land Conservation
Paul Houck – Bayfield County Information Technology
Verne Gilles – Community member
Jeff Lee – Norvado
Carrie Linder – Bayfield County Human Services
Paul Susienka - Sheriff
Jan Victorson – Emergency Management.
Sara Wartman – Bayfield County Public Health

Those who notified they were unable to attend:

Scott Kluver – City of Washburn
Tom Kovachevich – City of Bayfield
Dennis Pocerlich – Bayfield County Board of Supervisors
Gary Victorson – EMS / Coroner

Jason Laumann and Cody Kamrowski of Northwest Regional Planning Commission (NWRPC) were present. They reviewed the mitigation plan revision process. The committee was reminded that the mitigation plan is about increasing preparedness – not planning for response and recovery.

The Hazard Matrix from the current plan was reviewed with discussion related to additional hazards. After lengthy discussion it was decided that NWRPC folks would send out an updated hazard matrix, with additional hazards included as well as clear directions for completing it. Committee members would work through the matrix individually, send results to Jan for forward to Jason by March 22nd. The results of the rankings would be reviewed/discussed at the next meeting.

The City of Bayfield, City of Washburn, Red Cliff Tribe, and Village of Mason, will need to complete their own Hazard Matrix based on their community risks.

The committee was reminded that they have three responsibilities:

1. Complete the Hazard Matrix; submit no later than March 22nd.
2. Develop Mitigation Strategies based on identified hazards.
3. Review content of the plan as developed.

Discussion of need to document expenditures related to local match (time – salary and fringe), mileage, etc.)

Public comment needs to be included as a line item on each meeting agenda.

Training specific to mitigation is available both online (fema.gov) and through Wisconsin Emergency Management. Specific information will be forwarded to committee members.

Meeting adjourned.

Bayfield County Hazard Mitigation Plan

SIGN-IN
LEPC meeting / MITIGATION PLAN DEVELOPMENT – March 1, 2018

NAME	ORGANIZATION	MILES	
Jean Victorson	BAEM	0	
Bayon S Ledy	Redcliff Indian Reservation	15	1 way
BDALEY @ Redcliff Health	health.ORG		
Nick Stepha	Northern Lights Health		nstepha@nlHealth.org
Carye Linder	Bayfield CO. DHS		
Paul Susimko	Bayfield County Staff		
Verile Gilles	LEPC Council	20	1 way
MIKE BEDEAU	XCEL ENERGY	13	1 way
Jeff Lee	Norvado	90	round trip
Don Dufford	BC Land & Water		
Jennifer Arquestre	Northern Lights		
Sara Wartman	Bayfield County Health Dept		swartman@bayfieldcounty.org
Mark Hake, Allison	Bayfield CTR Admin		
Paul Houck	Bayfield County IT		

From: Jan Victorson <JVictorson@bayfieldcounty.org>
Sent: Monday, March 26, 2018 3:50 PM
Subject: LEPC MEETING - APRIL 5TH

Bayfield County LEPC members and associates:

The next LEPC and Mitigation Planning meeting is scheduled –

Thursday – April 5th

2:30 pm

Bayfield County EOC / Courthouse Annex

Agenda items will include:

- Mitigation Planning
 - Review of Hazard Matrix (submitted by committee members)
 - Plan requirements
- Household Hazardous Materials Cleansweep event schedule
- SKYWARN training – April 30th

Please let me know if you are unable to attend.

And please forward your completed hazard matrix to ckamrowski@nwrpc.com!

Jan Victorson, Director
Bayfield County Emergency Management
Prepare. Plan. Stay Informed.

Bayfield County
LEPC - Local Emergency Planning Committee
Mitigation Planning Meeting Minutes
April 5, 2018

The meeting was called to order by Verne Gilles, Chair of the LEPC.

In attendance: Bryon Daley, Red Cliff Band of Lake Superior Chippewa; Ben Dufford, Bayfield County Land Conservation; Verne Gilles, Public member; Paul Houck, Bayfield County Information Technology; Tom Kovachevich, City of Bayfield; Jeff Lee, Norvado Communications; Jan Victorson, Bayfield County Emergency Management; Sara Wartman, Bayfield County Public Health. Cody Kamrowski of Northwest Regional Planning Commission (NWRPC) was also present.

Notified that unable to attend:

Mike BeBeau – Xcel Energy
Carrie Linder – Bayfield County Human Services
Mark Scribner - CenturyLink
Gary Victorson – EMS / Coroner

Public comment was requested.

Minutes of the March 1st meeting were reviewed and accepted by consensus.

Cody Kamrowski of NWRPC reviewed the hazard matrix developed by committee members. He stated that City, Village and Tribal participants in the planning process would be asked to develop their own hazard matrix.

The committee reviewed the critical facilities list developed by NWRPC. There was discussion related to each jurisdiction and their critical facilities.

Discussion followed on possible culvert inventory, tracking of outages with power companies, hazardous materials data sources, cyber security, coastal erosions and shoreland analysis, etc. NWRPC is currently working on a flood analysis for the eight northwest counties.

Cody presented draft hazard descriptions for new hazards identified during this planning process. Committee members will be encouraged to review and expand upon those descriptions.

SKYWARN TRAINING is being offered on Monday, April 30th at 6:30 pm in the Bayfield County EOC. All are welcome to attend.

NEXT MEETING: Thursday, May 10th – 3:00 pm / Bayfield County EOC.

Meeting adjourned.

SIGN-IN: Bayfield County LEPC Meeting/ Mitigation Plan Development April 5, 2018

Name	Organization	Miles (round trip)
Verne J Miller	.	20
Lisa Wartman	Bayfield Co. Health Dept.	0
Brynn WAD	WI DNR	180
Bryon Daley	Red Cliff Tribe	24
Tina Houck	Bayfield County	0
Ben Dillard	BC. LWCD	0
Jan Viator	BAEM	0
Tom Kovachevich	city of Bayfield	26
Jeff Lee	Norwado Cable	90
Cody Kamrowski	NWRPC	—

BAYFIELD COUNTY LEPC MEETING - MAY 10TH

Jan Victorson <JVictorson@bayfieldcounty.org>

Sent: Mon 5/7/2018 11:55 AM

To:

 Message  04-05-2018.doc (45 KB)

Bayfield County LEPC members and associates:

The Bayfield County LEPC (Local Emergency Planning Committee) will be meeting this coming **Thursday, May 10th at 3:00 pm** in the Bayfield County EOC (Emergency Operations Center), 117 E Sixth Street, Washburn.

Agenda items include:

Public Comment

Minutes – April 5th meeting (Attached)

Review of Mitigation Plan

- Mitigation strategies
- Review data on new/added hazards
- Review

Lessons learned: WEM's Hazard Mitigation Planning workshop

Report on SKYWARN training

Report on Cleansweep planning

Please let me know if you are unable to attend.

Thank you,

Jan Victorson, Director

Bayfield County Emergency Management

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Bayfield County Hazard Mitigation Plan

SIGN-IN
LEPC meeting / MITIGATION PLAN DEVELOPMENT – May 10, 2018

NAME	ORGANIZATION	MILES	
Jan Vitousov	BAEM	NA	
Verne Gilles		20	
Marian Schraufneger	Village of Mason	21	
Bea Hayden	"	21	
Robin Kemkes	Northland College		
Byron Dabey	Red Cliff Indian Reservation	21	
Tom Kovachewich	City of Bayfield	18	
Scott Kluver	City of Washburn	18	
Carrie Lindor	BCDHS	0	
Nick Stetson	Northern Lights Health		
Paul Juniper	Bayfield County, Steno		
Mark Scribner	Central Link	14	
Mark Anderson	Bay County	—	

Bayfield County Hazard Mitigation Plan

FW: LEPC MEETING / MITIGATION PLAN REVIEW - Wednesday, June 13th

Jan Victorson <JVictorson@bayfieldcounty.org>

Sent: Fri 6/8/2018 3:31 PM

To: Cody Kamrowski

Bayfield County LEPC members and associates:

It is time to get together again!

Wednesday, June 13th

3:00 pm

EOC – Courthouse Annex / 117 E Sixth Street, Washburn

Agenda items:

- Public comment
- EPCRA Computer Grant approval – Jan Victorson
 - Application for printer/copier – funding up to \$6000.
- Designation of alternative signatory for LEPC documents – Jan Victorson
- Review/discussion of mitigation strategies – Cody Kamrowski
- Set next meeting date/time.

This will be a crucial meeting in development of the mitigation plan. Please make every effort to review the strategies before the meeting and be ready to discuss and prioritize with others on the committee. We started the process last meeting and felt the time was well spent!

Jan Victorson, Director

Bayfield County Emergency Management

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Bayfield County Hazard Mitigation Plan

Bayfield County
LEPC - Local Emergency Planning Committee
Mitigation Planning Meeting Minutes
June 13, 2018

The meeting was called to order by Verne Gilles, Chair of the LEPC.

In attendance: Toni Bondioli, Public Health; Nick Fletcher, Northern Lights Health; Scott Galetka, Land Records; Verne Gilles, Public member; Scott Kluver, City of Washburn; Al Krause, Washburn Schools and Washburn Fire; Tom Kovachevich, City of Bayfield; Marian Schraufnagel, Village of Mason; Jan Victorson, Emergency Management.
Cody Kamrowski of Northwest Regional Planning Commission (NWRPC) was also present.

Notified that unable to attend:

- Jennifer Augustine – Northern Light Health (Nick attending)
- Mike BeBeau – Xcel Energy
- Paul Houck – Bayfield County Information Technology
- Jeff Lee – Norvado Communications
- Carrie Linder – Human Services
- Paul Susienka – Sheriff
- Gary Victorson – EMS / Coroner

No public comment.

Minutes of the May meeting have been updated to reflect accurate attendance. Minutes were reviewed and accepted by consensus.

Consensus to approve grant application for computer equipment.

Chair announced a letter authorizing county administrator Mark Abeles-Alison to sign LEPC documents was developed in order to provide a redundancy when signatures are required. This letter will be submitted to Wisconsin Emergency Management (WEM).

Cody Kamrowski of NWRPC asked reported having received input from several committee members related to the mitigation strategies. He asked for committee input on the mitigation strategies table. Erosion: Coastal, Erosion: Inland and Flooding were reviewed. Cody will make revisions noted for the next draft and forward for distribution to the planning committee. At the next meeting we will review Severe Storms, Wild Fire and Winter Storms. Input will be requested from all members.

NEXT MEETING – The next meeting time was schedule for Thursday, July 12th at 2:30 pm.

Meeting adjourned.

NOTE: Cleansweep collection events are scheduled for July 21st in Washburn and Iron River.

Bayfield County Hazard Mitigation Plan

SIGN-IN

LEPC meeting / MITIGATION PLAN DEVELOPMENT – June 13, 2018

NAME	ORGANIZATION	MILES	
Jan Victorson	Emergency Management	n/a	
Deane Dille	City of Washburn	20	
Maria Schraufnagel	Village of Mason	20	
Al Krause	Washburn Fire/Schools		
Scott Kluver	City of Washburn	1	
Tom Kuvachewich	City of Bayfield	18	
Nick Fletcher	Northern Lights Health	—	
Tony Bondioli	Bayfield Co. Health Dept	—	
Scott Galbraith	BC	—	

FW: Mitigation Strategies Table

Jan Victorson <JVictorson@bayfieldcounty.org>

Sent: Mon 8/6/2018 10:58 AM

To:

Message  All_Mitigation_StrategiesV2.xlsx (46 KB)

Bayfield County Local Emergency and Mitigation Planning partners:
Meeting scheduled – August 16th at 2:00 pm.
Note from Cody related to agenda item/Mitigation Strategies table follows.

Attached is a table of the mitigation strategies. To the left of the table are checkmarks. That means it has been reviewed by the group at one of our meetings and it is done. But after the recent events in the County, I would suspect we will be revisiting some of the various sections (flooding). I would like to have this table completed by the end of our meeting on the 16th. With that, I would like for everyone to **review the strategies**, and have input ready to go that would be great. And if committee members would like to **send me what they have** beforehand that would be even better! By having everyone get a lot of the specific leg work done before the meeting, we should be able to complete everything as well as have great discussion on the subject matter. The two sections we have not looked over yet are #1) Winter Storms and #2) Severe Thunderstorms/Damaging Winds/ hail/ lightning/ tornadoes. The parts highlighted in light green are new edits that we have made thus far.

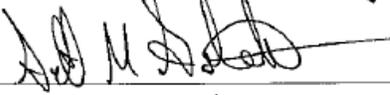
If we could run the meeting an hour and a half if we need it that would be great. We need to knock the rest of these mitigation strategies off the board.

Bayfield County Local Emergency/Mitigation Planning Committee:
Please see the time change for our next scheduled meeting –
Thursday, August 16th
2:00 pm
Bayfield County EOC

Thank you.
Again, please acknowledge receipt of this message/time change.

Jan Victorson, Director
Bayfield County Emergency Management
Prepare. Plan. Stay Informed.

MITIGATION PLANNING
Meeting – August 16, 2018

NAME	ORGANIZATION	MILES
Jan Vietersen	BAEM	0
Verne Gilles	LEPC	20
Marian Schraun Frazel	Village of Mason	21
	Bayfield Land Records	0
Paul Johank	Bayfield County Highway	
Al Krause	Washburn Schools	0
Carrie Lindur	BCDHS	0
Martz Abetes Allsen	Bayfield County	0
Ben Dufford	BayCo LWCD	0

FW: Ranking and Vulnerability

Jan Victorson <JVictorson@bayfieldcounty.org>

Sent: Tue 9/11/2018 12:59 PM

To:

Message Rankings.xlsx (25 KB) 08-16-2018.doc (45 KB)

LEPC members and mitigation planning partners:

Our next meeting is scheduled –

Thursday, September 20th

2:00 pm

Bayfield County EOC / Courthouse Annex

Work will continue on the mitigation plan.

From Cody –

Things for committee members to look over. I have attached an excel document and it contains 2 parts.

- Tab 1 are the Strategies we worked on and their ranking: The overall Risk Rating for each hazard is in yellow. The second part of the strategies table I would like everyone to glass over is the priority column on the right hand side. I want everyone to look these over to see if they agree with them.
- Tab 2 is vulnerability of the county for each hazard event. This is in the narrative part of the plan that I am currently working on. Each hazard has a vulnerability of Low, Medium or High that is determined by the committee.

I know that the rankings can really vary depending on location, population effected and the magnitude of the hazard. **But the important part is to look at the ranking at a countywide level.**

Could you have the committee look through all of these parts? They can then send me their thoughts/changes and I will tabulate everything for our next meeting. We then can have discussion based off of this.

Cody Kamrowski

Community Development Planner
Northwest Regional Planning Commission
1400 South River Street, Spooner, WI 54801
ph: 715.635.2197, ext. 226 | fax: 715.635.7262

Insert Sept 20 Sign –In sheet

Bayfield County Hazard Mitigation Plan

LEPC and MITIGATION PLANNING MEETING - November 1st

Jan Victorson <JVictorson@bayfieldcounty.org>

Sent: Mon 10/15/2018 1:35 PM

To:

Message  Big_Brook_Property_Sheet.docx (2 MB)  Big_Brook_PropertyMark_krmpelmann_Letter.pdf (1 MB)  DRAFT_Bayfield_Co_Haz_Mit_10_5_18.pdf (6 MB)

Bayfield County LEPC and Mitigation planning partners:

Our next meeting is scheduled –

Thursday, November 1st

2:00 pm

Bayfield County EOC

Following and attached is information from Cody Kamrowski – Northwest Regional Planning Commission.

Please take time to review this first draft of the revised Hazard Mitigation Plan.

Jan Victorson, Director

Bayfield County Emergency Management

Prepare. Plan. Stay Informed.

From Cody:

I have attached several documents for the committees reference.

The first 2 documents are relating to the property near Big Brook. The below paragraph is what I sent in a previous email.

"I would highly recommend that the committee includes addressing this in the strategies section of the plan. The undersized culverts on Big Brook is of Town concern, the structure being threatened pertains to the County concerning mitigation actions. As long as there is mention of this issue and identifying this as an action, there is a chance it could be funded as a mitigation project in the future. The most important part is including this in the County Hazard Mitigation Plan as an action. This makes the project eligible for grant dollars (because it's mentioned), regardless of what government entity it pertains to. The County completes the Hazard Mitigation Plan on behalf of the Town's, and does not circumnavigate their authority/power."

The next part relates to the draft plan and the committee's review. Here is a list of things I would like for everyone to look over and consider

- If there is something highlighted, that means there is more work to be done on either my side or I would like committee members to give it a look.
- Committee members can ignore table, image and figure numbering and references in the narrative. I do not finalize the numbering until the plan is being finalized in case the committee wants something changed (if something is added or deleted that throws off the numbering)
- A table of contents will be created when the plan is being finalized. I do not create one until the end because of page numbering changes (committee members can reference the page number on the lower right of the page)
- I would like for everyone to look through the entire plan, but the most critical segment is the hazard description sections starting with flooding and ending with Mass Casualty Incidents. This segment of the plan is the largest and would require the most expertise from committee members.
- If committee members have thoughts or edits, I would recommend they send as many of them to me before our meeting.

If you or committee members have any questions or concerns please feel free to have them reach me.

Thanks Jan and have a great weekend!

Cody

Insert Nov 1, meeting sign in

Annex C
Adoption Resolutions

Printers Affidavit of Publication

6B SATURDAY, JANUARY 12, 2019 | ASHLAND DAILY PRESS

PUBLIC NOTICES

PUBLIC NOTICE

The Bayfield County Hazard Mitigation Plan Update Committee, in conjunction with Northwest Regional Planning (NWRPC), will hold a Public Open House for the proposed changes to the draft of the Bayfield County Hazard Mitigation Plan update. This open house is to foster Public Awareness, Education, and to receive input and involvement in the decision-making process. Comments about the plan can be sent to Cody Kamrowski at the Northwest Regional Planning Commission at ckamrowski@nwrpc.com or 715-635-2197. A draft of the document can be found on NWRPC's website: <http://nwrpc.com/DocumentCenter/View/1497>

Tuesday, January 29th, 2019
4 p.m. - 6 p.m.

Bayfield County Courthouse - Washburn, Wisconsin
County Board Room (2nd Floor)

Consistent with the Americans with Disabilities Act (ACT) persons who require materials in an alternate format or other accommodations may contact Jan Victorson, Director, Bayfield County Emergency Management at (715) 373- 6113 before January 23, 2019.
*Quorum of the county board may be present at meeting.

1/12/19
WNAXLP

STATE OF WISCONSIN
CIRCUIT COURT
DOUGLAS COUNTY

CASE NO. 18SC001573
PUBLICATION SUMMONS
SMALL CLAIMS
UNDER DOLLAR LIMIT
CODE #31001

OneMain Financial Group, LLC

State of Wisconsin)
) ss.
County of Ashland)

Dave LaPorte, being duly sworn, on oath, says that he is the Legal Notice Representative of the daily newspaper known as **The Daily Press** and published at Ashland in Ashland County and the State of Wisconsin, says that the annexed printed copy of:

Mitigation Plan Update

Which forms part of this affidavit, was published in the said newspaper on the following dates:

1/12

And further, that the said printed notice so annexed was taken from the said The Daily Press, the newspaper in which the same was published.

By: [Signature]
Dave LaPorte
Title: Legal Notice Representative

Subscribed and sworn to before me on this 9
of January, 2019 AD

[Signature]

Notary Public
My term expires on : Feb 3, 2019

FEES:
1 Inset of 12 lines @ .7863 = \$ 5.111
Inset of _____ lines @ .6069 = \$ _____
Add Affidavit Fee = \$1.00
Total = \$ 52.11

Bayfield County Hazard Mitigation Plan

From: Cody Kamrowski [mailto:ckamrowski@nwrpc.com]

Sent: Monday, January 07, 2019 1:06 PM

To: psanchez@sawyercountygov.org; dorothy.tank@ashlandcountysheriff.us; 'keslerk@ci.superior.wi.us'; bdaley@redcliffhealth.org; 'Betty.Karr@redcliff-nsn.gov'

Cc: jvictorson@bayfieldcounty.org; vgilles@centurylink.net

Subject: Bayfield County Hazard Mitigation Plan Comment

Hello,

My name is Cody Kamrowski and I'm a Community Development Planner at the Northwest Regional Planning Commission and I have been working with Bayfield County on updating their Hazard Mitigation Plan. The reason why I am reaching out to you is because you are in close proximity to the County and are requested to provide comment, if you have any about the Plan. Attached and below is the Public Notice. Please feel free to reach me with questions, concerns or comments.

Thank you for your time,
Cody

Cody Kamrowski

Community Development Planner
Northwest Regional Planning Commission
1400 South River Street, Spooner, WI 54801
ph: 715.635.2197, ext. 226 | fax: 715.635.7262

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*Quorum of the county board may be present at meeting.

Annex D

2018 Regional Flood Study Overview: Bayfield County

During the period of July 11-12, 2016, seven counties in Northwest Wisconsin including Ashland, Bayfield, Burnett, Douglas, Iron, Sawyer, and Washburn and the Bad River Band of the Lake Superior Chippewa Tribe, were struck by historic severe storms and flooding that caused severe flood events throughout the region. Transportation infrastructure was heavily damaged when flood waters rose above the surface of roads and bridges. Many primary and secondary arterial roadways and culverts were washed out in the wake of the elevated water level experienced over a short time period. Damage to homes and businesses across the region was substantial, with over \$2.6 million in losses reported. Damage to public infrastructure was even more significant, with \$38 million reported. Business disruption and impacts to commerce were also significant as many communities were left completely isolated due to road closures. These counties had not anticipated, nor were they prepared to respond to an event of this historic magnitude. In the wake of the storm, county and local emergency response plans were implemented and the Wisconsin Emergency Operations Center was activated. In consultations with the Governor's Cabinet secretaries, county and local government officials expressed grave concerns about the state of local infrastructure, the need for better resiliency planning and the economic impacts of flooding on the tourism-dependent economy of northern Wisconsin.

Across this region of Wisconsin there have been very limited efforts to identify, evaluate, and address critical infrastructure in the event of future natural disasters- particularly the economic impact susceptibility related to business commerce, emergency services, transportation, communication, and utilities. Furthermore, there is virtually nothing in place to address community resiliency and business recovery after major storm events occur.

In 2018, a regional flood resiliency study project was completed by the Northwest Regional Planning Commission (NWRPC), which demonstrated the potential impacts of historic flood events, pre-identified likely impact areas and assessed the economic impacts to communities, businesses and residents. The study is now incorporated into the Bayfield County Hazard Mitigation Plan and now serves as a point of reference to guide flood mitigation activities across the county, which in turn, improves resiliency.

This process model uses FEMA's HAZUS software to estimate potential flood losses and to identify structures, businesses, economic assets and community infrastructure impacted by a historic flood event. The HAZUS model will allow for the identification of vulnerable areas that may require planning consideration. Understanding flood risk will allow communities to assess the level of readiness and preparedness to deal with a flood disaster before it occurs. Model results will provide decision makers with the information and tools needed to decide on how to allocate resources for most effective and efficient response and recovery. Effective local leadership is crucial to economic development, disaster resilience, and economic recovery activities in northwest Wisconsin communities. This project includes an outreach component to engage with local governing bodies and communities to help them understand why identifying and managing risks, proactively reducing vulnerabilities and improving response

and recovery capabilities are key to promoting economic development resilience across the region. This program will not only advance flood resilience, it also would improve and protect water quality and riparian and shoreline habitat.

HAZUS-MH

HAZUS is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. It graphically illustrates the limits of identified high-risk locations due to earthquake, hurricane, flood, and tsunami. Users can then visualize the spatial relationships between populations and other more permanently fixed geographic assets or resources for the specific hazard being modeled, a crucial function in the pre-disaster planning process. The HAZUS module provides varying levels of analysis based on the level of expertise of the user and the availability of locally-derived data inputs. Under a basic analysis, HAZUS generates a simplified analysis using the default national databases and parameters contained in the HAZUS software package. This is commonly referred to as the “out of the box” analysis, as no external data sources or parameter manipulation are required. An advanced analysis requires more detailed information on local hazard conditions than is provided by the default national databases included in HAZUS. National default inventories may be replaced by userdefined inputs of buildings, essential facilities or other infrastructure. More detailed topographic data, such as LiDAR (light detection and ranging) can be used to produce accurate maps and bare-earth terrain models. The HAZUS flood model uses ground elevation to determine flood depth of a particular area. Advanced analysis using HAZUS generally requires more user expertise.



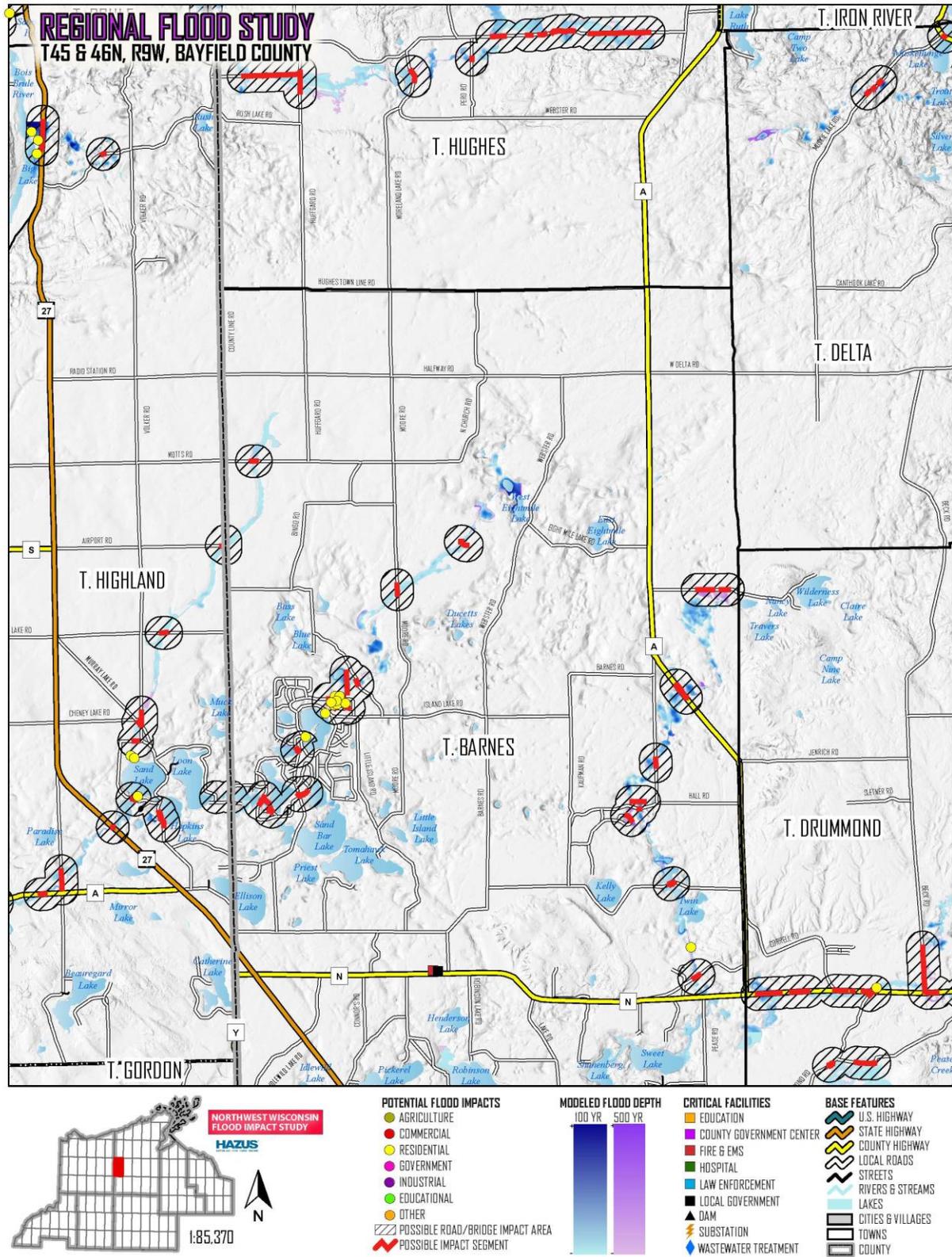
Through this analysis, 2 tables were generated for Bayfield County: one representing the loss with a 100 year flood and the other representing the loss in the occurrence of a 500 year flood. Additionally to the tables, 22 maps were generated representing various impacted areas throughout the County.

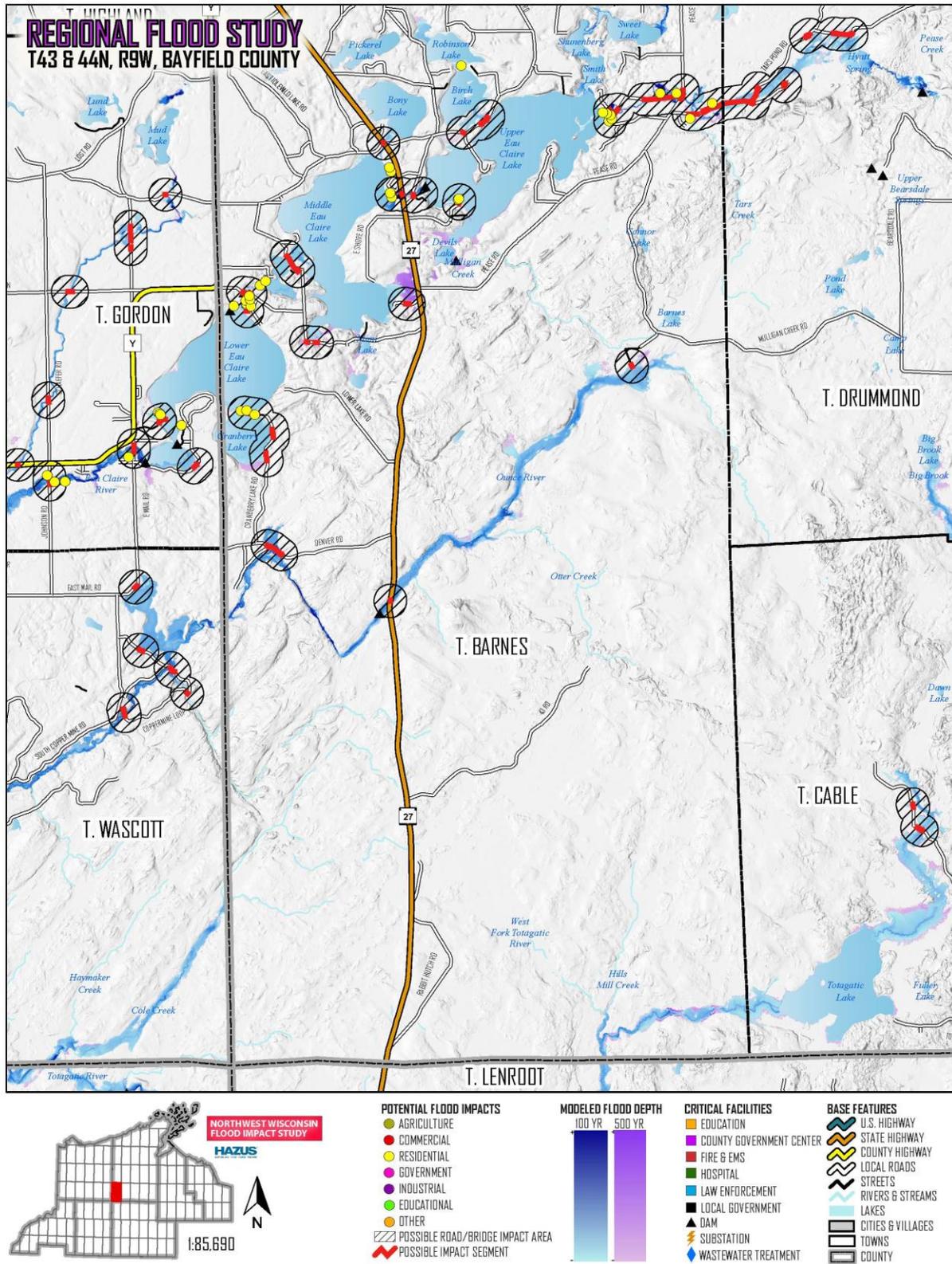
HAZUS 100-YEAR FLOOD LOSS ESTIMATES - BAYFIELD COUNTY

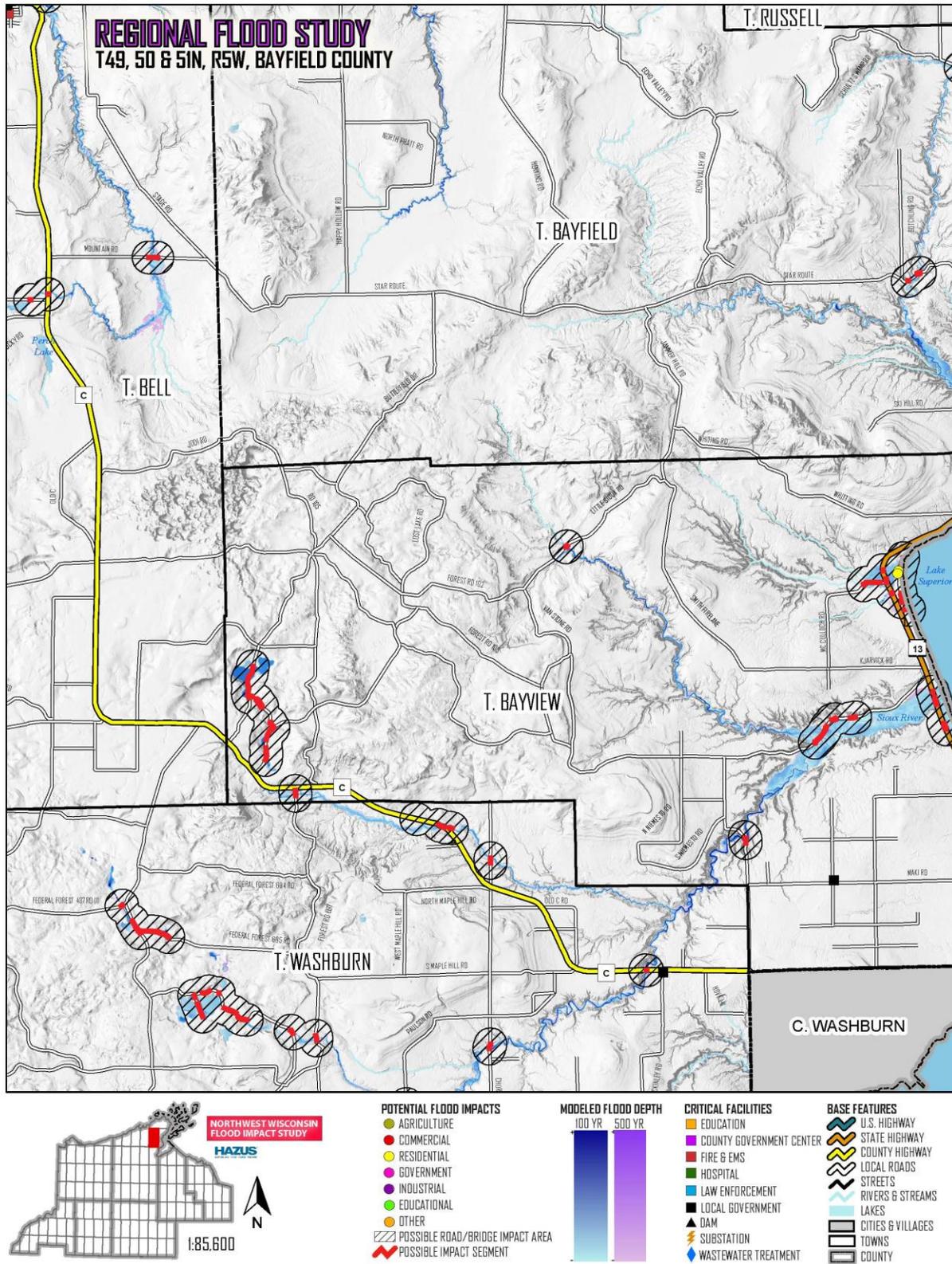
Municipality	Structures Impacted	Estimated Building Losses	Estimated Content Losses	Estimated Inventory Losses	Critical Assets Impacted	Debris Generated (tons)
T. of Barksdale	3	\$ 3,160.00	\$ 1,252.00	\$ 0	-	31
T. of Barnes	25	\$ 386,859.00	\$ 137,575.00	\$ 0	-	313
T. of Bayfield	2	\$ 30,064.00	\$ 9,891.00	\$ 0	-	17
T. of Bayview	1	\$ -	\$ -	\$ 0	-	6
T. of Bell	7	\$ 844.00	\$ 9,553.00	\$ 0	-	44
T. of Cable	2	\$ 24,705.00	\$ 8,864.00	\$ 0	-	6
T. of Clover	6	\$ 32,384.00	\$ 11,146.00	\$ 0	-	44
T. of Delta	2	\$ 54,462.00	\$ 17,211.00	\$ 0	-	15
T. of Drummond	8	\$ 127,962.00	\$ 47,133.00	\$ 0	-	84
T. of Grand View	3	\$ 15,400.00	\$ 4,026.00	\$ 0	-	36
T. of Iron River	2	\$ 28,498.00	\$ 12,049.00	\$ 0	-	20
T. of Kelly	1	\$ 18,585.00	\$ 14,018.00	\$ 0	-	27
T. of Keystone	1	\$ 1,680.00	\$ 161.00	\$ 0	-	41
T. of Lincoln	7	\$ 33,580.00	\$ 12,866.00	\$ 0	-	48
T. of Orienta	2	\$ 15,115.00	\$ 6,402.00	\$ 0	-	44
T. of Port wing	5	\$ 16,898.00	\$ 6,698.00	\$ 0	1	360
V. of Mason	1	\$ 6,580.00	\$ 41,904.00	\$ 0	-	3
Grand Total	78	\$ 796,776.00	\$ 340,749.00	\$ 0	1	1,139

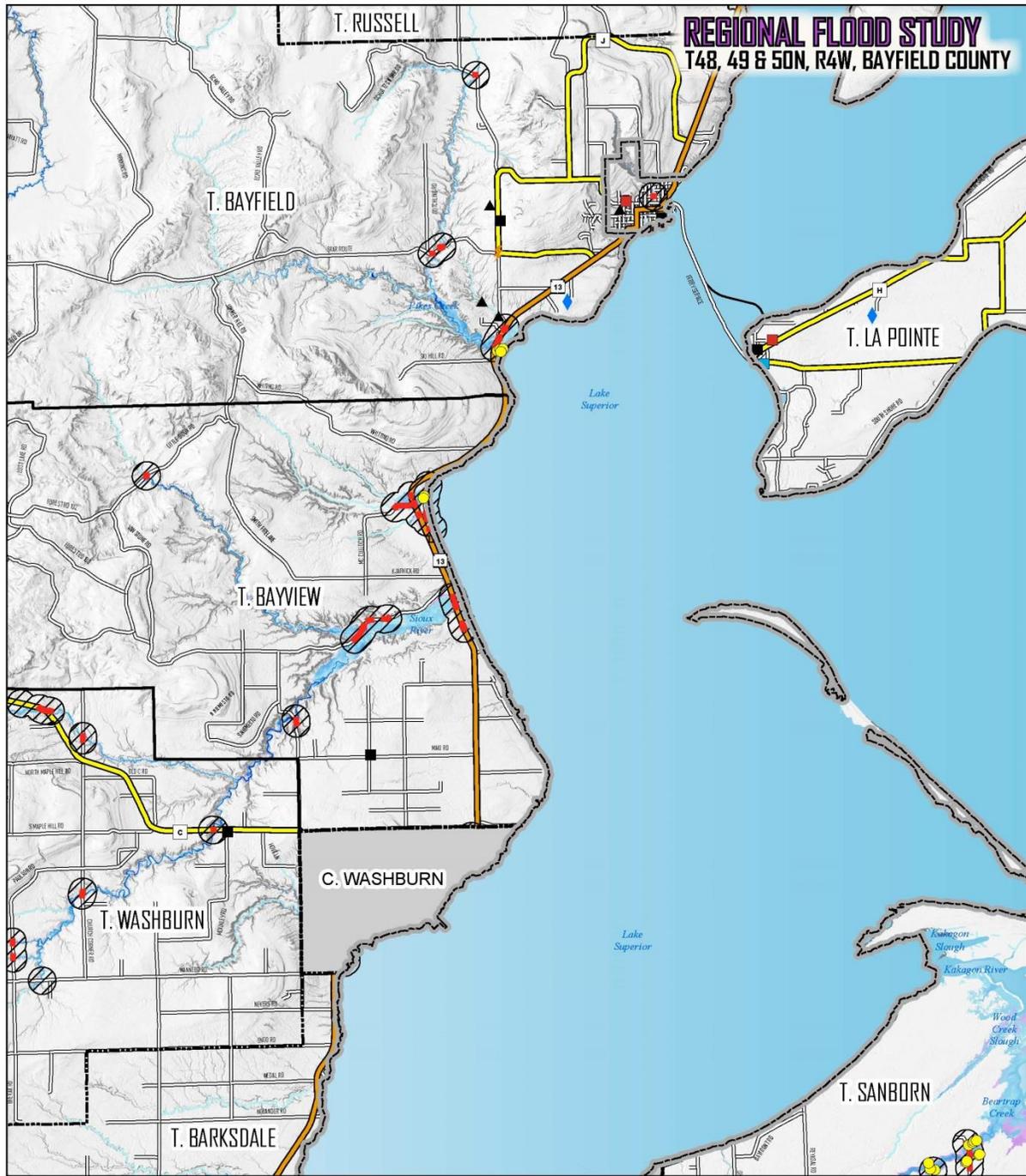
HAZUS 500-YEAR FLOOD LOSS ESTIMATES - BAYFIELD COUNTY

Municipality	Structures Impacted	Estimated Building Losses	Estimated Content Losses	Estimated Inventory Losses	Critical Assets Impacted	Debris Generated (tons)
T. of Barksdale	3	\$ 3,160.00	\$ 1,245.00	\$ 0	-	31
T. of Barnes	37	\$ 777,918.00	\$ 271,633.00	\$ 0	-	718
T. of Bayfield	4	\$ 66,238.00	\$ 21,015.00	\$ 0	-	40
T. of Bayview	2	\$ 0	\$ 0	\$ 0	-	18
T. of Bell	9	\$ 2,785.00	\$ 19,087.00	\$ 0	1	46
T. of Cable	4	\$ 45,260.00	\$ 20,142.00	\$ 0	-	25
T. of Clover	7	\$ 40,251.00	\$ 12,818.00	\$ 0	-	49
T. of Delta	3	\$ 84,348.00	\$ 27,697.00	\$ 0	-	19
T. of Drummond	12	\$ 197,339.00	\$ 66,737.00	\$ 0	-	121
T. of Eileen	1	\$ 490.00	\$ 980.00	\$ 207.00	-	4
T. of Grand View	4	\$ 17,950.00	\$ 6,897.00	\$ 0	-	54
T. of Iron River	5	\$ 247,964.00	\$ 66,407.00	\$ 0	-	142
T. of Kelly	1	\$ 21,468.00	\$ 18,015.00	\$ 0	-	27
T. of Keystone	1	\$ 1,680.00	\$ 161.00	\$ 0	-	41
T. of Lincoln	7	\$ 60,070.00	\$ 18,486.00	\$ 0	-	57
T. of Namakagon	2	\$ 0	\$ 0	\$ 0	-	22
T. of Orienta	2	\$ 5,680.00	\$ 2,304.00	\$ 0	-	31
T. of Oulu	1	\$ 0	\$ 0	\$ 0	-	2
T. of Port Wing	7	\$ 23,871.00	\$ 8,798.00	\$ 0	1	372
T. of Tripp	1	\$ 6,236.00	\$ 2,268.00	\$ 0	-	26
V. of Mason	1	\$ 7,326.00	\$ 47,000.00	\$ 0	-	3
Grand Total	114	\$ 1,610,034.00	\$ 611,690.00	\$ 207.00	2	1848

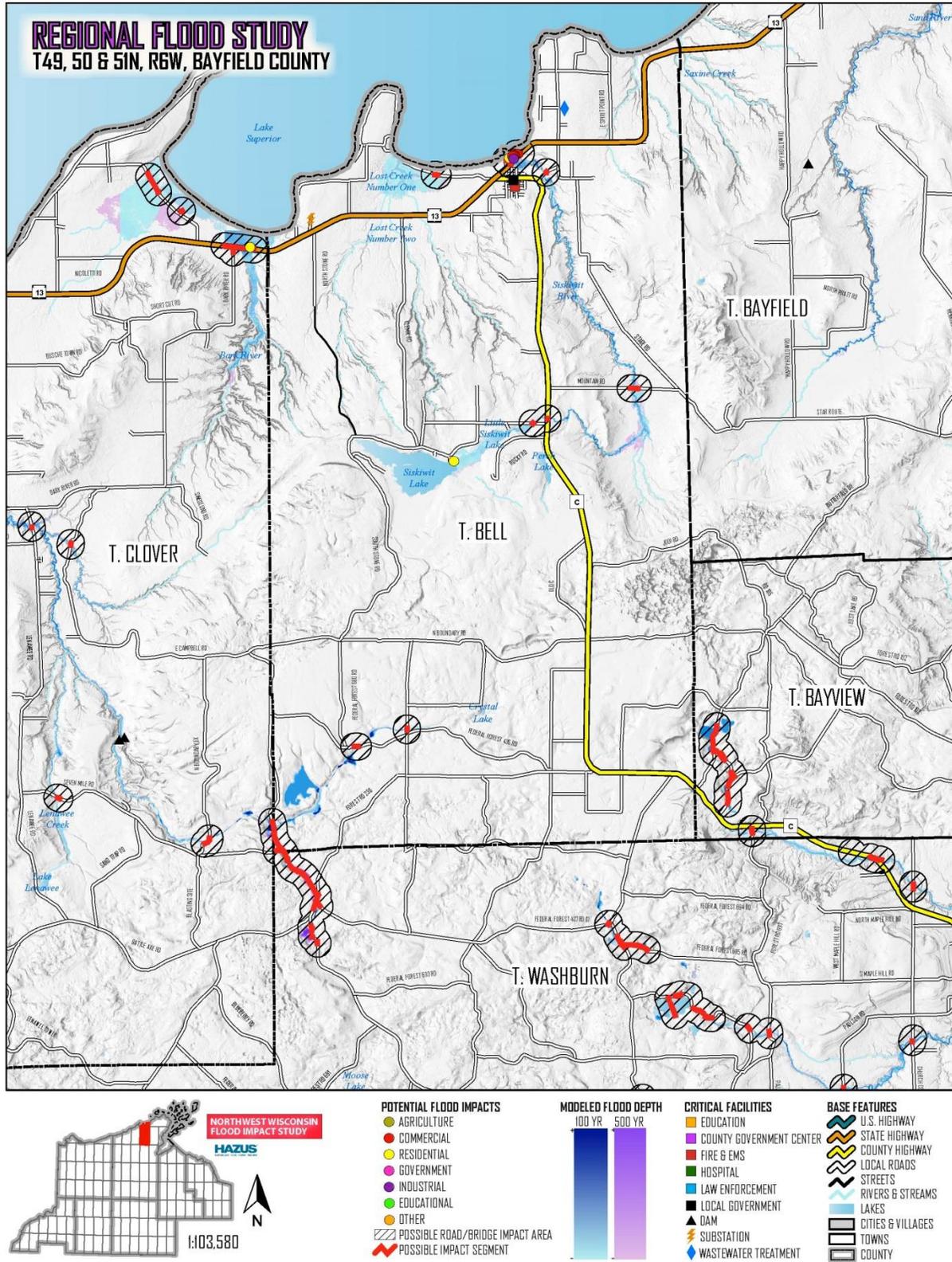


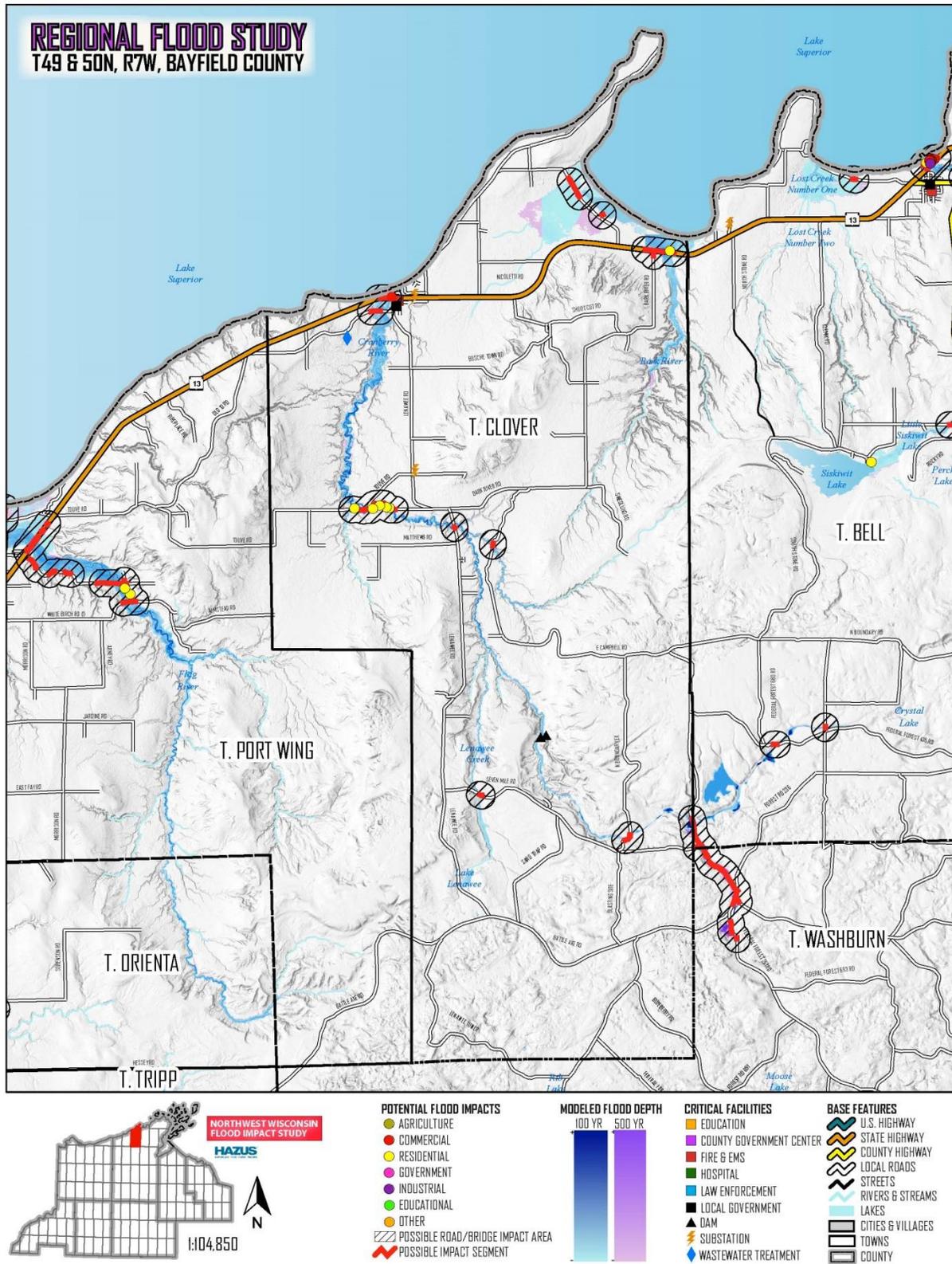


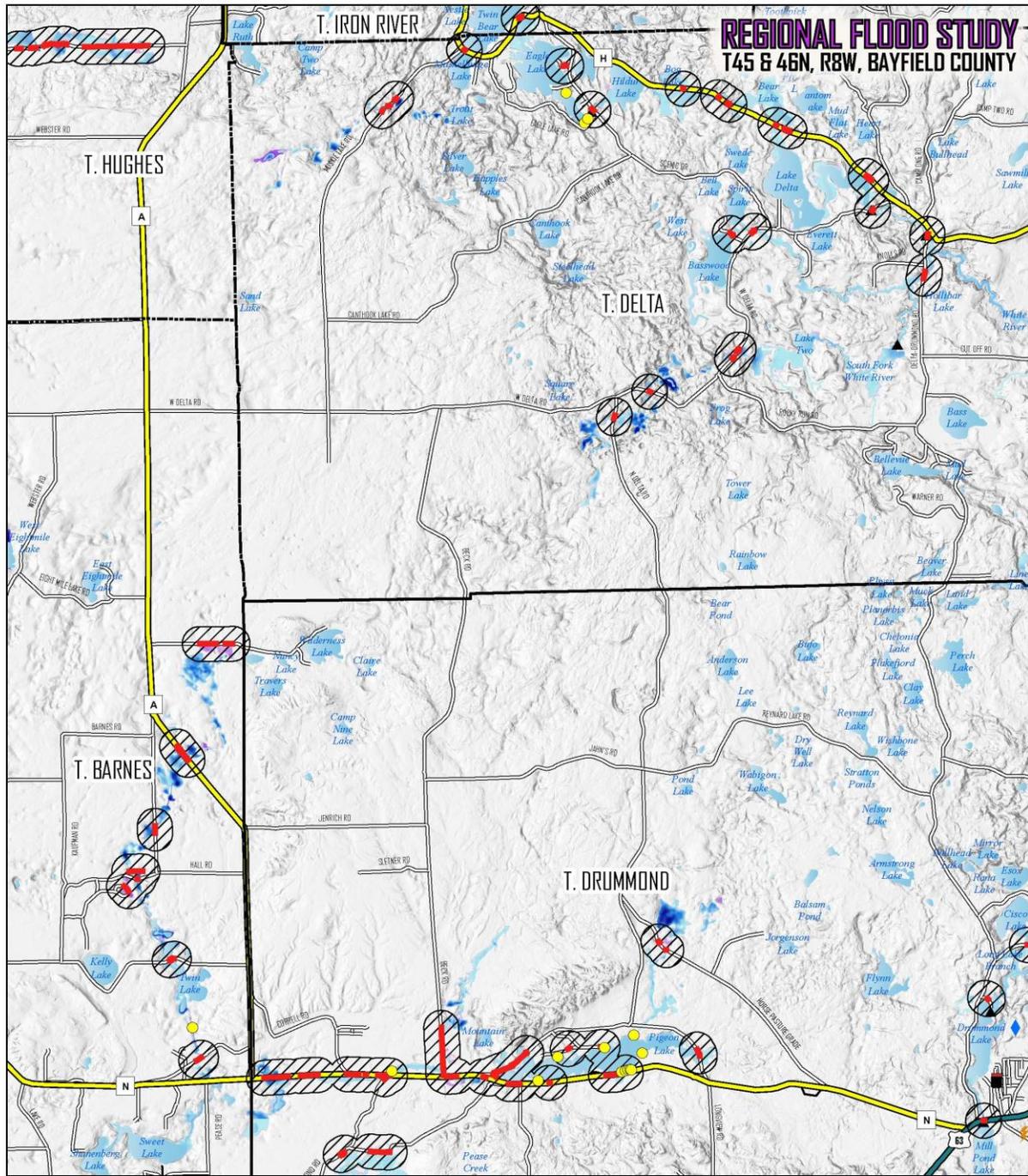




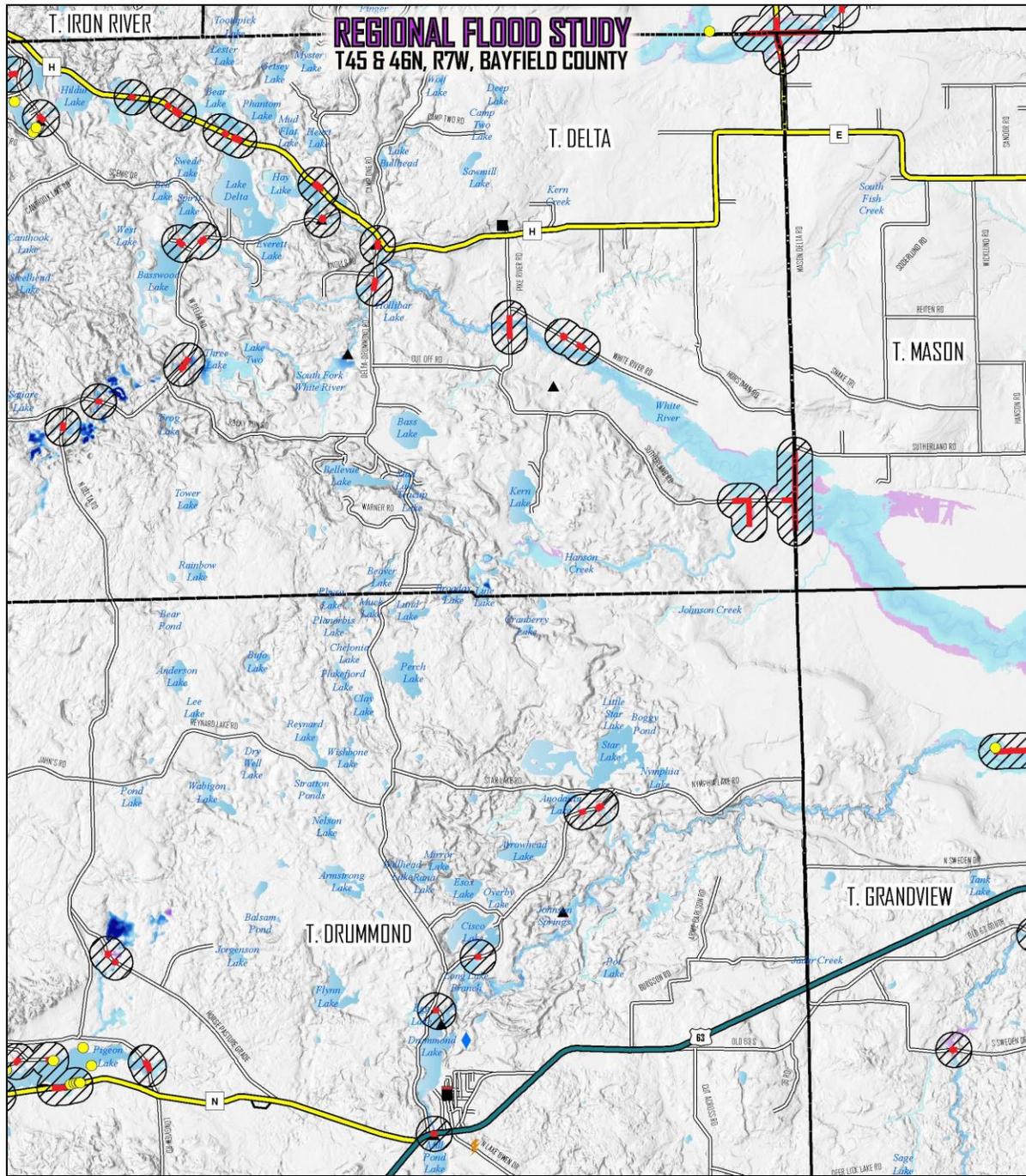
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| <p>POTENTIAL FLOOD IMPACTS</p> <ul style="list-style-type: none"> ● AGRICULTURE ● COMMERCIAL ● RESIDENTIAL ● GOVERNMENT ● INDUSTRIAL ● EDUCATIONAL ● OTHER ▨ POSSIBLE ROAD/BRIDGE IMPACT AREA ▨ POSSIBLE IMPACT SEGMENT | <p>MODELED FLOOD DEPTH</p> <p>100 YR 500 YR</p> | <p>CRITICAL FACILITIES</p> <ul style="list-style-type: none"> ■ EDUCATION ■ COUNTY GOVERNMENT CENTER ■ FIRE & EMS ■ HOSPITAL ■ LAW ENFORCEMENT ■ LOCAL GOVERNMENT ■ DAM ■ SUBSTATION ■ WASTEWATER TREATMENT | <p>BASE FEATURES</p> <ul style="list-style-type: none"> — U.S. HIGHWAY — STATE HIGHWAY — COUNTY HIGHWAY — LOCAL ROADS — STREETS — RIVERS & STREAMS — LAKES — CITIES & VILLAGES — TOWNS — COUNTY |
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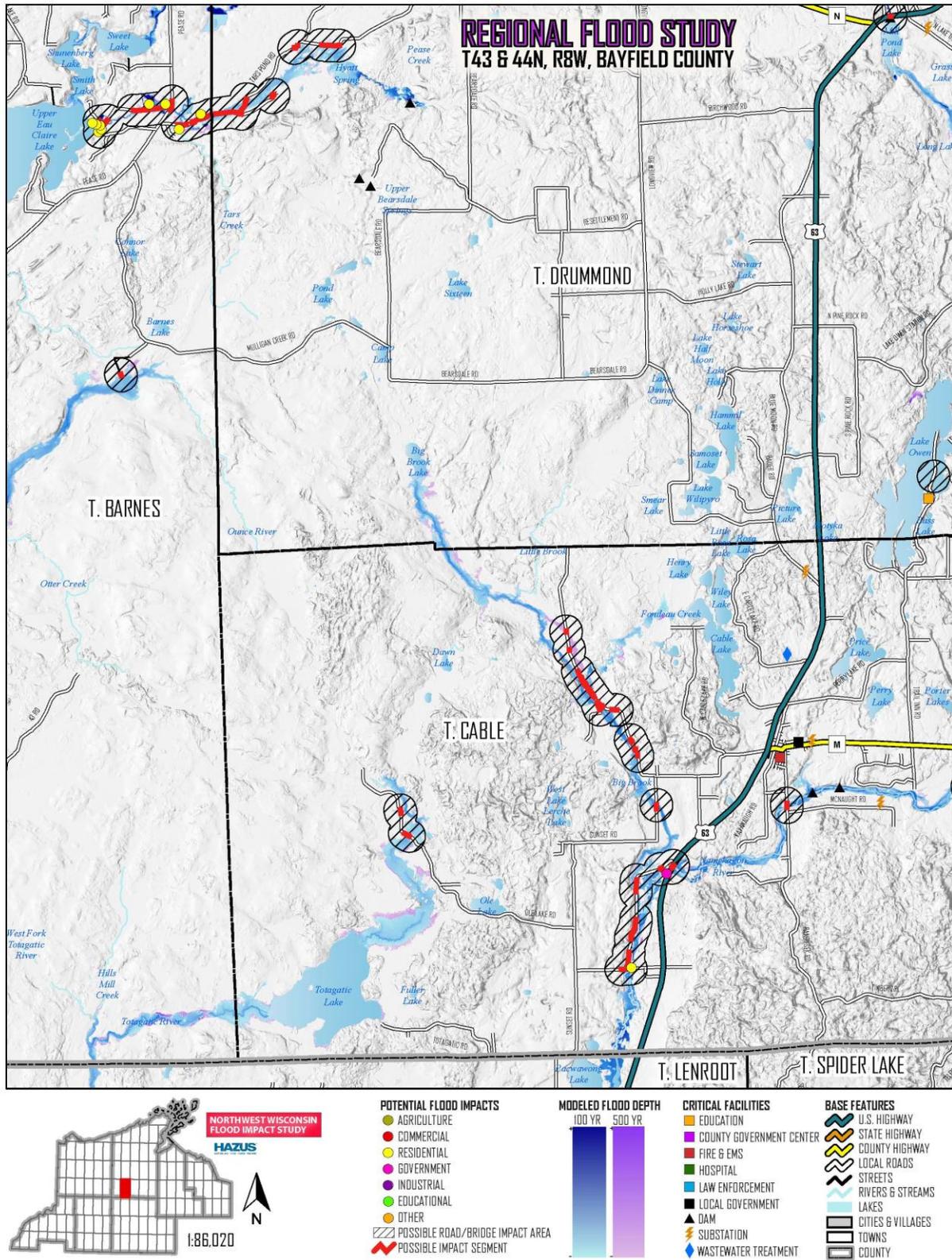


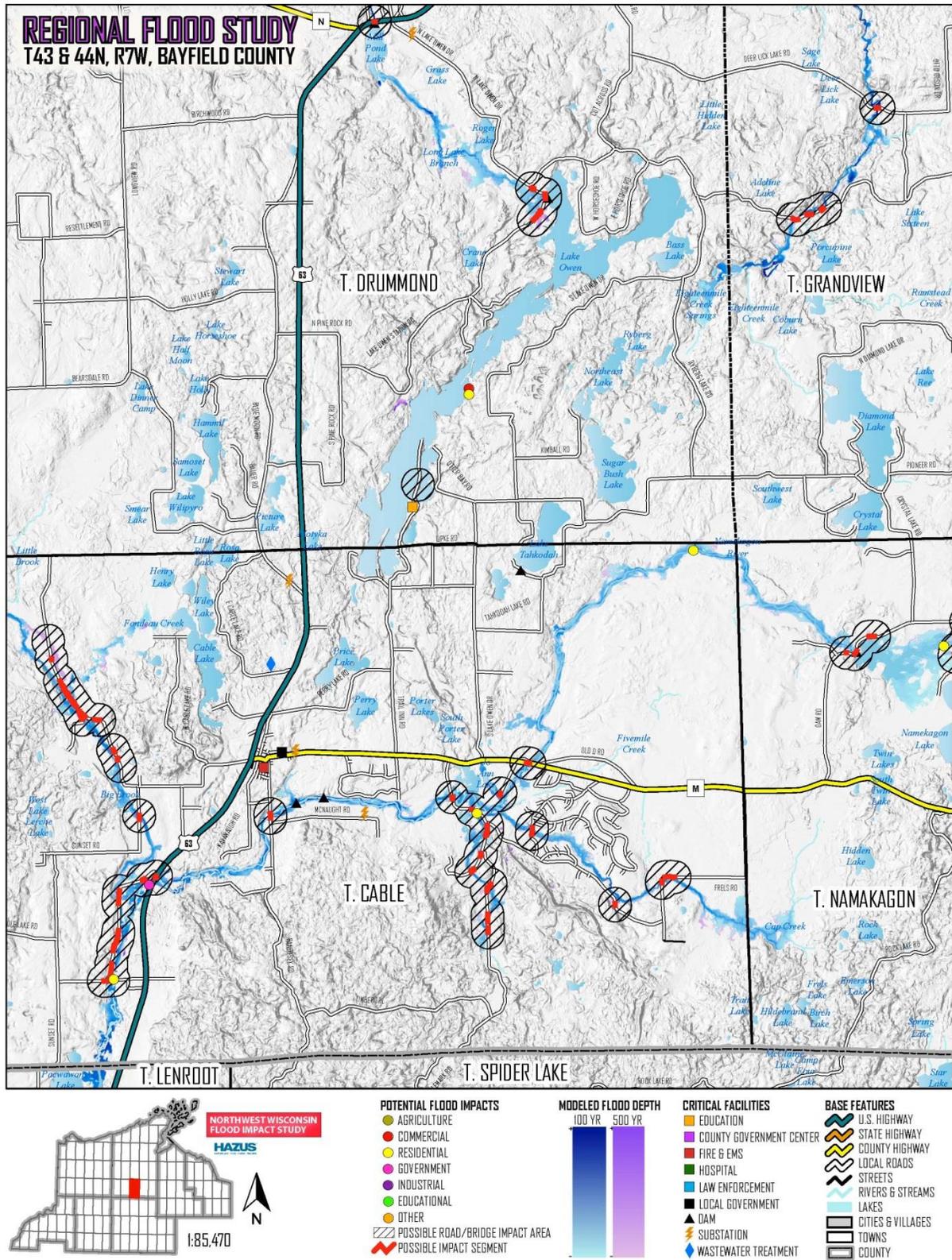


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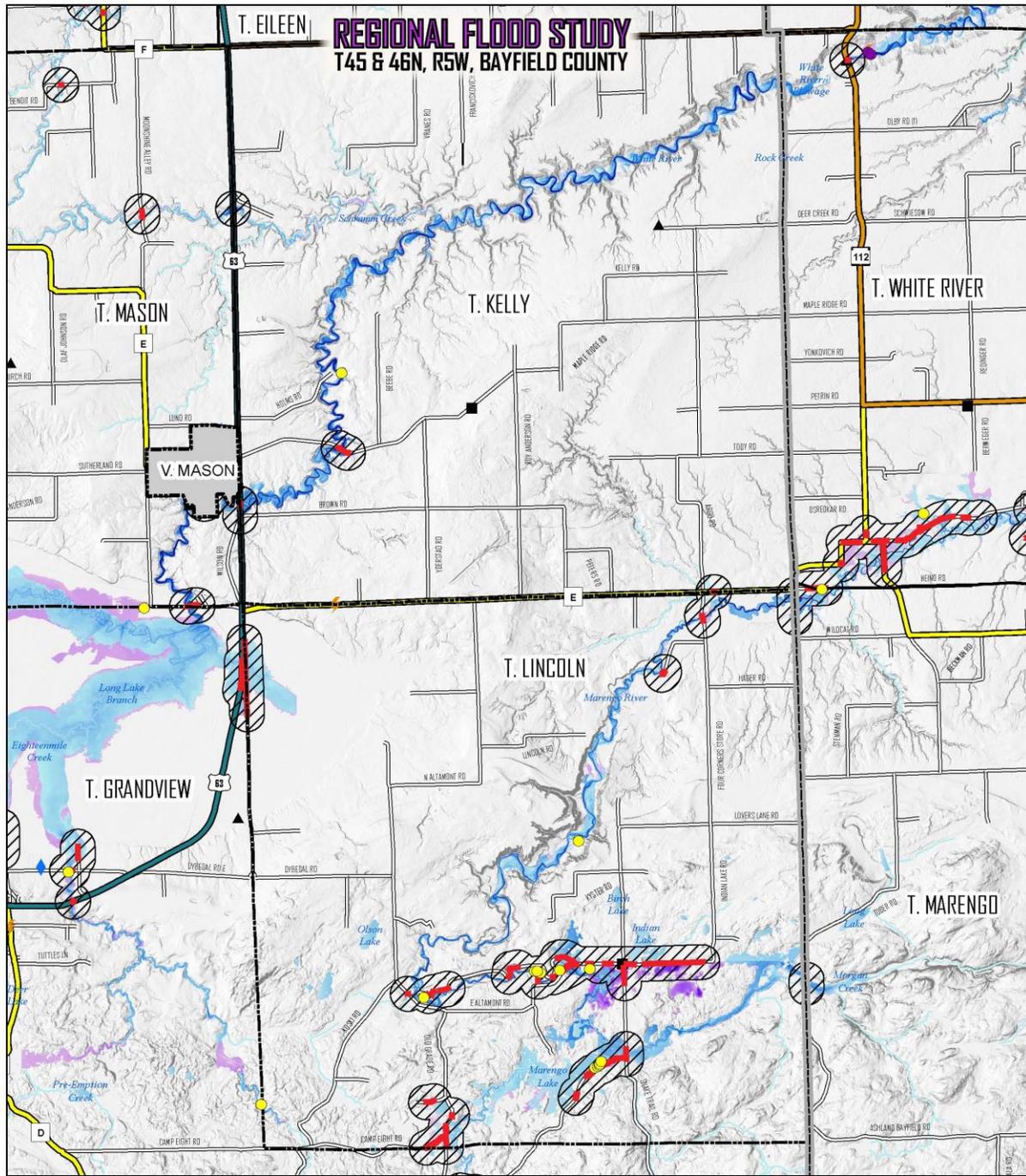


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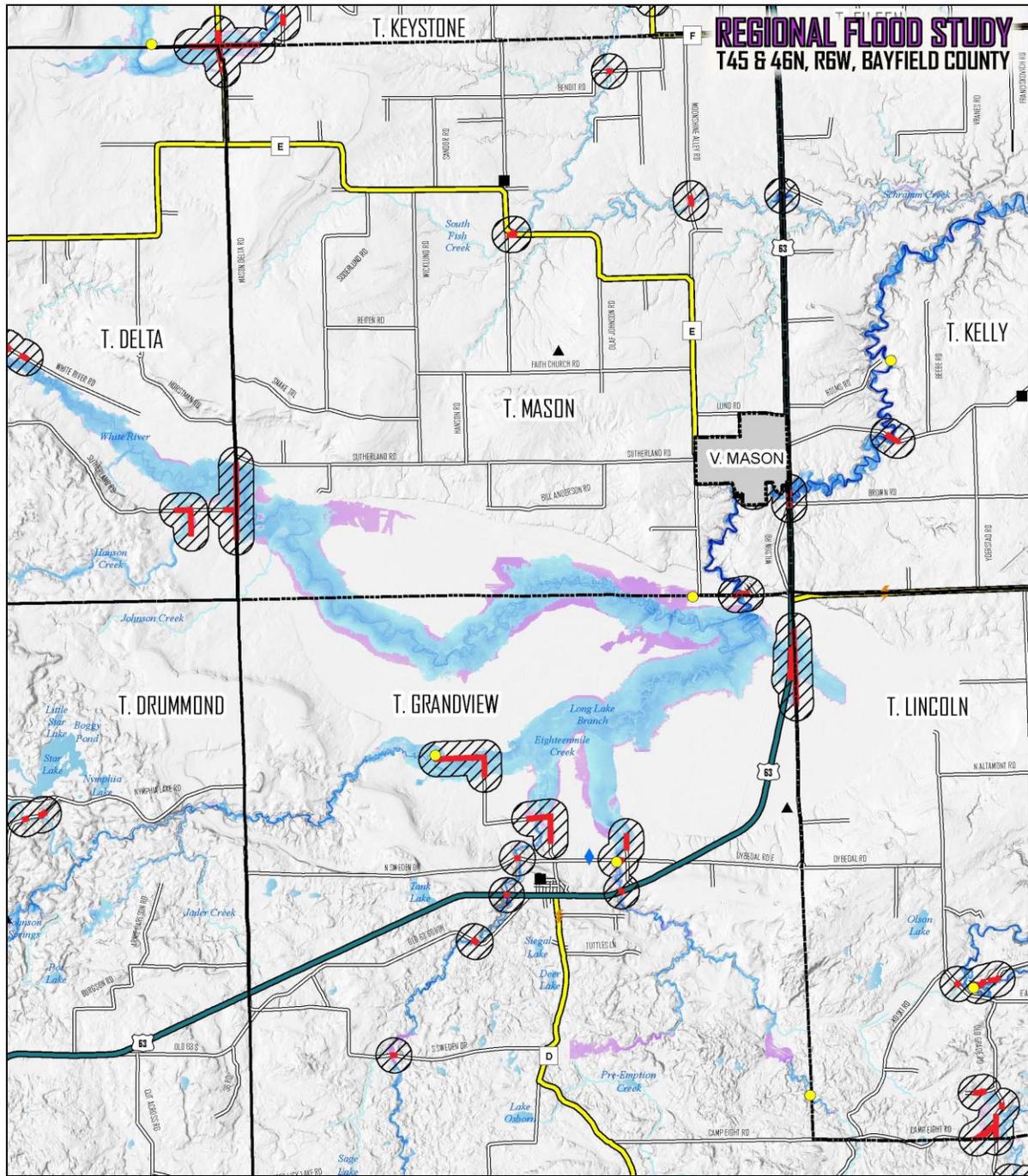




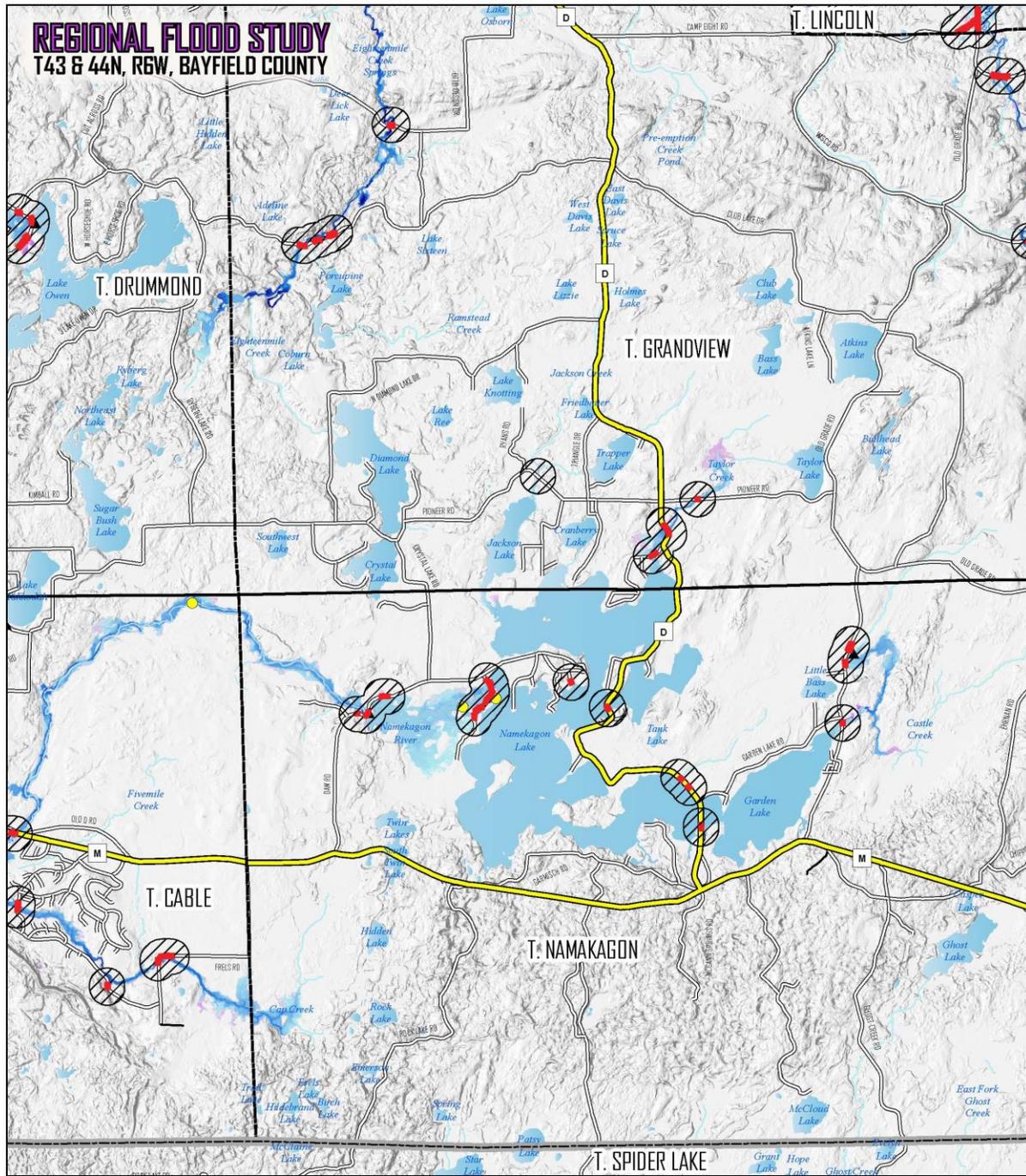




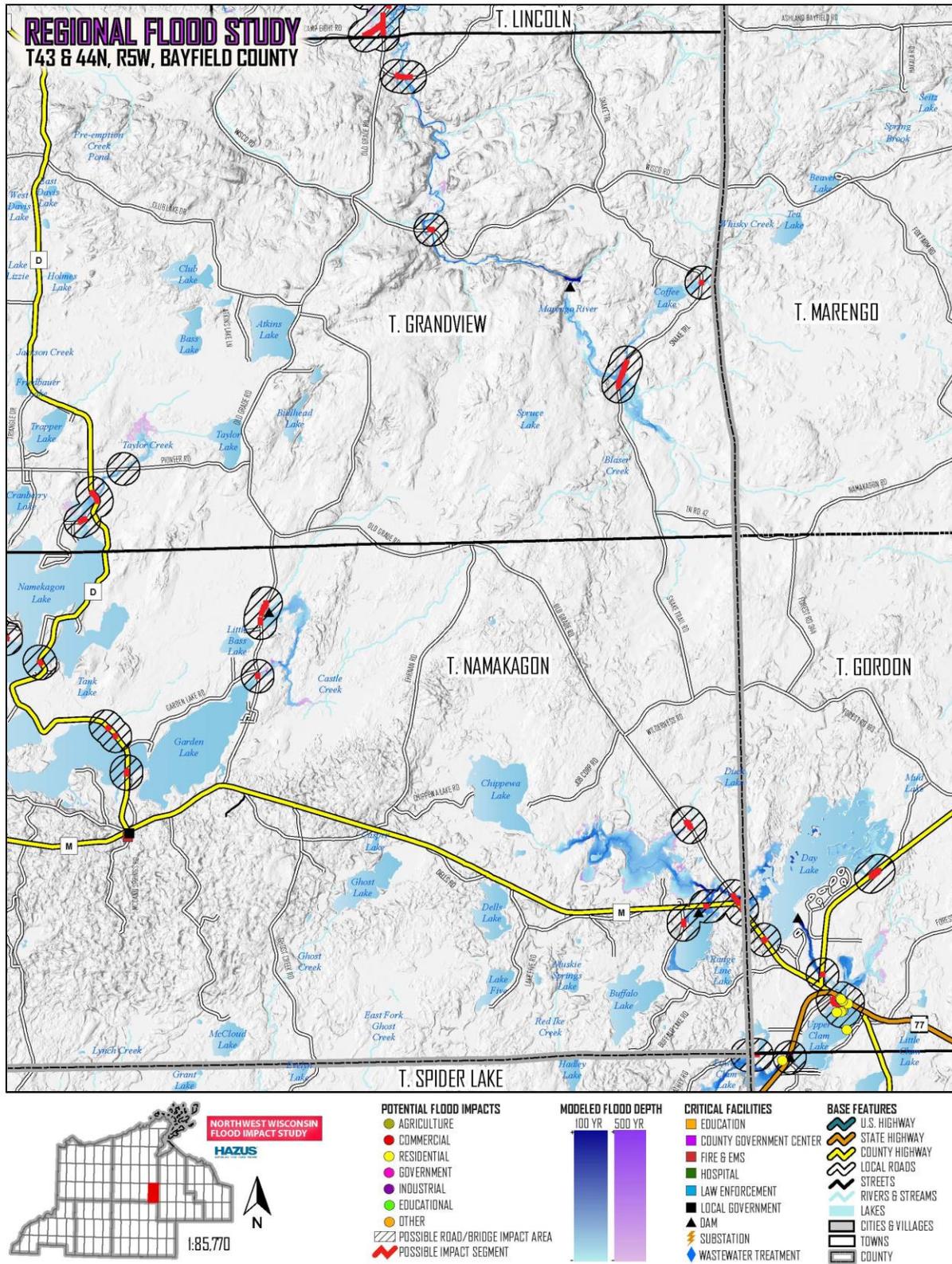
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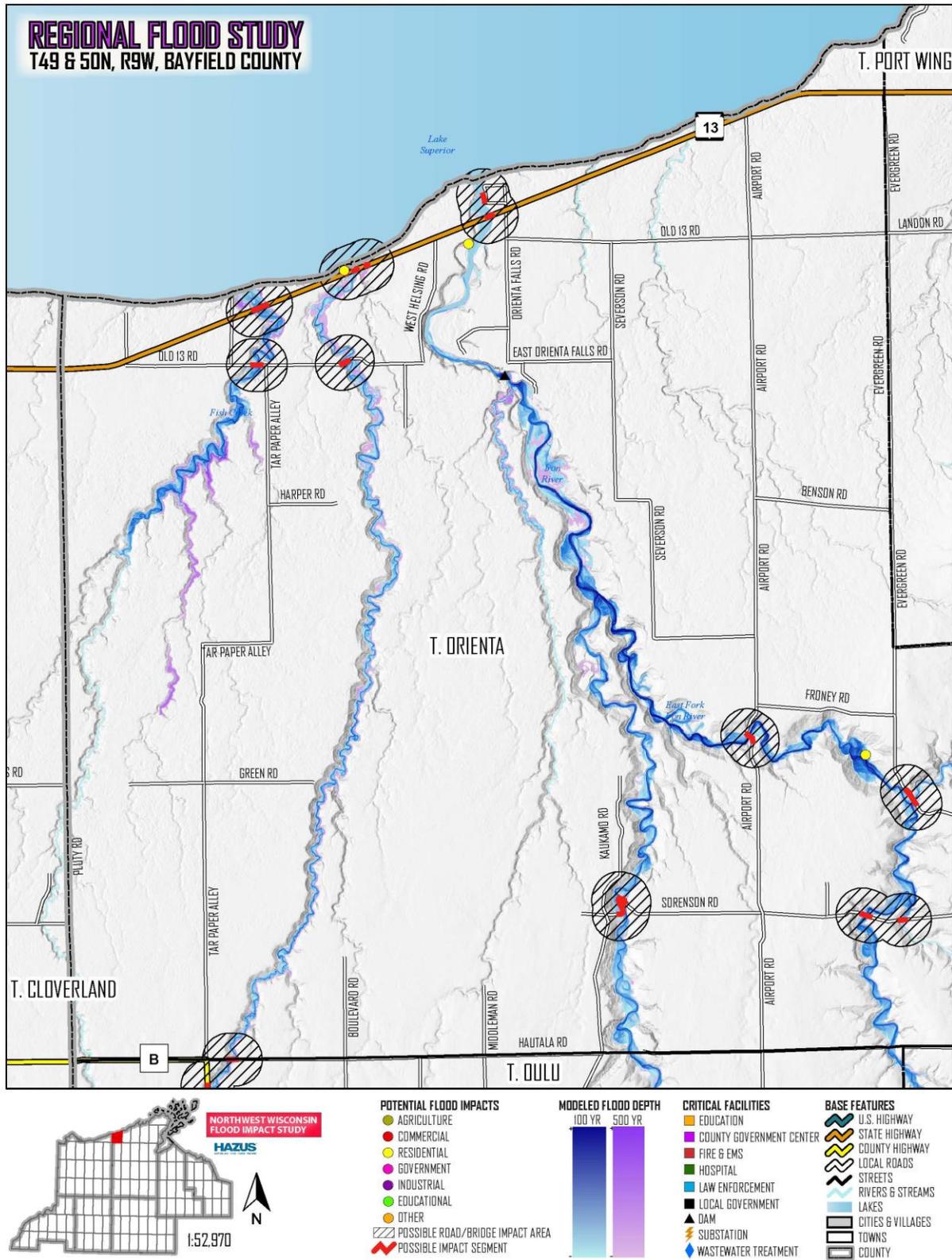


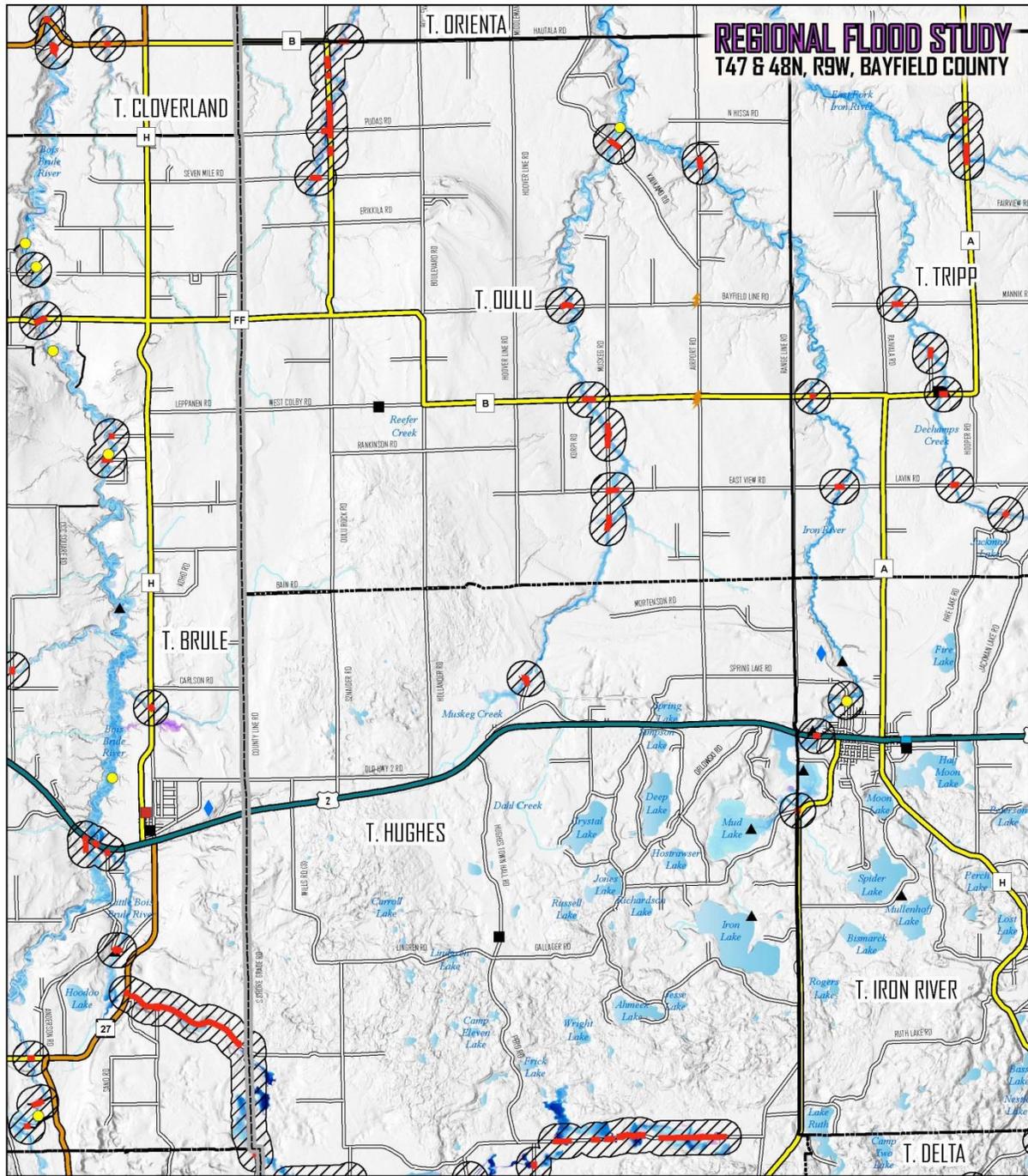
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REGIONAL FLOOD STUDY
T47 & 48N, R9W, BAYFIELD COUNTY



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