Introduction

Identifying and analyzing the hazards in a community is an important and vital step in the mitigation planning process. Before mitigation strategies can be determined, a risk assessment must be made. Part III of Dodge County's All-Hazard Mitigation Plan will focus on the following:

- Identification of all types of natural and manmade hazards that can affect Dodge County.
- An analysis of the hazards identified in Dodge County.
- History of previous occurrences of hazard events.
- The County's vulnerability of future events.

Hazard Identification

The process of identifying those hazards that should be specifically addressed in the Dodge County All-Hazards Mitigation Plan was based on consideration of a number of factors. The process first included a review of past hazard events to determine the probability of future occurrences and threat to human safety and property damage.

The most accessible tool in identifying hazards in Dodge County was from reports that already existed. In November 2002, Wisconsin Emergency Management (WEM) created the Hazard Analysis for the State of Wisconsin. It details the hazards that have caused or are likely to cause disasters in Wisconsin. This report also discusses hazards that threaten public health and safety, but may not be likely to cause a disaster. The descriptions of disasters, hazards and threats include information on frequency of occurrences, significant occurrences, potential and actual impacts and related programs.

A listing of possible hazards was to help identify which hazards should be included in the plan. The identification also included input from the Dodge County Local Emergency Planning Committee.

Based on these factors, hazards listed in this chapter are ranked according to threat to human safety and possible damage to property. The priority ranking of hazards accepted by the Local Emergency Planning Committee is as follows:

1. Severe Thunderstorms
2. Tornados
3. Flooding
4. Dam Failures
5. Winter Storms
6. Drought
7. Wildfires
8. Earthquakes
9. Hazardous Material Incidents

Hazard Analysis

The next step after identifying a hazard is to define the hazard and give some general background behind it. This can include hazard occurrences within the County or State. This section of Part III may also give some indication of the risk to public health and safety and to personal and public property.

History of Hazards

Past disaster experiences helps determine potential future occurrences for which Dodge County would be vulnerable. A review of past occurrences for each identified hazard in Dodge Count was completed.

Some disasters have had damages that exceed the capabilities of local communities and state agencies, federal assistance is then requested. Federal assistance may be offered through a variety of programs. Assistance may be directed to agricultural producers, individuals and families, business, or local governments. There have been 10 natural disasters in Dodge County where a Presidential Declaration was requested from 1971-2004. They include the following:

- 1974 Tornado – Presidential Disaster Declaration
- 1976 Ice Storm – Presidential Disaster Declaration
- 1976 Drought – Presidential Emergency Declared
- 1977 Tornado
- 1986 Flooding – Presidential Disaster Declaration
- 1993 Flooding – Presidential Disaster Declaration
- 1996 Flooding/Severe Storms
- 1998 High Winds/Severe Storms
- 2000 Severe Storms/Flooding/Tornado – Presidential Disaster Declaration
- 2004 Severe Storms/Flooding/Tornado – Presidential Disaster Declaration

It should be noted that this significantly underestimates the number of hazards that have occurred in Dodge County. Almost every year there are significant weather events or disasters that cause millions of dollars in damage for which no Federal disaster assistance is requested. Major indicators of hazard severity are the deaths, injuries, and economic losses resulting from natural hazards and disasters.

The National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) publishes National Weather Service (NWS) data describing recorded weather events and resulting deaths, injuries, and damages. From January 1950 to December 2004, NCDC reported 356 weather events for Dodge County. Table 8 summarizes the NCDC data by event. Though this data gives a good indication of the severity of each event, it is not indicative of the extent of deaths, injuries and damage for the County as a whole. In many cases, the geographic area impacted by the hazard event was much larger than the County itself.

Table 8	**Weather Hazard Events Recorded for Dodge County**				
Event	**Number Events**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Drought	6	0	0	0	4.43 M
Flood	18	0	0	38.245 M	228 M
Hail	73	0	0	388 K	2 K
Lightning	10	0	1	97 K	0
Tornado	52	0	36	28.058 M	900 K
Snow/Ice	33	0	1	100 K	0
Temperature Extreme	21	21	52	20 K	0
Thunderstorms/High Winds	143	4	24	15.713 M	1.829 M
Total	**356**	**25**	**113**	**82.621M**	**7.389M**

Source: National Climatic Data Center

Because the NCDC data is not entirely comprehensive and indicative of the hazards that have occurred in the County, other sources of information were referenced. Theses

sources included other plans and reports, documents from the Dodge County Office of Emergency Management, past local newspaper articles, the Wisconsin Department of Natural Resources (DNR), Wisconsin Emergency Management (WEM), and the National Weather Service.

Vulnerability Assessment

For each hazard identified, a summary of the impact on the community is given. When possible, the numbers of existing buildings, infrastructure and critical facilities located in the hazard areas are inventoried. Critical facilities (reference Maps 8 and 9) are defined as facilities that are critical to the health and welfare of the population, and are especially important following hazard events. This can include a hospital, town halls, mobile homes, or a concentration of homes around a lake.

Where possible, an estimate of the potential dollar losses to vulnerable structures is given. Values are identified by tax assessments, equalized values, or statements of values from insurance companies.

Because Dodge County is made up of local units of government, it is a requirement by FEMA to assess each jurisdiction's risk for each hazard. Unless noted in the specific hazard, all jurisdictions within Dodge County are equally vulnerable.

Hazard: Severe Thunderstorms

Hazard Analysis

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 ¾ of an inch in diameter or greater or a tornado. Strong winds, hail, and lightning will be addressed in the section. However tornados will be referenced separately.

History of Severe Thunderstorms in Dodge County

4 recorded deaths and 24 injuries have resulted in association with severe thunderstorms in Dodge County since 1950. 3 of the 10 requests for a Presidential Disaster Declaration for Dodge County have been associated with severe storms since 1971. The most recent occurrence happened on August 26, 2004. A line of thunderstorms bowed out as it moved through south-central and southeast Wisconsin, resulting in locally, powerful, downburst, straight-line wind gusts that leveled large trees and power lines.

Throughout the months of May and June 2004, the south central portion of Wisconsin received an unusual amount of thunderstorm activity. The cumulative damage from these events led to a disaster declaration for 44 counties. On June 23, 2004 Dodge County was the hardest hit from a line of thunderstorms. The storms resulted in an F3 tornado causing extensive damage to homes and all major highways and secondary roads in the northern third of the County were littered with debris or completely blocked. The City of Waupun was especially hard hit.

The NCDC reported 143 severe thunderstorm and high wind incidents from 1950 to 2004. According to the National Weather Service, Dodge County had 8 events of hurricane-force thunderstorm winds between 1970 and 2004. Hurricane-force winds are

classified as greater than 75 mph. Based on the number of previous events, severe thunderstorms are the most frequent of all the hazards considered in the All Hazards Mitigation Plan.

Vulnerability Assessment

The National Weather Service can forecast and track a line of thunderstorms that may be likely to produce severe high winds, hail, and lightening but where these related hazards form or touch down and how powerful they might be remains unpredictable. The distribution of thunderstorms and related hazard events have been widely scattered throughout the County.

Many thunderstorm events (without tornados) have caused substantial property and infrastructure damage, and have the potential to cause future damage. In order to assess the vulnerability of the Dodge County area to thunderstorms and related storm hazards, a review of the past events indicate significant impacts to:

- Infrastructure – Hospitals, schools, street signs, police and fire departments
- Utilities – electrical lines / poles / transformers, telephone lines, radio communications
- Transportation – debris clean-up
- Residential – mobile homes, garages, trees and limbs, siding, windows
- Businesses – signs, windows, siding, billboards
- Agriculture – building, crops
- Vehicles – campers, boats, windshields, body, paint

According to the NCDC, historic thunderstorm events with associated high winds reported $15,713,000 in property damage and $1,829,000 in events that reported crop damage. Historic thunderstorm events with associated hail that reported damage averaged $388,000 in property damage and $2,000 in crop damage amounts. Historic thunderstorm events with associated lightning that reported property damage averaged $97,000.

Based on review of the historical patterns of thunderstorms associated with high wind, hail, or lightening, there are no specific municipalities that have unusual risks. The events are relatively uniform and a countywide concern.

Future Probability and Potential Dollar Losses-Severe Thunderstorms

Historical data from the National Weather Service predicts that Dodge County has a 14 percent chance of having a severe thunderstorm event with hurricane-force winds (75 mph or greater) in a given year. This equates to just less than one event every five years.

Historical date from NCDC indicates that Dodge County will have three general severe thunderstorm events in a given year. The probability of a thunderstorm with damaging hail (0.75 inch diameter or greater) is 0.13 or 13 % in a given year.

The probability of a storm severe enough to warrant a presidential disaster declaration is 0.07 or a 7 % chance in a given year.

Historical data is again used to estimate potential future dollar losses due to severe thunderstorms. In Dodge County, severe thunderstorms have averaged damages of $313,250 for high winds events and $55,714 in hail events. The potential loss over the next ten years taking into consideration a 14 percent chance of a high wind event is estimated at $626,500. This is based on two events averaging $313,250 in damages per event. The potential loss over the next ten years, taking into consideration a 13 percent chance per year of a damaging hail event is estimated at $55,714. This is based on one events averaging $55,714 in damages per event.

Hazard: Tornados

Hazard Analysis

U.S. tornados are classified into six intensity categories, named F0-F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") has subsequently become the definitive scale for estimating wind speeds within tornados based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornados (all tornados are not assigned an F scale), and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornados. Though the Fujita scale itself ranges up to F12, the strongest tornado winds reach the F5 range (261 to 318 mph).

Wisconsin lies along the northern edge of the nation's maximum frequency belt for tornados, called "tornado alley" by some, which extends northeastward from Oklahoma into Iowa and then across to Michigan and Ohio. Broadly speaking, the southern and western portions of Wisconsin have a higher frequency of tornados, Dodge County is part of this area.

Table 9	**Tornado Wind Damage Scale**		
Tornado Scale	**Wind Speeds**	**Damage**	**Frequency of Occurrence**
F0	40 to 72 MPH	Some damage to chimneys, TV antennas, roof shingles, trees, and windows	29%
F1	73 to 112 MPH	Automobiles overturned, carport destroyed, trees uprooted.	40%
F2	113 to 157 MPH	Roofs blown off homes, sheds and outbuildings demolished, mobile homes overturned	24%
F3	158 to 206 MPH	Exterior walls and roofs blown off homes. Metal buildings collapsed or severely damaged. Forests and farmland flattened.	6%
F4	207 to 260 MPH	Few walls, if any, standing in well built homes. Large steel and concrete missiles thrown far distances	2%
F5	261 to 318 MPH	Homes leveled with all debris removed. Schools, motels, and other larger structures have considerable damage with exterior walls and roofs gone. Top	Less than 1%

		stories demolished	

History of Tornados in Dodge County

Dodge County has had 52 verified tornados from 1950 to 2004 (Table 10). Since 1950 the effects of tornados resulted in over $28,958,000 in damage and injured 36 people.

19 of the tornados recorded in Dodge County were classified as F0; 19 were reported as F1, 9 were recorded as F2, and 5 recorded as F3.

Dodge County has had five recorded F3 tornadoes that resulted in approximately $16,250,000 in damage, no deaths, and 16 injuries. The most recent tornado occurred on June 23, 2004. The storm length was 17 miles long by approximately 400 yards wide. This tornado resulted in one death in Green Lake County. Fortunately no deaths or injuries occurred in Dodge County. The tornado resulted in approximately $8,500,000 in damage.

Table 10 shows the recorded tornados from 1950 to 2004.

Table 10	Reported Tornados in Dodge County						
Date	Time	Length	Width	F Scale	Deaths	Injuries	Cost
6/19/1951	2050	1 mile	467 yards	F2	0	0	$ 25,000
7/21/1956	1600	n/a	n/a	F0	0	0	0
8/8/1960	1600	4 miles	33 yards	F1	0	0	$ 3,000
6/8/1963	1930	4 miles	33 yards	F2	0	0	$ 250,000
6/13/1963	1655	4 miles	33 yards	F1	0	0	$ 3,000
8/22/1964	1345	1 mile	33 yards	F1	0	0	$ 3,000
9/3/1964	1700	3 miles	33 yards	F1	0	0	$ 3,000
5/23/1966	1300	4 miles	50 yards	F2	0	3	$ 250,000
4/20/1968	1335	2 miles	100 yards	F1	0	0	$ 25,000
12/3/1970	1545	3 miles	50 yards	F1	0	0	$ 25,000
9/20/1972	1430	2 miles	50 yards	F1	0	0	$ 250,000
4/21/1974	1500	22 miles	200 yards	F3	0	0	$ 2,500,000
4/21/1974	1530	19 miles	200 yards	F3	0	6	$ 2,500,000
4/15/1976	1115	14 miles	33 yards	F1	0	0	$ 250,000
5/31/1977	1415	2 miles	100 yards	F1	0	0	$ 25,000
6/5/1977	0105	8 miles	100 yards	F1	0	0	$ 25,000
6/5/1977	2045	25 miles	400 yards	F3	0	6	$ 2,500,000
8/13/1977	1315	n/a	n/a	F0	0	0	0
6/17/1978	1857	17 miles	33 yards	F2	0	0	$ 2,500,000
8/9/1979	1905	n/a	n/a	F0	0	0	0
8/9/1979	1915	n/a	n/a	F0	0	0	0
8/9/1979	1920	n/a	n/a	F0	0	0	0
8/9/1979	1950	n/a	n/a	F0	0	0	0
8/9/1979	1952	n/a	n/a	F0	0	0	0
4/7/1980	1535	1 mile	67 yards	F3	0	4	$ 250,000
4/7/1980	1541	12 miles	70 yards	F2	0	16	$ 2,500,000
4/7/1980	1605	10 miles	50 yards	F2	0	0	$ 250,000
4/7/1980	1614	n/a	n/a	F2	0	0	$ 250,000

8/7/1980	1250	7 miles	67 yards	F1	0	0	$ 250,000
4/3/1981	2330	n/a	n/a	F1	0	0	$ 25,000
6/15/1981	1130	0 miles	17 yards	F1	0	0	$ 25,000
7/20/1981	1220	n/a	n/a	F0	0	0	0
7/14/1982	1450	0 miles	67 yards	F1	0	0	$ 25,000
7/19/1983	1930	0 miles	7 yards	F0	0	0	$ 3,000
8/21/1983	1441	0 miles	20 yards	F0	0	0	$ 3,000
6/8/1984	0117	11 miles	50 yards	F2	0	1	$ 2,500,000
7/23/1984	1430	3 miles	50 yards	F1	0	0	$ 250,000
7/12/1986	1700	0 miles	23 yards	F0	0	0	$ 3,000
7/12/1986	1745	0 miles	23 yards	F0	0	0	0
7/21/1987	1809	0 miles	23 yards	F0	0	0	$ 3,000
5/8/1988	1715	1 mile	50 yards	F0	0	0	$ 3,000
6/22/1988	0245	2 miles	100 yards	F1	0	0	$ 250,000
5/24/1989	2210	2 miles	73 yards	F1	0	0	$ 250,000
5/24/1989	2225	2 miles	73 yards	F1	0	0	$ 250,000
8/16/1995	1730	0 miles	10 yards	F0	0	0	0
6/1/2000	1706	15 miles	125 yards	F2	0	0	$ 1,500,000
6/11/2001	2013	8 miles	75 yards	F1	0	0	$ 700,000
6/11/2001	2045	3 miles	50 yards	F0	0	0	$ 25,000
7/6/2003	1605	0 miles	25 yards	F0	0	0	0
7/6/2003	1615	0 miles	25 yards	F0	0	0	0
7/6/2003	1647	0 miles	25 yards	F0	0	0	0
6/23/2004	1950	17 miles	400 yards	F3	0	0	$ 8,500,000
Totals:					**0**	**36**	**$28,958,000**

Source: National Climatic Data Center (NCDC)

Vulnerability Assessment

Though Dodge County is mostly a rural county, there are concentrations of population scattered throughout the County. Local communities and the cities of Beaver Dam, Fox Lake, Juneau, Horicon and Mayville area can be regarded as vulnerable because these areas pose more of a threat to human safety and property damage. Map 14 illustrates these areas within the County.

Mobile homes are of significant concern in assessing the hazard risks from tornadoes. In general, it is much easier for a tornado to damage and destroy a mobile home than standard constructed houses and buildings. Research by the National Weather Service (NWS) shows that between 1985 and 1998, 40 percent of all deaths in the nation from tornados were in mobile homes, compared to 29 percent in permanent homes, and 11 percent in vehicles.

Dodge County has 12 trailer courts located through out the County. Within the 12 trailer courts there are approximately 923 individual sites. The largest trailer court is located in the Town of Beaver Dam and has approximately 168 sites. The second largest is located in the Village of Theresa and has approximately 165 sites. Table 11 below lists the number of mobile homes reported by the Census for each municipality in the County. It also lists the fair market values and an individual average by municipality. Owners of these mobile homes do not own the land but rather rent or lease the land it resides on. In most cases, these are in mobile home parks. The total fair market value of all the

mobile homes for each municipality was totaled and divided by the number of mobile homes in the municipality to get an average fair market value. The average County fair market value for a mobile home is $22,347.

Table 11	**Mobile Home Values**			
Municipality	**2000 Census***	**Number ****	**Total Fair Mkt. Value**	**Average Fair Mkt.**
City of Beaver Dam	17	n/a	n/a	n/a
City of Columbus (part)	0	0	n/a	n/a
City of Fox Lake	29	29	$487,595	$16,813
City of Hartford (part)	0	0	n/a	n/a
City of Horicon	0	0	n/a	n/a
City of Juneau	5	n/a	n/a	n/a
City of Mayville	10	2	$46,900	$23,450
City of Watertown (part)	2	n/a	n/a	n/a
City of Waupun (part)	28	78	$1,795,876	$23,024
Village of Brownsville	0	0	n/a	n/a
Village of Clyman	41	33	$665,000	$20,151
Village of Hustisford	0	0	n/a	n/a
Village of Iron Ridge	85	88	$1,532,400	$17,413
Village of Kekoskee	2	1	$5,000	$5,000
Village of Lomira	106	104	$2,422,400	$23,292
Village of Lowell	4	n/a	n/a	n/a
Village of Neosho	3	n/a	n/a	n/a
Village of Randolph (part)	47	23	$151,600	$6,591
Village of Reeseville	42	50	$1,304,600	$26,092
Village of Theresa	153	162	$7,016,000	$43,308
Town of Ashippun	0	0	n/a	n/a
Town of Beaver Dam	298	355	$4,469,400	$12,590
Town of Burnett	9	1	$35,600	$35,600
Town of Calamus	53	66	$574,700	$8,707
Town of Chester	23	n/a	n/a	n/a
Town of Clyman	26	8	$134,100	$16,763
Town of Elba	4	0	n/a	n/a
Town of Emmet	22	15	$187,600	$12,506
Town of Fox Lake	86	53	$288,150	$5,436
Town of Herman	10	n/a	n/a	n/a
Town of Hubbard	66	58	$1,310,700	$22,598
Town of Hustisford	9	5	$34,700	$6,940
Town of Lebanon	144	159	$5,799,900	$36,477
Town of Leroy	7	7	$220,200	$31,457
Town of Lomira	26	11	$254,300	$23,118
Town of Lowell	51	n/a	n/a	n/a
Town of Oak Grove	18	2	$54,350	$27,175
Town of Portland	9	9	$167,349	$18,594
Town of Rubicon	0	0	n/a	n/a
Town of Shields	4	0	n/a	n/a
Town of Theresa	11	8	$375,700	$46,963
Town of Trenton	21	n/a	n/a	n/a

Town of Westford	87	25	$906,400	$36,256
Town of Williamstown	9	3	$39,300	$13,100
Dodge County	**1,567**	**1,355**	**$30,279,820**	**$559,414**

* = Number of mobile homes reported in 2000 Census
** = Number of assessed mobile homes by municipality on rented/leased land
Source: U.S. Census

Besides mobile homes, there are many other areas vulnerable to tornadoes such as campgrounds. Like mobile home parks, campgrounds are of concern in the County because often times there are a concentration of people with little shelter or no shelter provided. Map 14 shows the locations of the county owned and operated campgrounds. In addition to county owned and operated campgrounds there are a number of privately owned campgrounds.

Youth camps present another concern for Dodge County. Youth camps operate during the summer months and contain large populations of juveniles and young adults. Most youth camps consist of cabins used for sleeping and daily activities. A large number of these cabins are wood structures with no basements. This presents a problem for safely sheltering people in the event of a tornado or severe thunderstorm.

The following is a list of things that may be affected by a tornado. Much of this list can be referenced in Part II.

- Community facilities- hospitals, schools
- Public Service- police and fire departments
- Utilities- power lines, telephone lines, radio communication
- Transportation-debris clean-up
- Residential- nursing homes, garages, trees and limbs, siding, windows
- Businesses- signs, windows, siding, billboards
- Agriculture- buildings, crops, livestock

Based on review of historical events of tornados, there are no specific areas in the county that have unusual risks. The events are relatively uniform and a countywide concern.

Future Probability and Potential Dollar Losses-Tornados
Based on the historical data presented here, Dodge County can expect a tornado about once every year on average. This equates to a probability of 0.96 or about a 96% chance in a given year. Table 12 indicates the probability of a specific magnitude.

Table 12	**Probability By Intensity for Any Given Year**					
Tornado Scale	**F0**	**F1**	**F2**	**F3**	**F4**	**F5**
Number of reported Tornados	19	19	9	5	0	0
Probability of Occurrence	37%	37%	17%	10%	< 1%	< 1%

Historical data is again used to estimate potential future dollar losses due to tornados. Estimated damages from various tornados in Dodge County range from $0 to $8,500,000. On average, Dodge County might expect damages of $556,885 per tornado however, only 9 of these 52 tornados resulted in damages exceeding the average.

Hazard: Flooding

Hazard Analysis

Major floods in Dodge County tend to occur either in the spring when melting snow adds to normal runoff or in summer or early fall after intense rainfalls. Flooding which occurs in the spring due to snowmelt and /or a prolonged period of heavy rain is characterized by a period of days. This build up continues until the river or stream overflows its banks, for as long as a week or two and then slowly recedes inch by inch. The timing and location of this type of flooding is fairly predictable and allows ample time for evacuation of people and protection of property.

As described in Part II, there are approximately 405 miles of streams in Dodge County within thirteen main watersheds.

Floodplains exist along these thirteen main watersheds and the tributaries that feed into them. These floodplains are narrow along tributaries and lakes but extensive throughout the County. Floodplains are described in Part II and shown of Map 4 of this plan. The Federal Emergency Management Agency (FEMA) identified these floodplains on Federal Insurance Rate Maps (FIRMs).

History of Flooding in Dodge County

Flooding was the principal cause of damage in 5 of the 10 Presidential Disaster Declarations in Dodge County from 1950 to 2004. The most recent flood event occurred in 2004. Between May 19th and June 18th the county received heavy rainfall resulting in severe flooding throughout the County. The Village of Randolph was the hardest hit after a over 9 inches of rain fell over a 24-hour period on June 9th and 10th resulting in 250 homes and 15 businesses reporting basement or first floor flooding. Dodge County was one of 44 counties included in a Presidential Disaster Declaration.

Also in 2004, Dodge County received another Presidential Disaster Declaration. The declaration was awarded after severe storms passed through the area spawning several tornadoes, one which affected the City of Waupun, and causing numerous high wind damages across the northern portion of the county.

The NCDC recorded 18 flood events from 1950 to 2004. Five of the 18 events occurred in August of 1995.

Vulnerability Assessment

Flood events in the County have caused substantial property and roadway damage in the past, and have the potential to cause future damage. Looking at past events, the following have been significantly impacted by flooding:

- Roadway- Washouts, inundated roadways, debris clean-up
- Residential Structures- Flooded basements, damaged septic systems
- Agriculture- inundated cropland
- Businesses-Loss of commerce

In order to assess the flooding vulnerability of Dodge County, applicable basic inventory asset data described in Part II must be analyzed. For this purpose, special

consideration should be given to structures (specifically critical facilities), infrastructure and cropland.

One of the first reports to reference in assessing vulnerability to structures during flooding is the State of Wisconsin Repetitive Loss Report (Updated in 2000). The Repetitive Loss Report provides information to the status of repetitive loss property by community in Wisconsin. FEMA, through the Federal Insurance Administration (FIA), classifies a repetitive loss structure "when more than one flood insurance claim of at least $1,000 is made within a ten-year period". The information is used as a floodplain management tool and to supplement information provided by communities for flood mitigation grants administrated by WEM. According to the report, there are no local units of government within Dodge County contain existing repetitive loss structures.

With no structures in the County shown in the Repetitive Loss Report, structures within floodplains were analyzed. The floodplain boundaries (as well as the watershed boundaries) within Dodge County are shown on Map 4 in Part II. Map 4 is based off the Flood Insurance Rate Maps of 1991.

Methodology 1 – Structures within Floodplains:

1. Dodge County Land Information Department digitalized (electronically traced) the individual FEMA FIRM floodplain maps into a GIS coverage for the County.

2. A GIS floodplain coverage was combined with a GIS building structure coverage to determine which man-made structures were located within the floodplain. This is demonstrated on page 3-28.

3. The man-made structures identified were determined to be "vulnerable" to flooding.

4. Those identified structures recognized as vulnerable were then verified/rectified on the digital aerial photos coverage.

5. An average fair market value of residential structures for each municipality was identified by the Dodge County tax information.

6. The estimated value of vulnerable structures was determined by multiplying the number of structures located in the floodplain by the average fair market value of that municipality.

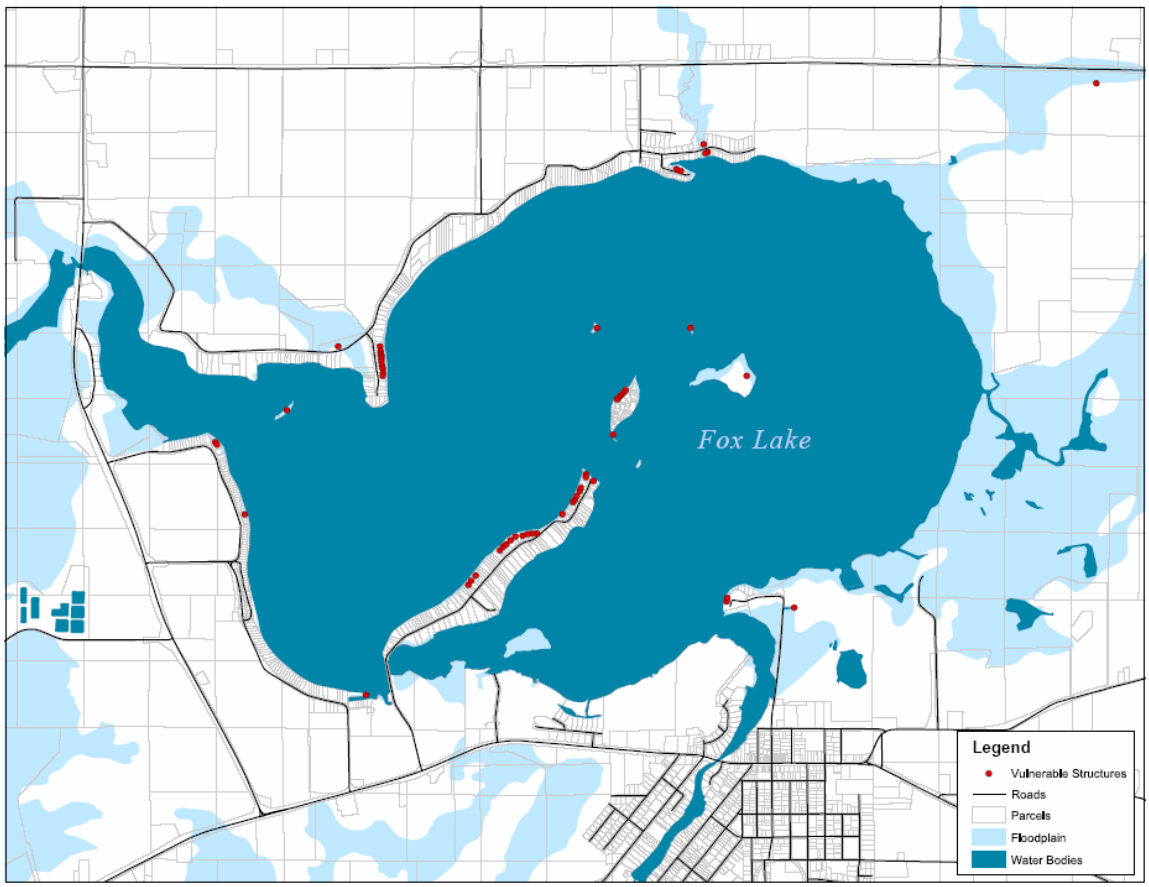


Table 13 shows the number of structures in each municipality that are identified as "vulnerable to flooding" according to the above methodology. There were a total of 494 structures identified in the designated floodplain boundaries. The average value of a structure was $96,857. An estimated total value of all structures in Dodge County that are located in the designated floodplain boundaries is $47,847,400. Map 15 illustrates Dodge County's flood vulnerability.

Table 13	**2005 Fair Market Values of Structures Located in Floodplains**		
Municipality	**# of Structures**	**Average Value**	**Total Value**
City of Beaver Dam	44	$152,273.00	$6,700,000.00
City of Columbus (part)	0	n/a	n/a
City of Fox Lake	n/a	n/a	n/a
City of Hartford (part)	0	n/a	n/a
City of Horicon	0	n/a	n/a
City of Juneau	0	n/a	n/a
City of Mayville	25	$125,000.00	$3,125,000.00
City of Watertown (part)	41	$91,951.00	$3,770,000.00
City of Waupun (part)	0	n/a	n/a
Village of Brownsville	0	n/a	n/a
Village of Clyman	0	n/a	n/a
Village of Hustisford	n/a	n/a	n/a

Village of Iron Ridge	1	$69,400.00	$69,400.00
Village of Kekoskee	n/a	n/a	n/a
Village of Lomira	0	n/a	n/a
Village of Lowell	3	$66,667.00	$200,000.00
Village of Neosho	0	n/a	n/a
Village of Randolph (part)	0	n/a	n/a
Village of Reeseville	15	$26,667.00	$400,000.00
Village of Theresa	n/a	n/a	n/a
Town of Ashippun	28	$118,253.57	$3,311,100.00
Town of Beaver Dam	7	$ 96,942.86	$ 678,600.00
Town of Burnett	16	$ 81,525.00	$1,304,400.00
Town of Calamus	7	$ 61,871.43	$ 433,100.00
Town of Chester	5	$ 53,920.00	$ 269,600.00
Town of Clyman	9	$ 75,688.89	$ 681,200.00
Town of Elba	14	$127,378.57	$1,783,300.00
Town of Emmet	2	$ 35,400.00	$ 70,800.00
Town of Fox Lake	76	$ 86,632.90	$6,584,100.00
Town of Herman	9	$ 89,161.11	$ 802,450.00
Town of Hubbard	29	$ 87,541.38	$2,538,700.00
Town of Hustisford	26	$124,573.08	$3,238,900.00
Town of Lebanon	33	$ 68,651.52	$2,265,500.00
Town of Leroy	0	n/a	n/a
Town of Lomira	1	$189,700.00	$ 189,700.00
Town of Lowell	11	$ 80,463.64	$ 885,100.00
Town of Oak Grove	13	$ 90,650.00	$1,178,450.00
Town of Portland	20	$ 78,285.00	$1,565,700.00
Town of Rubicon	14	$107,050.00	$1,498,700.00
Town of Shields	7	$155,685.71	$1,089,800.00
Town of Theresa	1	$ 95,600.00	$ 95,600.00
Town of Trenton	4	$ 85,700.00	$ 342,800.00
Town of Westford	30	$ 84,516.67	$2,535,500.00
Town of Williamstown	3	$ 79,966.68	$ 239,900.00
Dodge County	**494**	**$2,687,116.01**	**$47,847,400.00**

Source: Dodge County Land Information/Tax Information

Since flooding occurs outside the 100-year floodplain boundaries, a second methodology was used to determine the County's vulnerability to flood events. This includes structures out of the floodplain boundary based on inundated areas during past flood events.

Methodology 2 – Flooding from Past Events

1. Dodge County Emergency Management compiled a list of flood insurance claims provided to us by Wisconsin Emergency Management's Mitigation Department.

2. All structures that had reported damage and filed a flood insurance claims was averaged (fair market value) and used to determine potential future damage.

3. The reported damage amounts were taken and averaged to estimate future damage amounts.

4. From the above information in 2 and 3, an average potential damage figure along with an average actual damage figure was calculated. From this calculation an average fair market value structure can expect an average actual damage of a determined amount.

Table 14 shows the number of flood insurance claims identified according to methodology 2. There were a total of 16 structures identified in flooded areas that submitted flood insurance claims since 1979. The total submitted claim amount was for a total of $59,067.00 including damage to the structures or buildings and contents. The average claim was for $3,691.68.

Table 14	**Flood Insurance Claims Since 1979**			
Municipality	**# of Claims**	**Damage to Building**	**Damage to Contents**	**Total**
City of Mayville	3	$8,929.00	$1,385.00	$10,314.00
Village of Theresa	1	$2,196.00	$0	$2,196.00
City of Watertown	8	$32,861.00	$2,010.00	$34,871.00
Other Area Claims	4	$9,270.00	$2,416.00	$11,686.00
Totals	**16**	**$53,256.00**	**$5,811.00**	**$59,067.00**

Table 15 illustrates the Small Business Administration loans that Dodge County received for DR-1526 as of January 18, 2005 from the 2004 declaration. The table shows that Dodge County received 75 Small Business Administration disaster loans totaling $1,406,100.

Table 15	**2004 Small Business Administration Loans**	
	Number	**Amount**
Home Loans	65	$1,021,900
Business Physical Loans	6	$ 252,800
Business Economic Injury Loans	4	$ 131,400
Total	**75**	**$1,406,100**

In addition to structural and contents damage from past flood events, there has been significant damages to public roadways, particularly to roadway surfaces, culverts, ditches, and bridges. Floods have inundated roadways in the County from a period of a few days up to as much as three months. Such interruptions in the County transportation network result in travel delays through detours. In addition, local municipal agencies invest equipment and time into clearing roadways and ensuring public safety. Table 16 shows the Public Assistant grants awarded by FEMA after the 2004 Presidential Declaration for severe storms and flooding. These numbers reflect the federal and state grant shares along with administrative costs. Additionally each municipality was required to meet a 12.5% local match grant share which is not reflected in Table 16.

Table 16	2004 Public Assistant Grants for Dodge County			
Municipality	**Federal Grant Share**	**State Grant Share**	**Total Grant Payment**	**Admin. Cost**
City of Beaver Dam	$ 44,506.82	$ 7,417.81	$ 51,924.63	$ 1,780.27
Village of Brownsville	$ 12,094.63	$ 2,015.78	$ 14,110.41	$ 514.28
Town of Calamus	$ 16,982.99	$ 2,830.50	$ 19,813.49	$ 679.32
County of Dodge	$ 79,175.31	$ 13,195.89	$ 92,371.20	$ 3,167.01
Elba Sanitary District	$ 22,388.04	$ 3,731.34	$ 26,119.38	$ 895.52
Town of Elba	$ 8,679.45	$ 1,446.58	$ 10,126.03	$ 347.18
Town of Emmet	$ 1,429.50	$ 238.25	$ 1,667.75	$ 57.18
City of Fox Lake	$ 18,345.00	$ 3,057.51	$ 21,402.51	$ 733.80
City of Horicon	$ 5,805.75	$ 967.63	$ 6,773.38	$ 232.23
Town of Hubbard	$ 8,469.02	$ 1,411.50	$ 9,880.52	$ 338.76
Village of Hustisford	$ 4,789.50	$ 798.25	$ 5,587.75	$ 191.58
City of Juneau	$ 13,008.00	$ 2,168.00	$ 15,176.00	$ 520.32
Lake Sinissippi Improvement District	$ 3,121.50	$ 520.26	$ 3,641.76	$ 124.86
Town of Lebanon	$ 7,261.42	$ 1,210.23	$ 8,471.65	$ 2,787.35
Town of Leroy	$ 16,595.25	$ 2,765.88	$ 19,361.13	$ 529.59
Town of Lomira	$ 10,623.19	$ 1,770.53	$ 12,393.72	$ 424.93
Village of Lowell	$ 13,085.42	$ 2,279.03	$ 15,953.20	$ 546.97
City of Mayville	$ 4,890.75	$ 815.13	$ 5,705.88	$ 195.63
Village of Neosho	$ 2,358.75	$ 393.13	$ 2,751.88	$ 94.35
Town of Trenton	$ 4,756.95	$ 792.83	$ 5,549.78	$ 190.28
Village of Randolph	$113,658.56	$ 18,288.73	$131,947.29	$ 0.00
City of Waupun	$283,853.04	$ 47,308.84	$331,161.88	$ 8,569.41
Town of Westford	$ 6,550.50	$ 1,091.75	$ 7,642.25	$ 262.02
Total	**$702,429.34**	**$116,515.38**	**$819,533.47**	**$23,317.06**

Wisconsin Emergency Management Disaster Recovery Aids Program Listing for Public Assistance

The primary impact from damages to roadways is to businesses. The monetary impact is unknown but past floods have restricted public access and have even closed businesses. Since tourism is an important industry to the County, several campgrounds, lodges, and restaurants may be affected by flooding.

The agriculture industry is a sector that can face substantial losses. During floods, cool, rainy/wet, sunshine deficient climatic conditions of the spring and summer create a general condition of high water and saturated soils throughout the County.

Flood conditions can leave farmers with the following economic setbacks:

- Delayed planting (reduced growing season)
- Prevention of fields from being seeded
- Seed and agriculture chemicals washing out of the fields
- Rotting of plants due to excess moisture
- Areas where planted crops left in the fields due to excessive moisture
- Crops not reaching full maturity or stunted growth
- Requirements by farmers to expend higher amounts of money on additional soil amendments

- Lower quality (nutritional value) of harvestable crops as a feed source

Reductions in quantity can result in loss of revenues from cash crops and increase expenses for purchasing the needed livestock feed from outside sources. Additionally, reductions in crop quality result in lower prices received for cash crop.

Saturated soil conditions responsible for these woes are generally throughout the County. Agricultural land in Dodge County is scattered throughout the County.

Economic losses to farmers can generate a ripple affect to the local community as well. Reduction in farm income will curtail the farmers' ability to purchase new equipment and make other improvements. Farmers will have less money to spend at farm dealers, farm supplies, building/hardware suppliers, fertilizer, feed and seed dealers, and other agribusiness and retail establishments. The State itself will have reduced tax revenue. Farmers will have less money to save and invest, and suffer still more increases in debt load.

Future Probability and Potential Dollar Losses-Flood

Based on the historical data presented here, Dodge County can expect a flood event about every 3 years on average. This equates to a probability of 0.33 or about a 33 percent chance each year. The damage resulting from the frequent flooding may be minor and unpredictable. During the 54-year period, three of the floods recorded resulted in a Presidential Disaster Declaration. Taking this into consideration, the County might expect a significant flood every 18 years on average. This equates to a probability of 0.06 or about a six percent chance each year.

Historical data was again used to estimate future dollar losses due to flooding. Based on the 2004 flood event for which we have fairly good loss figures, Dodge County can anticipate losses of approximately $2,192,929. 64 percent or $1,406,100 can be expected in the residential and business category and 36 percent or $786,829 can be expected in the public category.

An average residence today, based on the figures from Tables 14 and 15, involved in a significant flood can expect approximately 10 percent or $1,572 in damage to personal property like furniture, appliance, etc. The average structural damage to a residence would be expected to be approximately 90 percent or $14,148, mainly consisting of foundation damage.

Hazard: Dam Failures

Hazard Analysis

A dam can fail for a number of reasons such as excessive rainfall or melting snow. It can also be the result of poor construction or maintenance, flood damage, earthquake activity, weakening caused by burrowing animals or vegetation, surface erosion, vandalism or a combination of these factors. Dam failures can happen with little warning resulting in the loss of life and significant property damage in an extensive area downstream of the dam.

There are 70 dams in Dodge County. These dams serve many useful purposes including agricultural uses, providing recreational areas, erosion control, water level

control and flood control. According to the DNR, Dodge County has 22 large dams, which have a structural height of over 12 feet. The Wisconsin Department of Natural Resources (WDNR) regulates all dams on waterways to some degree, however small dams are not stringently regulated for safety purposes.

The Wisconsin Department of Natural Resources assigns hazard ratings to large dams within the state. When assigning hazard ratings, two factors are considered: existing land use and land use controls (zoning) downstream of the dam. Dams are classified into three categories that identify potential hazards to life and property downstream should the dam fail. A high hazard indicates that a failure would most probably result in the loss of life. A significant hazard indicates a failure could result in appreciate property damage. A low hazard exists where failure would result in only minimal property damage and loss of life is unlikely. For Dodge County, there are three dams that have a high hazard rating – City of Beaver Dam, Upper Dam; City of Mayville, Upper Mayville; and Town of Theresa, Theresa Marsh. Eight has a significant rating, while the rest are low.

All dams perceived as posing a threat to downstream development should have a Dam Failure Analysis performed in order to identify the hydraulic shadow (that area of land downstream form a dam that would be inundated by water upon failure of the dam during a regional flood). This information can be used to develop an Emergency Action Plan (EAP) for the dam. The EAP includes provisions for notifying emergency authorities for assistance and warning affected downstream residents if the potential for failure exists.

History of Dam Failures in Dodge County

Dodge County has not experienced a dam break with any loss of life or substantial property damage. However, the recent Marquette County dam blowout in Michigan's Upper Peninsula is a prime example of the kind of destruction a dam failure can cause. On May 15, 2003, an earthen dike washed away after heavy rainfall. The preliminary damage was estimated at $102 million. It washed away $3 million worth of roads and bridges, plus 20 homes, and sent a massive plume of sediment into Lake Superior. It was a serious blow to the economy of Marquette County hurting basic industries and tourism.

Table 17	Dodge County Dams				
Municipality	**Name**	**Size**	**Hydraulic & Structure Height (feet)**	**Hazard Potential**	**Most Recent Inspection**
City of Beaver Dam	Upper Dam	Large	10.0/20.0	High	7/2/2002
	Beaver Dam Creek	Small	2.0/7.0	n/a	n/a
	Middle Dam	Abandoned	10.0/na	n/a	n/a
City of Fox Lake	Fox Lake	Large	9.0/16.0	Significant	9/14/1999
	Fox Lake Carp Barrier	Small	3.0/6.0	Low	n/a
City of Horicon	Horicon	Large	1.0/12.0	Significant	1/10/1989
City of Mayville	Furnace Bridge	Large	10.0/14.0	Significant	4/18/1988
	Upper Mayville	Large	10.0/15.0	High	12/21/1989
Village of Kekoskee	Kekoskee	Large	10.0/16.0	Significant	1/10/1989
Village of Lowell	Lowell	Large	10.0/16.0	Significant	8/21/1987
	Herbert A. Polsin, ETUS	Small	4.0/7.0	n/a	n/a
Village of Neosho	Neosho	Large	9.3/12.0	Low	4/29/1987
Village of Theresa	Theresa	Small	2.0/5.0	Significant	8/27/1969
Town of Ashippun	Alderly Mill	Large	7.0/9.0	Low	7/1/1987
	Merten, Walter L.	Small	14.0/19.0	n/a	n/a
	Franz, Marie	Small	7.0/13.0	n/a	n/a
Town of Beaver Dam	Crystal Lake	Large	10.0/13.0	Low	4/12/1995

Town of Burnett	Luck	Small	na/4.0	n/a	n/a
	Horicon Marsh-Burnett	Large	8.0/8.0	Low	n/a
	Horicon Marsh-Mieske	Small	na/3.0		
	Upper Horicon	Large	1.0/8.0	Low	n/a
Town of Calamus	Dedolph, Carter and Joyce	Small	1.0/3.0	n/a	n/a
Town of Chester	Rosati	Small	n/a	n/a	n/a
	Frankfurth Marsh	Large	4.0/7.0	Low	n/a
	Pool Three	Small	na/5.0	n/a	n/a
	Pool Two	Small	na/5.0	n/a	n/a
Town of Clyman	Rovics, Jack	Small	n/a	n/a	n/a
	Juneau Rod & Gun Club	Small	na/4.0	n/a	n/a
Town of Elba	Danville	Large	10.0/17.0	Low	12/20/1989
Town of Fox Lake	Lake Emily	Small	3.0/5.0	Low	8/28/1969
	Gibbs, Kenneth	Small	4.0/6.0	n/a	n/a
	Giese, William	Small	3.0/4.0	n/a	n/a
Town of Hubbard	Karsten No. 2	Large	17.0/24.0	Low	8/13/1998
	Tall Boys	Small	2.5/6.0	Low	n/a
Town of Hustisford	Hustisford	Large	7.0/11.0	Significant	4/18/1988
	Hustisford Canning Company	Small	3.0/4.0	Significant	8/25/1969
Town of Lebanon	Camp Cross Acres Boys Camp	Small	15.0/21.0	n/a	n/a
Town of Leroy	Radtke Pool	Large	8.2/10.2	Low	4/13/2005
	Pool Eleven	Small	na/5.0	n/a	n/a
	USF&WS	Small	6.5/8.5	n/a	n/a
	Labros, Arthur	Small	7.0/12/0	n/a	n/a
	Heinrich, William	Small	6.0/9.0	n/a	n/a
	Bachhuber, M.W.	Small	12.0/18.0	n/a	n/a
	Pool Eight	Small	5.0/80.0	n/a	n/a
	Pool Nine	Small	5.0/485.0	n/a	n/a
Town of Lomira	Camelot Country Club #7	Small	na/5.0	n/a	n/a
	Camelot Country Club #8	Small	na/5.0	n/a	n/a
	Camelot Country Club #8	Small	na/6.0	n/a	n/a
Town of Lowell	Norwind Farms	Small	3.0/5.0	n/a	n/a
Town of Rubicon	Barch, Kathleen M.	Small	2.0/4.0	n/a	n/a
	Saylesville	Small	Abandoned	n/a	n/a
	Mishler, Robert	Small	8.0/12.0	n/a	n/a
Town of Theresa	Theresa Marsh Runoff Pond B	Small	2.0/na	n/a	n/a
	Theresa Marsh	Large	1.0/10.0	High	7/16/1998
	Theresa Marsh Runoff Pond A	Small	2.0/na	n/a	n/a
	Theresa Marsh Pool 1	Small	2.0/na	n/a	n/a
	Theresa Marsh Pool 2	Small	2.0/na	n/a	n/a
	Theresa Marsh Pool 3	Small	2.0/na	n/a	n/a
	Theresa Marsh Pool 4	Small	2.0/na	n/a	n/a
	Theresa Marsh Pool 5	Small	2.5/na	n/a	n/a
	Theresa Marsh Pool 6	Small	3.0/na	n/a	n/a
Town of Trenton	Alto Creek #1, 2, & 3	n/a	n/a	n/a	n/a
	Fish Camp Marsh	Small	5.0/6.0	n/a	n/a
Town of Williamstown	Horicon Marsh I-1	Small	na/6.0	n/a	n/a
	Horicon Marsh I-2	Small	na/2.0	n/a	n/a
	Horicon Marsh East Dike	Large	7.0/7.0	Low	n/a
	Horicon Marsh I-4	Small			
	Karsten No. 1	Large	10.0/18.0	Low	8/13/1998
	Horicon Marsh-Redhead	Large	8.0/8.0	Low	n/a
	Horicon Marsh-Greenhead	Large	8.0/8.0	Low	n/a

Source: WIDNR

Vulnerability Assessment:

Dodge County has three dams that have a high hazard rating, and eight that have a significant hazard rating (reference Map 16). Only two of the eleven dams have

Emergency Action Plans developed. The dams with developed plans include Beaver Dam's Upper Lake Dam and Mayville's Upper Dam.

Areas located downstream from existing dams are more vulnerable to a dam failure then other areas of the County. The cities of Beaver Dam and Mayville and the town of Theresa all have dams within their jurisdiction that are assigned a high hazard rating.

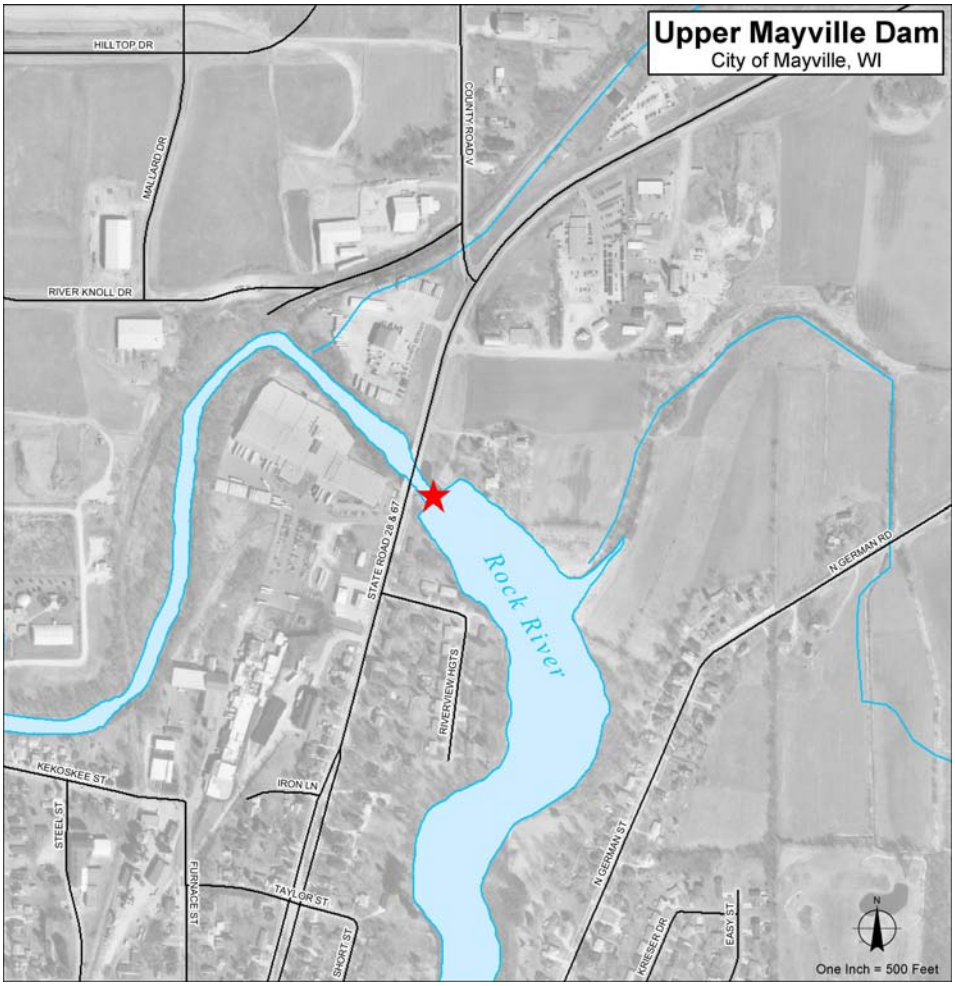
Upper Dam – Beaver Dam Lake Dam:

The Upper Dam – Beaver Dam Lake Dam is located on the Beaver Dam River in the City of Beaver Dam in Dodge County. The dam discharges into the Beaver Dam River. The dam consists of six manually operated stoplog sections and a 60-inch diversion penstock, controlled by a vertical sliding sluice gate. The City of Beaver Dam Wastewater Utility is responsible for operating the dam and regulating flows in the Beaver Dam River.

The reservoir formed by the Upper Dam has normal headwater elevation of 870.9 feet. It has a surface area of 6,000 acres, and storage volume of 10 billion gallons at normal pool. Average flow is about 120 cubic feet per second (cfs).

The structures at greatest risk from the failure of the Upper Dam are retail stores which span the river bed in the downtown area. Kirsh Foundry, which has smelting ovens that could explode if the building spanning the riverbed would collapse, is also at risk. There are also residential structures up stream of the buildings that span the river bed that could be affected.

Flows discharged into the Beaver Dam River from the Upper Dam directly affect the Lowell Dam, approximately 15 miles downstream. The operator of Lowell Dam is to be notified of any changes in discharges at the Upper Dam.



Upper Mayville – City of Mayville:

The Upper Mayville Dam is located on the East Branch of the Rock River in the City of Mayville in Dodge County. The dam discharges into the Rock River. The dam consists of three manually operated tainter gates, three overflow fixed crest spillways and one manually operated splashboard spillway. The City of Mayville Public Works Department is responsible for operating the dam and regulating flows in the Rock River.

The reservoir formed by the Upper Mayville Dam has normal headwater elevation of 913.8 feet. It has a storage volume of 227 acre feet at normal pool.

The structures at greatest risk from the failure of the Upper Mayville Dam are properties on the east side of Main Street and west of the River from Horicon Street to Buchanan Street. Most of these properties are commercial with some upper level apartments. There are also approximately 11 homes and associated outbuildings on the west side and north end of Barwig Avenue which are at risk.

Flows discharged into the Rock River from the Upper Mayville Dam directly affect the Lower Dam (Furnace Bridge Dam) also owned and operated by the City of Mayville. The Lower Dam is approximately one mile downstream. The Kekoskee Dam is approximately 2.5 miles downstream of the Lower Dam. The owner of the Kekoskee Dam is to be notified of any changes in discharge at either the Upper or Lower Dam.

Theresa Marsh – Town of Theresa:

The Theresa Marsh Dam is located on the East Branch of the Rock River in the Town of Theresa in Dodge County. The dam discharges into the Rock River. The dam consists of six, 9-foot, manually operated stoplog sections and a 7’ x 14’ tainter gate. The Wisconsin Department of Natural Resources is responsible for operating the dam and regulating flows in the East Branch of the Rock River.

The reservoir formed by the Theresa Marsh Dam has normal headwater elevation range of 932.0 feet to 934.0 feet. It has a surface area of 380 acres, and storage volume of about 250 million gallons (760 acre-feet) at 932.0 feet at normal pool.

Flows discharged into the Rock River from the Theresa Marsh Dam directly affect the Theresa Dam, owned by the Village of Theresa, approximately 2.1 miles downstream.

Future Probability of Potential Dollar Losses – Dam Failure

Due to the significant number of dams and particularly large dams with high hazard ratings, dam failure is an important hazard event to plan for in Dodge County. However, based on past experience, the actual probability of a major dam failure is very low. Considering the lack of historical problems along with the historic flood frequency data, probability of a dam failure might be estimated at (less than) 0.03 or 3 percent chance in a given year, although this is not completely accurate, since failure of the dam maybe avoided by human intervention.

Estimated future dollar losses for dam failure is problematic as well. If Beaver Dam's Upper Dam failed, approximately 19 structures would be located in the affected area. Likewise, if Mayville's Upper Dam failed approximately 22 structures would be affected. Due to the limited information available regarding the Theresa Marsh Dam we were unable to obtain any figures should a failure occur. Table 28 shows the potential losses from the three high hazard rating dams.

Table 18	**Fair Market Value of Vulnerable Structures**		
Dam	**# of Structures**	**Average Value**	**Total Value**
Upper Dam – Beaver Dam	19	$315,789	$6,000,000
Upper Dam – Mayville	22	$103,036	$2,266,800
Total	**41**	**$418,825**	**$8,266,800**

Additional property damage may result from failures of dams that do not have an Emergency Action Plan developed for them. In most cases smaller dam failures will result in minimal if any property damage.

Hazard: Winter Storms

Hazard Analysis

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

True blizzards are rare in Wisconsin. They are more likely to occur in the northwestern part of the state than in south-central Wisconsin, even though heavy snowfalls are more frequent in the southeast. However, blizzard-like conditions often exist during heavy snowstorms when gusty winds cause severe blowing and drifting of snow. Heavy snow and ice storms have been part of nearly every winter in Dodge County.

History of Winter Storms in Dodge County
The NCDC has reported 33 major winter storm events for Dodge County since 1950. All of these storms contained some form of snow, sleet, freezing rain, or slippery road conditions.

Most recently, a 2004 winter storm coated roads and bridges during the morning hours with a light freezing drizzle. Newspaper reports indicated numerous vehicle accidents, with vehicles sliding off roads or crossing median stripes and hitting other vehicles, or rolling over. Some accidents were multi-vehicle and emergency workers were kept busy throughout the morning hours.

On March 3, 2002 the south-central and southeast portions of the state was affected by a winter storm that produced 7 to 11 inches of snow. Accumulating snows during this event came in two waves, one during the overnight hours and the other one lasting from about 1200CST to 2100CST on March 2nd. In between the two waves, some mixed precipitation, consisting of snow, sleet, and freezing rain, was observed. Numerous indoor and outdoor activities across south-central and southeast were cancelled, and many airplane flights were delayed or cancelled. Based on newspaper accounts, at least 300 to 400 vehicle accidents occurred.

Since 1997, seven winter storms affected Dodge County producing 8 to 14 inches of snow with each storm. An additional three ice storm events have affected Dodge County since 1995.

Vulnerability Assessment
Winter storms present a serious threat to the health and safety of affected citizens and can result in significant property damage. Heavy snow or accumulated ice can cause the structural collapse of buildings, down power lines, or isolate people from assistance or services. The following is a list of things that may be adversely affected by a winter storm. Much of these community assets can be referenced in Part II.

- Infrastructure – Operation of emergency services, operation of public facilities and schools.
- Utilities – Down power and telephone lines
- Transportation – Automobile accidents, roadway plowing, salting/sanding
- Residential – Roofs
- Business – Commerce

There are specific areas in the county that have unusual risks. Winter storms cover a broad area and are a region-wide concern.

Future Probability and Potential Dollar Losses – Winter Storms
Based upon historical frequency, Dodge County can expect one major winter storm per every two year on average. In other words, the probability is 50 percent chance in a given year.

Estimating potential future losses for winter storms is difficult. Damages and losses are typically minor and widespread. Minor auto accidents and additional snow removal time are typical impacts of winter storms, and such claims are not aggregated or tracked. Winter storms, however, do have the potential to be extremely disastrous, particularly in

the case of ice storms. NCDC has no historical dollar loss listed for the winter storm events recorded.

Hazard: Drought

Hazard Analysis

A drought is an extended period of unusually dry weather, which may be accompanied by extreme heat (temperatures which are 10 or more degrees above normal high temperature for the period). There are basically two types of droughts in Wisconsin: agricultural and hydrologic. Agricultural drought is a dry period of sufficient length and intensity that markedly reduces crop yields. Hydrologic drought is a dry period of sufficient length and intensity to affect lake and stream levels and the height of the groundwater table. These two types of drought may, but do not necessarily, occur at the same time.

Droughts, both agricultural and hydrologic, are relatively common in the state. Small droughts of shortened duration have occurred approximately every ten years since the 1930's.

History of Drought in Dodge County

The drought of 1976-1977 was most severe in a wide band stretching from north to south across the state. Stream flow measuring stations recorded recurrence intervals from 10 to 30 years. Agriculture losses during this drought were set at $624 million. 64 counties in the state were declared federal drought areas and deemed eligible for assistance under the Disaster Relief Act. Dodge County was one of the 64 counties eligible for assistance.

Dodge County experienced the 1987-1988 droughts with the rest of the Midwest. It was characterized not only by below level precipitation, but also persistent dry air and above normal temperatures. Stream flow measuring stations in the state indicated a recurrence interval of between 75 and 100 years. The drought occurred early in the growing season and resulted in a 30 to 60 percent crop loss, with agricultural losses set at $1.3 billion for the state. No statistics were available for the amount of crop lost in Dodge County, but 52 percent of the state's 81,000 farms were estimated to have losses of 50 percent or more, with 14 percent estimated having losses of 70 percent or more.

NCDC recorded another drought event that affected Dodge County during the month of August in 2003. It was a very dry month across central. Many locations received less than a quarter inch of precipitation for the month.

Vulnerability Assessment

Droughts can have a dramatic effect on the farms located throughout Dodge County. As a result of droughts, farmers have to irrigate crops in place to make up for necessary rainfall. Irrigation can negatively impact the environment by drawing water that naturally goes to aquifers and surface water. Drought can exacerbate the problem when high withdrawal rates versus little precipitation deplete water bodies and aquifer supplies, therefore decreasing drinking water supplies, drying streams, and hindering aquatic and terrestrial wildlife. During severe droughts some wells, mainly private, will go dry.

Droughts can trigger other natural and man-made hazards as well. They greatly increase the risk of forest fires and wildfires because of extreme dryness. In addition the

loss of vegetation in the absence of sufficient water can result in flooding, even from average rainfall, following drought conditions.

The following is a list of things that may be adversely affected by a drought. Much of these community assets can be referenced in Part II.

- Infrastructure-Municipal water supplies
- Surface Water- Groundwater reserves, recreation, and wildfire
- Forest
- Agricultural-Crops, livestock

The areas most susceptible to drought conditions would be agricultural towns. Agricultural land is scattered throughout the county but largely in the townships of Calamus, Leroy, Lomira, Oak Grove, Shields and Trenton.

Future Probability and Potential Dollar Losses-Drought
Based on frequency of past events, Dodge County can expect a drought every nine years, which is a probability of an 11 percent chance each given year. Significant severe drought is somewhat less common, affecting Wisconsin once about every 15 years.

Drought is another hazard lacking good loss figures at the county level. However, a look at aggregate data for the last two droughts can give some indication of potential impact. The last two major droughts in Wisconsin resulted in losses of $9.6 million (1976-1977) to $18 million (1987-1988) per county on average.

Hazard: Wildfire

Hazard Analysis
A wildfire is any instance of uncontrolled burning in brush, marshes, grasslands or fields lands. The causes of these fires include lightning, human carelessness and arson. Wildfires can occur any time of the day and during any month of the year, but the peak season in Wisconsin is normally from March through November. The season length and peak months may vary appreciably from year to year. Land use, vegetation, amount of combustible materials present and weather conditions such as wind, low humidity and lack of precipitation are the chief factors.

History of Wildfires in Dodge County

The National Climatic Data Center does not list any wildfires or forest fires for Dodge County. The Wisconsin Department of Natural Resources no longer keeps records of wildfires either.

Vulnerability Assessment
Dodge County has only 32,926 acres of woodland, or about six percent of the area, scattered throughout the County. However, Dodge County has 107,276 acres of wetlands with a majority of those wetland consisting of the both State and Federally owned Horicon Marsh, or about 19 percent of the area. The potential for property damage from fire increases each year as more recreational structures are developed on

wooded lands and along wetland boundaries and increased numbers of people use these areas.

Rural buildings may be more vulnerable because of lack of access. Access to buildings off main roads is sometimes long, narrow driveways with minimal vertical clearance making it hard for emergency vehicles to combat fires. These buildings also may not have much of a defensible space because of minimal space between the structures themselves and highly flammable vegetation.

Campgrounds are a concern because of campfires. Dodge County has four county-owned campgrounds and numerous privately owned campgrounds throughout the County.

Future Probability and Potential Dollar Losses – Wildfire
Wildfires are rare occurrences in Dodge County. Unfortunately, neither the Wisconsin DNR nor the National Climatic Data Center have any records of the wildfires that have occurred in Dodge County. Typically, according to the DNR, any wildfires are contained rapidly and remain small, so that each has a minimal impact.

Because of the relatively small impact and infrequent occurrences in the County, loss data is not tracked. This makes it difficult to develop an estimate of potential future dollar losses. However, as with any type of fire, the County should expect some fires to "get out of hand" and likely cause significant property damage. In addition to property damages and possible health hazards, suppression costs may become substantial as well.

Hazard: Earthquake

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

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

History of Earthquakes in Dodge County
Earthquakes that have affected Wisconsin from 1899 to 1987 are listed in Table 19. The most severe earthquake in Wisconsin was the recorded earthquake of 1811, centered along the New Madrid Fault. Most earthquakes that do occur in Wisconsin are very low in intensity and can hardly be felt. These very minor earthquakes are fairly common, occurring every few years. Events of moderate magnitude have occurred in locations in Illinois and Michigan. Those and other stronger earthquakes from other parts of the country have been felt primarily in southern Wisconsin.

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

Vulnerability Assessment

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

Future Probability & Potential Dollar Losses-Earthquake

The earthquake threat to Dodge County is considered low. Minor damage (e.g. cracked plaster, broken windows) from earthquakes has occurred in Wisconsin, but most often the results have been only rattling windows and shaking ground. There is little risk,

except to structures that are badly constructed. Most of the earthquakes that are felt and reported have been centered in adjacent and other states. The causes of these local earthquakes are poorly understood and are thought to have resulted from the still-occurring rebound of the earth's crust after the retreat of the last glacial ice.

Dodge County is not likely to suffer directly from a severe earthquake so the future probability and potential dollar losses could not be figured.

Hazard: Hazardous Materials Incident

Hazard Analysis

This type of hazard occurs with the uncontrolled release or threatened release of hazardous materials from a fixed site or during transport that may impact public health and safety and/or the environment.

Under the Emergency Planning Citizen Right to Know Act (EPCRA), a hazardous material is defined as any chemical that is a physical hazard or health hazard [defined at 29 CFR 1910.1200(c)] for which the Occupational Health and Safety Administration (OSHA) requires a facility to maintain a Material Safety Data Sheet (MSDA). Under EPCRA there is no specific list of hazardous materials. An extremely hazardous substance (EHS) is defined as one of 356 substances on the United States Environmental Protection Agency (EPA) list of extremely hazardous substances, identified at 40 CFR Part 355.

EPCRA of 1986 also known as SARA Title III, brings industry, government and the general public together to address emergency planning for accidental chemical releases. The emergency planning aspect requires communities to prepare for hazardous chemical releases through emergency planning. This provides essential information for emergency responders. The community right-to-know aspect increases public awareness of chemical hazards in their community and allows the public and local government to obtain information about these chemical hazards.

Fixed Facilities

As of 2005, 114 facilities reported that they had an extremely hazardous substance present at any one time in the amount equal to or exceeding the chemical-specific Threshold Planning Quantity (TPQ). Of these facilities, 42 indicated having substances subject to EPA reporting requirements. Most of the substances are used for retail and paper production.

The most common extremely hazardous substances at fixed facilities in the County are:

1. Sulfuric Acid
2. Anhydrous Ammonia
3. Chlorine

Highway

Trucks carry the bulk of hazardous materials to and through the County. Regular shipments of gasoline, propane, acid and other substances are delivered across Wisconsin. Every roadway in the County is a potential route for hazardous material transport, but major transportation routes are Federal and State Highways (See Map 3 Transportation Routes in Part II).

Railroad
The Wisconsin Southern Railroad, Union Pacific Railway, C.P.R.S. Railroad and Central Ltd. Railroad are another mode for the transportation of hazardous materials (see Map 3). Although trucks transport most of the hazardous materials in the state and U.S., rail can carry significant larger loads of hazardous materials.

No statistics are available regarding the types of extremely hazardous substances transported annually throughout Dodge County, but the potential exists for the transportation of any extremely hazardous substance listed on the U.S. EPA's list or OSHA's toxic and Hazardous Material List. These substances are transported in containers that range form ten-ounce agricultural packages to 196,000 pounds of rail car quantities.

Pipeline
Koch Pipeline Company provides a pipeline to move petroleum through the County. It runs northwest and is located in the southwest part of the County.

History of Hazardous Materials Incidents in Dodge County
Since 2004 Dodge County recorded two hazardous material spills. There have been many oil, gasoline, pesticide, acid, and other forms of toxic material spills in Wisconsin. Spills from fixed facility operations exceed incidents from transportation accidents. Eighty per cent of these spills involve petroleum products. Most of these spills consisted of small amounts of petroleum product that did not meet the reporting requirements. In most cases these incidents involved the response of a local municipal fire department.

The two hazardous material spills in 2004 were significantly more serious. One of the spills occurred at a fixed planning facility. The following Table 20 demonstrates the date, location and description of the spills.

Table 20	**Significant Hazardous Material Spills**		
Date	**Location**	**Description**	**Cost**
5/22/04	Highway 41	Overturned fuel tanker	$1,436.15
8/4/04	Seneca Foods	Hazardous materials spill of 2,500 gallons of sodium hydroxide.	$ 945.00

Source: Dodge County Office of Emergency Management

Vulnerability Assessment
Counties in Wisconsin, including Dodge County have Local Emergency Planning Committees (LEPC) that is set up in accordance with the federal legislation and is responsible for implementation of EPCRA at the county level. The County Emergency Management Director is a member of LEPC to ensure continuity and coordination of emergency response planning.

To meet the requirements of Title III of EPCA, LEPC developed the County Hazardous Material Response Plan. This plan establishes policies and procedures for responding to hazardous material incidents. LEPC is required to review, test, and update the plan every two years. Methods for notification and reporting an incident are outlined in the plan. This plan also works in conjunction with the County Emergency Operations Plan (EOP) where alert to the public, communications, and response procedures are outlined.

The plan is tested through tabletop, functional, and full-scale exercises and actual response situations.

To provide a high level of hazardous material response capabilities to local communities, Wisconsin Emergency Management contracts with eight Regional or "Level A" Hazardous Materials Response Teams. The Regional team for Dodge County is located in Madison, Dane County. The 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 spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies.

County or "Level B" Teams respond to chemical incidents which require a lower level of protective gear but still exceed the capabilities of standard fire departments. Currently, there are 36 counties that have a "Level B" team. Those teams may provide assistance to surrounding counties and are approved by the Local Emergency Planning Committees. Dodge County currently has a county or "Level B" Hazardous Response Team. The "Level B" team is made up of fire personnel from the Beaver Dam Fire Department and area volunteer fire departments.

A majority the fixed planning facilities in Dodge County are located within the City of Beaver Dam, with others being located in the cities of Fox Lake, Hartford, Horicon, Mayville and Waupun; the villages of Clyman, Iron Ridge, Lomira and Randolph; and the towns of Ashippun, Calamus, Elba and Emmet. Based on the location of the fixed facilities, the City of Beaver Dam has a higher probability of a chemical release. In addition, transportation of hazardous chemicals too and from these fixed facilities creates an increased chance of transportation related accidents.

Future Probability & Potential Dollar Losses-Hazardous Materials Incidents

Based upon historical data presented (frequency of past events). Dodge County can expect a significant hazardous material spill every once every 27 years on average. This equates to a probability of 0.04 or about a four percent chance each year. In addition to a significant event, the county can expect numerous smaller spills that often go unreported. These events still require resources and the response of local fire departments.

Historical data from hazardous material spills that have a known response cost, was used to determine an average response cost for a hazardous material spill. The two recorded incidents have associated response costs ranging from $945.00 to $1,436.15. Using this data, Dodge County can expect an average hazardous material response cost of $1,190.58. This potential cost is only reflective of the Hazardous Material Response Team; additional cleanup and disposal costs may apply. Costs of smaller, less significant spills are usually absorbed by fire departments and other first responder budgets. These costs are hard to estimate as they are seldom reported and recorded.