

CHAPTER 3: HAZARD INVENTORY

The hazard inventory chapter is divided into two parts: Natural Hazards and Manmade/Technological Hazards, defined by the Minnesota State Hazard Mitigation Plan.

Definition – Natural Hazard

Natural hazards are those presented by the physical world, rather than those presented by humans. In a natural hazard, there is an interaction between the physical world, the constructed environment, and the people that occupy them. Natural Hazards are primarily atmospheric or geologic.

Definition – Technological Hazard

Technological hazards are those presented by humans, rather than those presented by nature. They are comprised of substances and processes that are flammable, combustible, explosive, toxic, noxious, corrosive, oxidizers, irritants, or radioactive.

NATURAL HAZARDS – PRESENTED BY THE PHYSICAL WORLD

Introduction

Source: Minnesota State Hazard Mitigation Plan

Guarding against the unpredictable forces of nature has always been a goal of society. Ways to accomplish this goal include informing society of known hazards and constructing building environments to prevent serious damage from occurring. As the forces of nature can strike with unpredictable fury, there is always an element of risk associated with natural hazards. To inventory hazards that have occurred in Yellow Medicine County the Local Task Force committee identified hazards, established relationships between hazards, recognized current plans and programs in place to mitigate hazards, and highlighted gaps and overall deficiencies in current plans and programs.

For the purposes of this plan, natural hazards identified are organized into these groups:

1. Violent Storms

a. Winter Storms

Blizzards, Ice Storms, Sleet Storms, Heavy Snow or Snow Storm

b. Summer Storms

Thunderstorms, Lightning, Tornadoes, Hailstorms, Windstorms

2. Extreme Temperatures

Summer Heat, Winter Cold

3. Floods

4. Drought

5. Wildfires

6. Dam Failures

Violent Storms

Violent storms can occur throughout the year in Yellow Medicine County. For practical purposes violent storms are categorized as summer or winter storms although there is no sharp end or beginning to when they might occur.

Winter Storms

Yellow Medicine County experiences three basic types of winter storms: blizzards, heavy snow events and ice storms. Ice storms include freezing rain, freezing drizzle and sleet.

Blizzards Blizzards, the most violent of winter storms, are characterized by low temperatures usually below 20° Fahrenheit, strong winds in excess of 35 miles per hour, and blowing snow that creates visibility issues at one-quarter mile or less for at least three hours. Blowing snow leads to whiteouts and drifting on the roadways, causing stranded motorists and the difficulty or inability of emergency vehicles to respond to incidents. While blizzards can occur in Yellow Medicine from October through April, they most commonly occur from November through the end of March.

Ice Storms Freezing rain, the most serious of ice storms, occurs during a precipitation event when warm air aloft exceeds 32°F while the surface remains below the freezing point. When precipitation originating as rain or drizzle contacts physical structures on the surface, ice forms on all surfaces creating problems for traffic, utility lines, and tree limbs.

Sleet Storms Sleet forms when precipitation originating as rain falls through a rather large layer of the atmosphere with below freezing temperatures, allowing raindrops to freeze before reaching the ground. Sleet is also commonly referred to as ice pellets. Sleet storms are usually of shorter duration than freezing rain and generally create fewer problems.

Heavy Snow or Snowstorm In Minnesota, six or more inches of snow in a 12-hour period or eight or more inches of snow in a 24-hour period defines a heavy snow event. Snow is considered heavy when visibility drops below one-quarter mile regardless of wind speed.

Table 29. Yellow Medicine County Winter Events from 1993 - 2013

Winter	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Number of Events	5	4	10	9	1	4	1	7	3	2
Winter	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Number of Events	4	2	3	1	3	7	7	10	1	7
Events include: blizzards, winter storm, heavy snow, blowing snow, ice storm, glaze, low and extreme wind chills										

Source: National Climatic Data Center – Event Query 2014

History of Winter Storms in Yellow Medicine County

The winters of 1995–1996 and 1996–1997 were exceptionally extreme. In the season of 1995-1996, four blizzards were reported. Three blizzards were reported in 1996-1997. In addition, heavy snow, high wind and winter storms made these two winters difficult for Yellow Medicine County. There were many school cancellations and high costs to remove snow. The winter of 1996-1997 was declared a Presidential Disaster because of the snow emergency. Snow removal was extremely expensive because of the large amounts of snow, which damaged and destroyed buildings. In Echo, the community center roof collapsed after the snow load in 1997.

The two weather stations used in and near Yellow Medicine County are located in Canby and Montevideo. Table 33 and 34 shows the snowfall extremes for these two weather stations. Canby had a record season of 87.7 inches of snowfall in 2010-2011. The blizzard of January 17 and 18 in 1996 dropped record amounts of snow.

Table 31. Yellow Medicine County Snowfall Extremes by Month from 1951 - 2013

Month	Canby		Montevideo	
	High (in)	Year	High (in)	Year
January	29.0	1979	33	1982
February	29.0	2011	28	1962
March	36.0	1951	44	1951
April	31.5	2008	23.5	2013
May	1.5	1954	1	1954
June	0	-	0	-
July	0	-	0	-
August	0	-	0	-
September	0	-	0	-
October	6.0	1976	6	1991
November	25.5	1975	25	1985
December	33.5	2009	32.5	2010
Season (Jul-Jun)	87.7	2010-2011	82.2	1983-1984

Source: Midwest Regional Climate Center 2014

**Table 32. Yellow Medicine County Largest One-day Snowfall
in Canby and Montevideo from 1951 - 2013**

Month	Canby		Montevideo	
	1-Day Max (in)	Date	1-Day Max (in)	Date
January	10	1/11/1975	12	1/18/1996
February	12	2/21/2011	12	2/21/2011
March	16	3/15/2002	14	3/3/1989
April	14	4/26/2008	8	4/11/2013
May	1	5/2/1954	1	5/2/1954
June	-	-	-	-
July	-	-	-	-
August	-	-	-	-
September	-	-	-	-
October	4	10/24/1995	6	10/31/1991
November	16	11/20/1975	12	11/28/1983
December	14	12/1/1981	12	12/9/2012
Season (Jul-Jun)	16	3/16/2002 & 12/1/1981	14	3/3/1989

Source: Midwest Regional Climate Center 2014

Relationship to Other Hazards – Cascading Effects

Because most of Yellow Medicine County is relatively flat, dangerous winter conditions are created when the wind blows including drifting, white outs and wind chills. Drifting and blizzard conditions can occur even if there are no new snow accumulations. During the winter of 1996-1997, drifts were higher than most street vehicles.

The winter of 1996-1997 also contributed to record spring flooding. This event is discussed in the flooding section.

Summer Storms

Thunderstorms Thunderstorms are the most common summer storm in Yellow Medicine County, occurring primarily during the months of May through August with the most severe storms most likely to occur from mid-May through mid-July. Thunderstorms are usually localized and produced by cumulonimbus clouds, always accompanied by lightening, and often have strong wind gusts, heavy rain, and sometimes hail or tornadoes.

Lightning While windstorms and tornadoes are significant hazards associated with severe thunderstorms, lightning is the most frequent hazard associated with thunderstorms and the hazard that results in the greatest loss of life. Lightning occurs to balance the difference between positive and negative discharges within a cloud, between two clouds and between the cloud and the ground. For example, a negative charge at the base of the cloud is attracted to a positive charge on the ground. When the difference between the two charges becomes great enough a lightning bolt strikes. The charge is usually strongest on tall buildings, trees and other objects protruding from the surface. Consequently, such objects are more likely to be struck than lower objects.

While cloud-to-ground lightning poses the greatest threat to people and objects on the ground it actually accounts for only 20 percent of all lightning strikes. The remaining lightning occurs within the cloud, from cloud to cloud, or from the ground to the cloud. Within-cloud lightning is the most common type.

Tornadoes Tornadoes are the most violent of all storms. A tornado is a rapidly rotating column of air, spawned by a cumulonimbus cloud. When it drops to the ground it can create significant damage and loss of life. Tornadoes always occur in association with thunderstorms. While somewhat more common in southern Minnesota, they have occurred in all counties in the state.

Tornadoes are most likely to occur during warm, humid spells during the months of May, June, July, and August but have occurred as early as March and as late as November in Minnesota. On occasion tornadoes called cold air funnels occur after the passage of a cold front when air is much less humid but the air aloft is very cold creating enough instability to make funnel clouds. Most tornadoes occur during the warm part of the day – late afternoon or early evening; over 80 percent of tornadoes occur between noon and midnight.

The tornado's path typically ranges from 250 feet to a quarter of a mile in width. The speed of a tornado varies but commonly is between 20 and 30 mph. However, larger and faster tornadoes have occurred in Minnesota. Most tornadoes stay on the ground for less than five minutes. Tornadoes frequently move from the southwest to the northeast but this, too, is variable and consequently cannot be counted on in all instances.

Hailstorms Hail is considered ice and is a result of severe thunderstorms. Hail is formed when strong updrafts within the cumulonimbus cloud carry water droplets above the freezing level or when ice pellets in the cloud collide with water droplets. The water droplets freeze or attach themselves to the ice pellets and begin to freeze as strong updraft winds toss the pellets and droplets back up into colder regions of the cloud. Both gravity and downdrafts in the cloud pull the pellets down, where they encounter more droplets that attach and freeze as the pellets are tossed once again to higher levels in the cloud. This process continues until the hailstones become too heavy to be supported by the updrafts and fall to the ground as hail.

Most hail in Minnesota ranges in size from pea-size to golf-ball sized hail. Larger hailstones have been reported but are much less common. Strong updrafts are usually associated with severe thunderstorms. The area covered by individual hailstorms is highly variable because of the changing nature of the cumulonimbus cloud. While almost all areas of southern Minnesota can expect some hail during the summer months, most hail is not large enough to cause significant crop or property damage.

Windstorms Windstorms can and do occur in all months of the year but the most severe windstorms usually occur during severe thunderstorms in the warm months. These include tornadoes and downburst or straight line winds. Winds of greater than 60 mph are also associated with intense winter, spring, and fall low-pressure systems. These inflict damage to buildings and in some cases overturn high profile vehicles.

Straight-line Winds A downburst is a severe, localized downdraft from a thunderstorm or a rain shower. This outflow of cool or colder air can create damaging winds. Winds up to 130 mph have been reported in the strongest thunderstorms. Downburst winds can cause as much damage as a small tornado and are frequently confused with tornadoes because of the extensive damage they cause. As these downburst winds spread out they are often referred to as straight-line winds. They can cause major structural and tree damage over a relatively large area.

Strong winds combined with saturated soils can lead to wide spread loss of trees. This becomes a problem in communities when downed trees injure people, damage property, knock down power lines, or impede traffic. Downed power lines present a risk of electrocution or fire. Risks associated with downed trees can be managed through proper tree selection and proper maintenance programs. Some communities desire the look and feel of tree-shaded roads. This desire may lead a community to encourage the planting of trees that are too large for the boulevards, resulting in a greater risk of property damage.

History of Summer Storms in Yellow Medicine County

At one time or another Yellow Medicine County has experienced all of the summer storms described above. Thunderstorms, hail storms, and windstorms are relatively common and can, among other things, topple trees, cause destruction to homes, and destroy agriculture crops. Table 33 lists the number of summer storm events between 1955 and 2013, as reported by the National Climatic Data Center. The average number of each type of events per year in Yellow Medicine County is also calculated.

Table 33. Yellow Medicine County Summer Storms from 1955 - 2013

	Thunderstorm Wind 1955-2013	High Wind 1955-2013	Hailstorms 1955-2013	Tornadoes 1955-2013
Events	50	13	57	17
Years	58	58	58	58
Average per year	0.86	0.21	0.98	0.29

Source: National Climatic Data Center – Event Query 2014

According to the Storm Database, the county has experienced 17 tornadoes since 1955, as well as three funnel clouds. Of the nineteen tornadoes, nine were classified as F0, six were classified as F1, one was classified as F2, two classified as F3 and one classified as F4. Significant damage was done to Clarkfield from an F3 tornado and to Granite Falls from a F4 tornado. Many of the tornadoes occurred in rural areas and did little damage; however some of the destructive tornadoes destroyed farm buildings and downed trees. Straight line winds have also caused damage in Yellow Medicine County.

Granite Falls Tornado. A destructive and deadly tornado struck the city of Granite Falls (Yellow Medicine County) on July 25, 2000. One person was killed, over a dozen injured, and millions of dollars of damage was done to residences, businesses, and public facilities.

The tornado first touched down in rural Yellow Medicine County, eight miles west, and three miles north of Granite Falls. The tornado lifted before exiting Granite Falls, leaving the most concentrated damage path two miles long, and 500 feet wide, through a primarily residential area of Granite Falls. Most of the damage in Granite Falls was caused by F2 to F3 wind speeds. However, this tornado was classified as a minimal F4 tornado, based on the twisted wreckage of an overturned railroad car near the intersection of 9th Ave. and 14th St. in Granite Falls.

Clarkfield Tornado. On June 16, 1992, an F3 tornado hit the south part of Clarkfield turning one house completely upside down and ripping siding off many homes. Late afternoon on the 16th spotters were called out to watch for tornadoes and they called in to report a tornado touch down west of Clarkfield. This tornado damaged several buildings south and west of Clarkfield. The damage included several destroyed barns and buildings and was set back on the foundation.

Police Chief Hill had received notice that a second cell of activity could be approaching the city and should be expected around 11:00 p.m. The fire department was prepared to return to their spotting locations and watch for dangerous activity later that evening. While waiting for that cell to arrive, another cell of activity developed without warning. At 9:33 p.m. a tornado struck the city of Clarkfield. There had been no advance notice that anything was in the area and warnings had not been issued. The Police Chief immediately radioed for assistance and at that time, there was not a relay system to set off the sirens in Clarkfield. A firefighter tried to get to city hall to set off the alarms but the power went out. Without an emergency back-up system, the siren was useless.

A flurry of activity began as power companies arrived to cut power to the downed lines. Neighboring fire departments arrived to assist the local fire department with their house-to-house search to make sure residents were safe. Emergency crews were surprised to find no one was seriously injured. Deputy Blackwelder arrived to assist with setting up an emergency center at city hall. When daylight arrived the next morning, the city was a flurry of activity as people were finally able to view the devastation and begin the cleanup.

A majority of the homes and businesses in the city were damaged and emergency workers estimated \$7 million worth of damage was inflicted on the community. During the remainder of 1992 and in 1993, \$2,350,000 worth of building permits were issued in the city of Clarkfield as residents worked to recover from the tornado damage.

Relationship to Other Hazards – Cascading Effects

Flooding. Thunderstorms and heavy rain can cause flooding and property damage as well as disrupt emergency response, transportation, and communication.

Transportation, Emergency Services, and Utility Disruption. Violent storms of all types can cause property damage, loss of life, personal injury, disrupt transportation, communication, and emergency services, and threaten public health and safety. Summer storms can present significant threats to essential public infrastructure and services such as power, water supply systems, and sanitary systems. Utility disruptions, in particular, are most likely to occur if a violent storm were to destroy an “electrical center” located in cities. It could take up to a full day to restore communication power, pending the service provider.

Fire. The storms listed above could knock down power lines, which could lead to fires.

Plans and Programs for all Severe Storms

Severe Storm Spotters Network. This program, sponsored by the National Weather Service (NWS), enlists the help of trained volunteers to spot severe storm conditions and report information to the NWS. No tornado warning is given unless the storm has been spotted by someone or is confirmed by NWS radar reports. Yellow Medicine County has trained all fire departments, law enforcement and emergency management personnel in severe weather conditions. An additional 60 civilian severe weather spotters are trained and recertified each year and report directly to the NWS and the local dispatch when severe weather is observed.

Severe Weather Awareness Week. Each spring Yellow Medicine County Emergency Management personnel conduct a severe weather-training workshop for schools, hospitals and nursing home personnel.

Severe Weather Shelters. Most parks in Yellow Medicine County do not have safe shelters for severe weather. Timm Park with 22 campsites, north of Wood Lake, does not have a safe place for campers to go in the event of an emergency.

Windbreaks. MnDOT and the Yellow Medicine County Soil and Water Conservation District have been promoting a living snow fence program. Strategically planted strips of trees, shrubs and/or native grasses can use natural snow fences to protect highways and dramatically reduce blowing and drifting snow. MnDOT has worked with the USDA to access CRP resources to help implement this program.

Live Weather Conditions. All schools in the county have computer access to online weather radar.

Phone call system.

Severe Weather Warning System. The county’s cities have emergency sirens to warn residents in the event of severe weather. Yellow Medicine County dispatch center has its own radar to track weather. The system is very old and may need to be updated.

Publication “The Right Tree”. Minnesota Power has published The Right Tree. This handbook can be useful in selecting proper trees - especially around power lines. Proper maintenance of trees can also prevent problems. DNR forestry staff, as well as private consultants, is available to work with communities to develop community forestry programs.

Hourly Data. Hourly weather data is available online from various websites, including the MnDOT Website.

Gaps and Deficiencies

- There are homes in the county that lack basements that would provide shelter in the event of a tornado or damaging winds from a severe thunderstorm. Moreover, some of the county's nursing homes do not have basement shelters or other suitable shelter for residents. In the event of a violent storm residents are moved to an interior hall away from windows.
- The manufactured home park in Canby does not have a safety shelter on-site. They do have an evacuation plan, but the city has not approved the plan. In Yellow Medicine County there is no city that requires an on-site shelter for mobile home park residents in case of severe weather. The county is recommending that communities require shelters for mobile home park residents or provide information on evacuation routes to safe shelters elsewhere.
- There may be areas beyond the broadcast range of the weather radio. It should be determined if additional towers are needed so that rural residents are not outside the range of the severe weather warning system sirens.
- Local radio stations do provide warnings but are effective only if tuned into by residents.
- Most power lines in the county are above ground and subject to damage from ice storms, wind and falling tree limbs. There are few community requirements that discourage the planting of large trees near power lines.
- In many communities, the local city hall is the emergency operations center. However, most are not able to access a backup power source.

Extreme Temperatures

Located in the center of the continent, Minnesota and Yellow Medicine County experience the extremes of summer heat and winter cold. Summer temperatures in Yellow Medicine County have been as high as 110° F on several occasions while winter temperatures have been as cold as 39°F below zero. Both heat and cold pose risks for people, animals, equipment, and infrastructure.

History of Summer Heat in Yellow Medicine County

The average July maximum temperature in most of Yellow Medicine County is about 85°F. July is the warmest month. On average the county experiences 23 days of 90 degrees or higher during a summer. The all-time recorded high is 111° F in Canby, which occurred in 1936.

Table 34. Yellow Medicine County Temperature Extremes

	Highest Temp	Date	Lowest Temp	Date
Canby	111°F	July 12, 1936	-33°F	January 22, 1936
Montevideo	110°F	July 31, 1988	-39°F	February 16, 1936

Source: Midwest Regional Climate Center 2014

While summers are typically warm but pleasant in Yellow Medicine County, it is not uncommon to experience high dew points and temperatures in the 90s for several days in a row. Extended periods of warm, humid weather can create significant risks for people, particularly the very young, those that are ill, and seniors who may lack air conditioning and proper insulation or ventilation in their homes. Animals are also at risk during extended periods of heat and humidity.

Heat Index has been developed as a measure that combines humidity and temperature to better reflect the risk of warm weather to people and animals. The index measures the apparent temperature in the shade. People exposed to the sun would experience an even higher apparent temperature. A heat index of 105°F is considered dangerous. With prolonged exposure, it could result in heat stroke, heat exhaustion, and heat cramps. People are reminded to use extreme caution when the heat index is between 90° and 105°F. A heat index of 90°F occurs when the temperature is 90°F and the relative humidity is 50 percent. This is more of a problem when these conditions are present for several days in a row, allowing buildings to become hotter and hotter as the conditions persist.

According to the State Climatologist, there is some evidence that current dew points are not only higher but are occurring with greater frequency than was true in the past. If that is true, Yellow Medicine residents can expect an increasing number of hours with heat indexes in the danger category.

History of Winter Cold in Yellow Medicine County

On average, January is the coldest month, with daytime highs of averaging 24° F and nighttime lows of 5°F. Table 37 describes the lowest temperatures reached in Yellow Medicine County. However, these averages do not tell the entire story. Maximum temperatures in January have

been as high as 67°F and minimums as low as -39° F below in Yellow Medicine County. The winter months on average produce about 34 days of 0° F or lower.

Cold weather is often accompanied by winds creating a dangerous wind chill effect, putting both people and livestock at risk. Most of the county is at risk of this kind of weather because of its relatively flat, open character. More wooded, hilly areas of the county are less severely affected by wind chill. Wind chills of -35°F and lower can present significant risk, particularly if people are not properly clothed or protected. A -15°F air temperature with wind speeds of 10 miles per hour creates a wind chill of 35 degrees below zero. Under these conditions, frostbite can occur in just minutes on exposed skin.

Relationship to Other Hazards – Cascading Effects

Violent Storms. Temperature extremes are often associated with weather extremes such as snowstorms and blizzards.

Drought. Extended high temperature extremes can phase into drought.

Wildfire. Dry, hot conditions can increase the risk of wildfires.

Collapsed Structures. Structural weakness results from building material failure, settling, and other factors. Tornadoes, floods, high winds, snow, heavy rainfall, may cause major damage to structures.

Utility Failure. Heavy utility use to heat or cool buildings can cause utility damage or failure.

Plans and Programs for Extreme Temperatures

The following programs and projects are in addition to the ones already mentioned for violent storms:

School Closings. The county's school districts each have their own school closing policy. The superintendents decide when to send students home based on current weather forecasts. Local radio stations partner with the districts to make sure school closure announcements are out by 6:00 a.m. or earlier.

Heat Advisories. The local radio and TV media in concert with the National Weather Service issues a heat advisory when the combination of temperature and humidity create risks for people and animals. A heat index of 105 to 114° F warrants a heat advisory. This occurs when air temperature reaches 95°F and the relative humidity is 50 percent. An excessive heat warning is issued when the heat index reaches 115°F. This occurs with an air temperature of 95°F and relative humidity of 60 percent. An index of 115° F or higher creates severe risk for both humans and animals.

Wind Chill Warnings. The local radio and TV media collaborate with the National Weather Service and issue wind chill warnings when temperatures are 30° F or below. Severe wind chill warnings are provided when conditions warrant and when severe risk and safety is a factor. Wind chills of -40°F or lower frequently prompt the closing of schools to protect children, particularly those that might have to wait outside for extended periods of time.

Hourly Data. Granite Falls Airport has an AWAS system in place as of October 2003.

Program Gaps or Deficiencies for Extreme Temperatures

- Some of the schools in the district have an automated weather station providing current weather conditions. Additional stations at schools throughout the county would provide more current information and quicker response to dangerous and changing weather conditions.

Flooding

A flood is defined as an overflowing of water onto an area of land that is normally dry. For floodplain management purposes, the Federal Emergency Management Agency (FEMA) uses the following definition of "100-year flood." Other water hazards considered in this section include flash floods and washouts.

The term "100-year flood" is the flood elevation that has a one percent chance of being equaled or exceeded each year. Thus, a 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on a map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage. One-hundred year floodplains have been identified, mapped and used for further analysis using the county's Geographic Information Systems (GIS).

Floods generally occur from natural causes, usually weather-related, such as a sudden snowmelt, often in conjunction with a wet or rainy spring or with sudden and very heavy rain falls. Floods can, however, result from human causes such as a dam impoundment bursting. Other water-related hazards include wash-outs and ice freezes that affect dams and culverts. In the spring of 2009, a great amount of water overflowed roads, causing a major washout and road closures throughout the county.

History of Flooding in Yellow Medicine County

Flooding in the county occurs primarily in the spring during periods of peak conditions (rainfall and snowmelt) and in areas where the soil has low permeability qualities. Damages are mainly confined to the Yellow Medicine and Lac qui Parle watersheds. According to estimates by the U.S. Army Corp of Engineers and Soil Conservation Service, there are approximately 27,657 acres in the 100-year floodplain within the Lac qui Parle and Yellow Medicine watersheds. Within the Lac qui Parle watershed, average annual damages resulting from flooding amount to about \$390,030. In the Yellow Medicine River watershed annual damages amount to about \$471,080. These figures were determined using 1985 cost benefit figures. Therefore, the damage figures given are underestimated in today's economy.

In Yellow Medicine County, there are large flood plains associated with the confluence of Canby and Lazarus Creeks, and the confluence of Spring Creek and the Yellow Medicine River. It would be appropriate to evaluate flood risk for these areas. The MnDNR strongly encourages relocation of homes and retirement of farmland within the floodplain.

Granite Falls Flood History.

Source: Granite Falls Flood Mitigation Plan 2001

Floods on the Minnesota River at Granite Falls occur mostly in the spring from snowmelt runoff. Low level flooding (considered as events with estimated frequency between 10 and 25 years) impact areas directly adjacent to the main river channel. Flood fighting for low level events is based more on individual efforts than on community-wide efforts. At flood stage (approximately 25-year frequency event), river flows are split between the main river channel and a secondary river channel along the westerly and southerly edge of the city.

The flood of record on the Minnesota River at Granite Falls occurred in April 1997. This flood had a peak discharge of approximately 53,000 cubic feet per second (cfs) at Granite Falls. This was measured at the Minnesota Falls Dam, located on the Minnesota River approximately 2.7 miles below the confluence of the secondary channel and the main river channel (Reference 1). Distribution of flows were estimated at 40,000 cfs in the main channel and 13,000 cfs in the secondary channel (Reference 2). A similar event occurred in the spring of 2001. While not reaching the same levels as the 1997 event, the magnitude on flows and impact to the community were similar.

Flood fighting efforts in the Granite Falls area during the last two floods consisted of hundreds of volunteers filling hundreds of thousands of sandbags and building sandbag levees around homes and businesses. Many agencies were involved in the previous two flood fights including the US Army Corps of Engineers, Minnesota National Guard, National Weather Service, US Geological Service (USGS), Minnesota Department of Transportation (MnDOT), and state, county and local officials. Flood fighting itself carries significant risks for the volunteers. Levee heights reach as high as ten feet. Volunteers worked day and night adjacent to the flooded Minnesota River, flowing at dangerous levels, with very fast velocities of eight to ten feet per second (12 to 15 miles per hour), and at a water temperature just above freezing. In 2001, a total of 620,000 sandbags were filled and placed with volunteer labor, with 550,000 sandbags used to construct levees.

In 1997, the city spent \$852,086 for flood fighting efforts and cleanup (cost figures provided by city staff). Over \$175,000 was spent by the US Corps of Engineers in construction contracts to fight the floods in 1997 (Reference 6). An estimated \$3.1 million was prevented from damage from the 1997 flood due to flood fighting activities (Reference 6). In 2001, the city spent \$437,115 for flood fighting efforts and cleanup (cost figures provided by city staff). The US Corps of Engineers awarded temporary levee construction contracts in 2001 totaling \$112,250 for Granite Falls. Other large floods occurred in April 1952 (25,300 cfs), April 1969 (43,000 cfs), and April 2001 (cfs uncertain but likely between 34,600 and 43,000). Significant flood events occurred in June 1919, April 1951, April 1965, and March 1994. It should be noted that ice flow

or frazzle ice have exacerbated flooding impacts in the city on some occasions during spring flows.

Flood fighting efforts as a result of flooding over the past four years has cost hundreds of thousands of dollars, extensive property damages, economic hardship, and has carried a significant risk for the volunteers involved in the flood fighting efforts. In 1997 and 2001, Granite Falls experienced floods, residential property damage and the forced evacuation of people from their homes. The total private property damages for the 2001 floods, based on estimates by the county assessor's office, were in excess of \$150,000.00. Damage to public structures amounted to \$1.5 million.

Figure 2. NCDC & DNR Flood Summaries

**Flooding Reports from the
National Climatic Data Center
(NCDC) Storm Event
Database**

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

Flash Flood: August 20, 2002
Nearly seven inches of rain fell in extreme northeastern Yellow Medicine County, on the southern outskirts of Montevideo. Three roads were flooded with two to three feet of water, and a few basements were flooded.

**DNR Waters Summary on Climatic Conditions that led to the
1997 and 2001 flooding**

See Appendixes 3 & 4 for complete report

1997 Floods Factors

- 1) Heavy autumn precipitation
- 2) Extraordinary winter snowfall
- 3) Less than ideal snowmelt scenario
- 4) Heavy early spring precipitation

2001 Floods Factors

- 1) Significant autumn precipitation
- 2) Heavy winter snowfall
- 3) Less than ideal snowmelt scenario
- 4) Record-breaking April precipitation

Figure 3. NCDC 1997 & 2001 Flood Reports

Flooding Reports from the National Climatic Data Center (NCDC) Storm Event Database

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

100-year flood in 1997

Above normal temperatures during the last week of March began melting a deep snow cover across much of west central into parts of central Minnesota. Snow depth rank was in the 80 to 90th percentile over the area as measured on 3/20/97. The snow cover had high moisture content. In addition, several storms deposited additional rain and snow over the area on 3/24/97 and 4/5/97. The flooding resulted in severe losses to both public and private property. Damage was extensive to roads, bridges, culverts, agricultural drainage areas, homes and businesses. Drainage ditches and culverts plugged with snow and ice resulted in sporadic flooding. Scattered road closures were a result of the spring thaw as well. Many smaller rivers also overflowed their banks resulting in road closures and structural flooding.

The river remained above flood stage until mid May. Flood stage of the river in Montevideo was 14 feet which was reached on 4/2/97. The river crested at 23.9 feet on 4/7/97 establishing a new record crest in Montevideo. Other monitoring points along the Minnesota River reached crests that were at 3rd or 4th all time record levels, including Mankato, Henderson, Jordan, Shakopee and Savage.

Minnesota River flooding resulted in severe losses to public and private property. An early spring storm brought heavy rain, snow and high winds to the area on 4/5-6/97 at the peak of the flooding, severely aggravating the situation. Many roads were closed in the Montevideo and Granite Falls areas. Firefly Creek Casino closed due to lack of road access. Yellow Medicine County museum flooded on 4/5/97. Sanitary sewer lift station failed in Montevideo causing sewage backup into homes. Four hundred residents were evacuated. Up to 150 homes in Montevideo reported flooding to some degree. Sewer backups also reported in Watson and Clarkfield. Highway 212 bridge collapsed west of Granite Falls.

More than 60 homes evacuated in Granite Falls. Flood waters knocked out Granite Falls water treatment plant, forcing water rationing. Schools were closed in districts close to the Minnesota River. At one point, only one bridge (Highway 4 in Fairfax) spanning the Minnesota River was still open between Mankato and the South Dakota border.

The Minnesota River remained in flood stage through mid May. The river first went above flood stage in late March. Peak crests of the river were reached during the first two weeks of April. The crest at Montevideo reached 23.9 feet on 4/7/97 which set a new record crest. Minnesota River flooding resulted in severe losses to public and private property.

100-year flood in 2001

Heavy snowfall during winter remained on the ground through the end of March and then rapidly melted, resulting in river stages close to record levels. Water began to gush through drainage ditches, streams and into the mainstream rivers during mid-day April 1. Heavy rain April 7-8 over much of central Minnesota prolonged the high water and also added one or two feet to many crests during mid-April. Another period of heavy rain April 22-23 caused rivers to crest again in late April and early May; in some cases the crest was higher than the first. Many rivers remained well above flood stage into mid-May. The crest at Montevideo on the Minnesota River was the second highest ever, only 1.3 feet lower than in 1997.

Numerous roads and bridges were closed millions of sandbags used, and approximately 200 homes and businesses were partially submerged with flood waters. About 100 homes and businesses were damaged beyond repair.

Snowmelt flooding that began April 1 continued into early May on the major rivers: the Minnesota, St. Croix, Crow River, South Fork of the Crow River, and the Mississippi River below its confluence with the Minnesota River. The last of the river levels finally went below warning criteria on May 8.

Add TABLES regarding 1997 and 2001 flooding events

Info on 2014 Flooding

Relationship with Other Hazards – Cascading Effects

Hazardous Materials. Structures that house hazardous materials may be flooded causing leaks or transportation routes may be washed out, causing overturned vehicles.

Infectious Disease. Water issues often translate into issues around infectious diseases. Water contamination and wastewater removal many times go along with flooding issues. Diseases such as hepatitis A, giardia, cryptosporidium, and West Nile virus are potential hazards that have direct links to water.

Transportation, Emergency Services, and Utility Disruption. Violent storms of all types can cause property damage, loss of life, personal injury, disrupt transportation and communication and emergency services and threaten public health and safety and be significant threats to essential public infrastructure and services such as power, water supply systems and sanitary systems.

Landslide and Debris Flow. There were issues with debris flow and bridge damage in the floods of 1997 and 2001. It was difficult to keep the rivers and drainage ditches clear and therefore backup of floodwaters occurred.

Destabilized stream banks are related to flooding. As rivers evolve they carve out a channel adequate to handle typical peak flows (1-2 year flood events). As landscape hydrology alters, higher peak flows carve out larger channels. Unfortunately, this often results in riverbanks being destabilized. Across the region these unstable banks have threatened farmlands, roads and homes. Bank stabilization projects are expensive and often only shift the problem to a different place along the stream. Long term mitigation for riverbank stabilization is 1) holding water on the landscape and 2) proper setback of infrastructure and building from rivers.

Debris flow includes downed trees being carried by floodwaters. These trees caused problems at various bridges over the Minnesota River in the last round of major flooding. The trees ran into bridges and got caught forming logjams. Contractors lifted the trees over bridges and returned them to the river downstream of the bridge, with the end result of trees floating to succeeding bridges to be lifted over again. Large flood events can and do kill trees within the flood plain, including large cottonwood and maples. In subsequent flood events these standing dead trees can be knocked down and washed away, causing havoc to communities and counties.

Plans and Programs for Floods

County Flood Area Map and Controls. The current county Flood Insurance Rate Maps (FIRM) to identify the 100-year flood areas as shown in Figure 5 (Chapter 4 pg. 20). The county zoning ordinance controls the permitted land uses in these areas which describes what can be built and how [refer to Yellow Medicine County Land and Related Resource Management Ordinance].

Granite Falls Flood Map and Control. Granite Falls has identified 100-year flood areas on its official land use map and adopted in its zoning ordinance a floodplain ordinance which identifies appropriate zoning and land use controls governing these areas as shown in Figure 20 (Chapter 4 pg. 62-63).

Operations Center. The emergency operations center for the county has been moved to the basement of the new Law Enforcement Center located in Granite Falls, MN.

Program Gaps or Deficiencies for Floods

- DNR forestry staff suggest that the costs and hazard associated with downed trees as debris flow might be mitigated through improved “sanitation cutting” in the floodplain. There are provisions within the Reinvest in Minnesota (RIM) set aside program that allows limited timber cutting on lands enrolled in the program. However, the cutting must be allowed in a timber management plan prepared by a DNR Forester. Soil and Water Conservation Districts and landowners have not been utilizing this aspect of the RIM program.
- Some county roads, including 266th Avenue, have been completely submerged when the MN River rises above the river bank.

Drought

Drought is defined as a prolonged period of dry weather or a lack of rainfall.

History of Drought in Yellow Medicine County

Yellow Medicine County has experienced prolonged periods without rainfall. The most severe in climatic records occurred during the 1930s. There has not been a drought so prolonged since.

Record low precipitation for the summer in Canby was 2.95 inches in 1950 and in Montevideo, 3.46 inches in 1976. Record low for the month of July in Canby was .13 in 1947 and in Montevideo, 0.12 inches in 1936. Annual record low rainfall for both Canby and Montevideo was in 1976 and was 9.01 and 13.08 respectively.

Granite Falls receives its drinking water supply from the Minnesota River. In 1988, Granite Falls requested to hold back more water in order to prevent a shortage. This request was denied.

Individual shallow wells in the Granite Falls area have occasionally failed, requiring the affected parties to re-drill into reliable aquifers. The wells for the City of Granite Falls are not adequate and new sources are being explored.

Drought also gives way to insect infestation. Grasshoppers were abundant during the 1988 drought.

Drought of 1920's & 1930's. Perhaps the most devastating weather-driven events in American history were the droughts of the 1920's and 1930's, which significantly impacted Minnesota's economic, social, and natural landscapes. Abnormally dry and hot weather during the growing season throughout the better part of two decades turned Minnesota farm fields to dust and small lakes into muddy ponds. The parched soil was easily taken up by strong winds, often turning day into night. The drought peaked with the heat of the summer of 1936, setting many high temperature records that still stand today.

Drought of 1974-77. Drought-like conditions began in the winter of 1974 and extended through the summer of 1977. The dry conditions of these years lowered water levels in wells and caused record low stream flows throughout the state. Late summer forest fires broke out, and conflicts arose between domestic well owners and neighboring high capacity well owners. The DNR Division of Waters formulated new policies to resolve these resource management problems and user conflicts. Many of these new policies formed the basis of subsequent amendments to agency rules and state statutes.

Drought of 1987-89. The warm, dry winter of 1986-87 was the beginning of this period of little rainfall and extreme dryness. Drought conditions became very serious in mid-June 1988 when Mississippi River flow levels threatened to drop below the Minneapolis Water Works intake pipes at the city of Fridley. Below normal precipitation coupled with declining lake levels, ground water levels, and stream flow to create statewide concern. To facilitate coordination of drought response actions, a State Drought Task Force was convened by the director of the Division of Waters. The State Drought Task Force brought together local, state, and federal officials to share information and coordinate drought response strategies. Several actions were taken following the summer of 1988 to better prepare the state for the next drought. The Governor appointed a "Twin Cities Water Supply Task Force" specifically to make recommendations on how to meet future water demands in the event of low flow conditions on the Mississippi River. The Corps of Engineers initiated review of its operating plans for the Mississippi River headwaters reservoirs, and the 1989 legislature charged the Metropolitan Council with preparing water use and supply plans for the metropolitan area. In the summer of 1988, rains finally came in August, but not soon enough to save agriculture crops.

Drought of 2003. For a three-month period from mid-July through mid-October, a stubbornly persistent weather pattern resulted in extremely dry weather across the state of Minnesota. Few widespread rain events moved through the state during this time period and precipitation totals were less than six inches across much of Minnesota. Total rainfall for the mid-July through mid-October period fell short of historical averages by four or more inches in many areas. Rainfall deficits exceeded seven inches in parts of southeastern Minnesota. When compared with other July 15 through October 20 time periods in the historical database, mid-July through mid-October 2003 rainfall totals rank among the lowest on record for many areas of south central and southeastern Minnesota, as well as a small portion of west central Minnesota.

Yellow Medicine County traditionally sees "Abnormally Dry" weather with pre-drought conditions annually. Between 2000 and 2010, three droughts occurred countywide. The first took place from September 2003 to June of 2004 categorized as a "Moderate Drought", followed by another "Moderate Drought" from the end of July 2006 to end of August 2006. The final drought occurrence varied between a "Moderate Drought/Severe Drought" from the end of July 2007 to mid-September 2007.

Relationship with Other Hazards – Cascading Effects

Wildfires. Woods, brush land, and non-cultivated fields stressed by drought, significantly increases the risks of wildfire.

Plans and Programs of Drought

Water Plan. The current Yellow Medicine County Comprehensive Water Plan identifies major and minor watersheds serving the county.

Water Consumption Use. Semiannual or annual water consumption by various major consumers, urban residential, industrial/commercial or agricultural, is documented through water meters.

Program Gaps and Deficiencies for Droughts

- County has no estimates of annual recharge rates or the capacities of the various aquifers.
- Semiannual or annual water consumption by various major consumers, urban residential, industrial/commercial or agricultural, is not documented or known.
- Water conservation provisions and use restrictions in times of drought are not included in the county ordinance or in all city ordinances.
- The current county water plan recommends wellhead protection standards for adoption via ordinance by Yellow Medicine County, but has yet to be implemented. Lincoln-Pipestone is currently working on a rural Water Burr Well Field Wellhead Protection program.

Wildfire

A wildfire is an uncontrolled fire spread through vegetative fuels, posing danger and destruction to property. Wildfires can occur in undeveloped areas and spread to urban areas where structures and other human development are more concentrated. While some wildfires are started by natural causes such as lightning, humans cause four out of every five wildfires. Burning debris, arson, and carelessness are the leading causes of wildfires. As a natural hazard, a wildfire is often the direct result of a lightning strike that may destroy personal property and public land areas, especially on state and national forest lands. The greatest risks of wildfires are the destruction of timber, property, wildlife, and injury or loss of life to people living in or using the area for recreational activities

Wildfire risks are not limited to public lands. There are extensive tracts of privately owned grasslands as well. These include both conservation program lands (CRP, RIM, CREP, etc.) and “rough ground” that has been hayed, pastured, or left wild. These private lands particularly in combination with public lands (such as WMA, SNA, State Parks, WPA, etc.) can combine to create substantial blocks of grasslands.

To date, there has been very little injury or loss of property resulting from wildfire in the Upper Minnesota Valley Region. However, there are some risks that should be managed to mitigate potential disasters.

History of Wildfires in Yellow Medicine County

Wildfires occur throughout the state of Minnesota. According to the Minnesota State Fire Marshal, there are more than 2,000 annual wildfires with an estimated loss of more than \$13 million dollars.

Yearly occurrences are wildfires started along the railroads and farmland. Two other potential wildfire hazards are along power lines and utility structures and timber bridges. The hot exhaust from farm equipment can also start fields on fire.

Wildfire behavior is based on three primary factors: fuel, topography and weather. When dry weather mixes with windy conditions, areas with fuel have the potential for a wildfire to spread out of control as it did in the 2003 fire near Milan. Yellow Medicine County currently has 24,722 acres enrolled in CREP, RIM, CRP and the Wetland Reserve Program. These areas are left for wildlife habitat and are not burned on a regular basis. As a result, years of dead grasses accumulate on these lands and are a good fuel for any fire that may start. The Minnesota River Valley and the Wildlife Management Areas also provide an abundance of fuel for wildfires. Wildlife Management Areas occupy approximately 12,000 acres in Yellow Medicine County. Starting in 2003 all new CRP contracts require mid-management either a prescribed burn, mowing, etc. once during the life of the contract. With CRP and/or CREP, landowners can request a firebreak between their CRP field and the landowner's farmstead.

Topography is important in determining wildfire potential, as it affects the movement of air and fire over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels and the majority of Yellow Medicine County is relatively flat. The Yellow Medicine River Valley has some defined slope, while the Minnesota River Valley is wide around Lac qui Parle Lake and has a more defined slope below the Lac qui Parle Dam.

Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind affect the severity and duration of wildfires. These conditions are similar throughout the county. Although higher wind speeds are possible in the northern portion of the county due to the lack of vegetation and slope, the area is dominated by agricultural uses and lacks major stands of forests.

Relationship with Other Hazards – Cascading Effects

Flooding and Erosion. Major wildfires can completely destroy ground cover which can cause heavy erosion and loss of all vegetation. If heavy rains follow a major fire, flash floods, landslides and mudflows can occur since vegetation is essential in deterring flooding during heavy rainfalls or spring runoff.

Hazardous Materials. Anhydrous ammonia tanks that sit in the countryside or on farms are at risk if a wildfire occurred. While most tanks can be moved quickly, fire departments and response teams may not be aware of their presence.

Plans and Programs for Wildfires

Fire Districts and Departments. Fire departments respond to any structure fires that are in their own fire district and help when needed in other districts (West Central Firefighters Association) and often work together on large fires. All the Fire Departments in the county are on the city level and are a part of the West Central Firefighters Association (includes 9 surrounding counties and 44 fire departments).

West Central Firefighters Association. These fire departments agree to make available to each other their fire-fighting equipment and personnel in the case of emergencies, and each has the legal authority to send its fire-fighting equipment and personnel into other communities.

Zoning. The Yellow Medicine County Zoning department, which includes the county building inspector, regulates the development of new housing. The department is also in charge of enforcing safety restrictions including setbacks, lot coverage, lot depth, and structure height. In addition, the Unified Building Code sets standards for roofing. The county building inspector is responsible for inspecting residential structures, while the fire marshal inspects commercial structures for potential fire hazards.

DNR Training. Firefighters participate in annual wildfire training classes offered by the Minnesota Department of Natural Resources, Forestry Department.

State Land Management. The DNR operates and regulates all state lands within the county. The park currently is managed predominantly for recreational activities. Wildfires are minimized by thinning brush and vegetation around the park, particularly around the campground areas.

FireWise. The DNR participates in a national wildfire education program called FireWise. This program provides tools for risk assessment and risk reduction and is available to communities who would like to do a detailed risk assessment. Small grants are available for 50 percent of projects.

Education and Outreach. Education is available through existing resources and channels such as the Extension Service and Soil and Water Conservation Districts. Countryside Public Health assists lead agency DNR to provide health information for the public.

Evacuation Plan. The county's cities have evacuation plans delineating routes residents should take in the event of large fires and other emergencies.

Program Gaps or Deficiencies for Wildfires

- Currently the county zoning lacks regulations regarding vegetation on property. One of the problems with past fires is the undergrowth and overhanging trees near residential structures. Although aesthetically appealing, vegetation around homes has destroyed numerous dwellings in past fires.
- There is currently no program to ensure that fire is considered when planning conservation plantings that include woody cover. Firebreaks should be included to protect homes and woody cover as well as allowing the use of fire as a management tool. (If a tree and shrub planting is placed in the middle of a prairie planting, it may be difficult to accomplish a prescribed management burn of that property without damaging or destroying the woody component. It may also be impossible to protect that planting in the event of a wildfire.)

Dam Failure

Dam failure is defined as the collapse or failure of an impoundment resulting in downstream flooding. Dam failures can cause loss of life and extensive property damages; and could result from an array of situations, including flood events, poor operation, lack of maintenance and repair, and terrorism.

The main purpose of dams is to hold water, which is important during high water or floods, especially during spring runoff and immediately after heavy rains. Although dams act to prevent

harm from flooding, they do pose potential threats in the event of failure. Dam failure can push a wall of water down to the valley below, causing serious destruction in its path.

The Lac qui Parle Dam is a "Low Head Dam" which means that if it failed, it is not life threatening to Granite Falls or Montevideo. A dam failure model for the "Probable Maximum Flood" showed travel time from the dam to Montevideo to be approximately six to seven hours. A dam failure during an event this large would only raise water stages in Montevideo by less than half a foot. For a "Normal High Pool" failure, the impact at Montevideo would be about five feet. The impacts at Granite Falls are very similar.

The Granite Falls Dam is a "High Hazard Dam", which means there is potential for loss of human life if failure of the dam should occur. A dam break analysis was performed and was filed with the appropriate state and federal regulatory agencies. Maximum "Sunny Day Failure" was 5.2 feet with a stage increase of one foot or more between Granite Falls Dam and Minnesota Falls Dam. For a dam break at a 15-year event, stage increases were 2.0 feet or less.

The Del Clarke Dam near Canby is owned and maintained by the Lac qui Parle – Yellow Bank Watershed District and has a spillway for flood events. The Watershed works with the US Army Corps of Engineers and the DNR to comply with all regulations and permits. An emergency contingency plan is in place and is updated annually.

Lazarus Creek, a tributary to the Lac qui Parle River, drains into the Minnesota River and is home to the Lazarus Creek Floodwater Control Project completed in 2005. The purpose of the project was to control runoff from a 21.2 square mile drainage area west of Canby, Minnesota by creating an earthen dam at 62 feet in height and 1,350 feet in length. The site also includes a vegetated earthen emergency spillway to prevent dam overtopping, thus creating a "dry dam" that can store approximately 1,950 acre-feet of runoff from 100-year storm events.

The U.S. Corps of Engineers operates and maintains day use recreation areas below Lac qui Parle and Marsh Lake dams. Facilities consist of picnic areas, playground, privies, bank fishing, and drinking water.

History of Dam Failure for Yellow Medicine County

The worst recorded dam failure in U.S. history occurred in Johnstown, Pennsylvania, in 1889. More than 2,200 people were killed when a dam failed, sending a huge wall of water downstream, completely destroying the town below. Although risks are minimal, dam failure can occur in Minnesota. Several dam failures have occurred in Minnesota in the past, but none have been reported in Yellow Medicine County.

Relations with Other Hazards – Cascading Effects

Flood. Dam failure, although the risk is minimal, has the potential to be devastating to the areas within the floodplain and around the stream directly below the dam in Montevideo and Granite Falls. If the Lac qui Parle Dam were to fail, Montevideo and Granite Falls would be impacted. Dam failure would cause immediate flash flooding, destruction of property, erosion of crops, and the potential destruction of infrastructure.

Plans and Programs for Dam Failure

Floodplain Ordinance. The county floodplain ordinance prohibits further development on the properties in the floodplain, including property directly below the dam. The Granite Falls ordinance prohibits further development in the floodplain in the city of Granite Falls.

Infrastructure Plan. The county infrastructure plan prohibits further development on the properties adjacent to the dam, including property directly below the dam. Yellow Medicine County has dedicated land adjacent and below the dam as public open space.

Dam Inspection. The Minnesota Department of Natural Resources regulates nearly 900 of the numerous dams in the state. The DNR and US Army Corps of Engineers regularly inspect the dam and reservoir capabilities for flooding and dam failure. Their report indicates that the size of the dam is adequate for any major floods or spring runoff. Del Clarke Dam and other dams constructed by federal government and Lac qui Parle Watershed District are inspected annually by the NRCS, Lac qui Parle Watershed District, Yellow Medicine SWCD and Area II. All large dams constructed by the federal government and the Yellow Medicine Watershed District are also inspected annually.

Monitoring. The county does some monitoring of tributaries emptying into the reservoir to help identify large volumes of water in times of flooding. This is completed by watershed projects.

Evacuation Plan. The county has an identified evacuation plan for all cities in Yellow Medicine County.

Contingency Plan. There is a contingency plan in place in case of dam failure for both the dam in Granite Falls and the Del Clarke Dam near Canby

Program Gaps or Deficiencies for Dam Failure

- Property around the Granite Falls dam is owned by the city of Granite Falls and is easily accessible by the public. The Del Clarke Dam is owned by the Lac qui Parle – Yellow Bank Watershed District and is also accessible to the public.
- Emergency plans for dam safety have been created by the US Army Corps of Engineers or the NRSC, but have a tendency to become out of date when not used; however the Yellow Medicine Emergency Plan has been recently updated. The US Army Corps Engineers does not regularly work with local emergency managers to ensure that information is up-to-date and in the event of a disaster, plans can be implemented.

TECHNOLOGICAL HAZARDS – PRESENTED BY MAN

Introduction

Source: Minnesota State Hazard Mitigation Plan

Technological hazards are a part of everyday life, a result the modern world in which we live. The challenge is to benefit from the use of technology while limiting potential harm to the community. In order to fully realize the benefits of technology, it is necessary to plan an effective response to unwanted technological emergencies before they occur.

From a hazard mitigation perspective, the existence of technological hazards in the community poses a risk to life, health, or property, just as natural hazards do. The use of hazardous materials in manufacturing and transportation can be extremely harmful if an unwanted release occurs and the use of nuclear materials in the presence of a community creates risks that must be managed. While dam failure can result from natural hazards, dams will still have a catastrophic impact on those downstream if poor engineering or construction cause it to fail. Further, the furnishings in our homes make a pleasant living environment, but are often flammable and produce toxic gases if ignited.

For the purposes of this plan, technological hazards identified are organized into these groups:

1. **Infectious Diseases**
2. **Fire**
3. **Hazardous Material**
4. **Water Supply Contamination**
5. **Wastewater Treatment System Failure**
6. **Civil Disturbance/Terrorism**
7. **Airplane Incidents/Accidents**

Infectious Diseases – In Progress (Skip to Fire)

An infectious disease is defined as an organism or matter that has the potential to spread or affect a population in adverse ways. Infectious diseases have the potential to affect any form of life at any time based on local conditions, living standards, basic hygiene, pasteurization and water treatment. Despite breakthroughs in both medicine and technology, infectious diseases continue to pose a major public health problem. Today, the issue of emerging and re-emerging infectious diseases is at the forefront of public health concern. The very young, older adults and hospitalized or institutionalized patients are at an increased risk for many infectious diseases. Changes in demographics, lifestyle, technology, land use practices, food production and distribution methods, child care practices, as well as increasing poverty, have roles in emerging infections.

Many infectious diseases are preventable and controllable. Prevention and control of infectious diseases involve collection of accurate condition assessment data. Outbreak detection and investigation and the development of appropriate control strategies (both short and long term) are based on specific epidemiological data. These activities require close collaboration among clinical providers (especially infection-control practitioners within hospitals), clinical laboratories, state and local health departments, and federal agencies. Furthermore, a need exists for continued education of food industry professionals, health-care students and providers, as well

as research to improve immunizations, diagnostic methods, and therapeutic modalities. The prevention of infectious diseases requires multidisciplinary interventions involving public health professionals, medical practitioners, researchers, community-based organizations, private and volunteer groups, industrial representatives, and educational systems.

History of Infectious Diseases in Yellow Medicine County

Minnesota has not had an infectious disease outbreak that has reached epidemic proportions in decades. Yellow Medicine County has experienced individual cases of infectious diseases over the last 50 years that have been considered isolated occurrences or minor exposures.

In contrast to typical natural disasters in which critical components of the physical infrastructure may be threatened or destroyed, an infectious disease outbreak may also pose significant threats to the people responsible for critical community services due to wide spread absenteeism in the workforce. In the non-health sector, this might include highly specialized workers in the public safety, utility, transportation, or food service industries, and will likely vary from jurisdiction to jurisdiction. State and local officials should carefully consider which services and key personnel within relevant firms or organizations are essential. It is important to identify where absenteeism would pose a serious threat to public safety or would significantly interfere with the ongoing response to the outbreak. To offset this issue, Countryside Public Health has collaborated with Yellow Medicine County to create a Continuity of Operations Plan that determines priority activities that will help to ensure an office will be able to remain open during times of high absenteeism.

In general, infectious diseases would have no effect on physical property. There would be, however, a negative impact on the economy in the case of a widespread outbreak. Businesses may be forced to shut down for an extended period. Yellow Medicine County's entire population is susceptible to exposure from an infectious disease because of the random nature of diseases. Infection rates and exposure risk will vary based on the disease, individual sanitation habits of and personal behaviors. Large population concentrations and sites with large numbers of people are especially at risk in the event of an outbreak. The following infectious diseases could be considered a health risk and disaster if a large outbreak occurred.

Human Health

Pandemic. A pandemic occurs when a disease is prevalent throughout an entire country, continent, or world, greatly affecting the human population. Many pandemics have occurred throughout history including small pox, cholera, measles, tuberculosis, and more recently HIV/AIDS and influenza. In November 2005, the U.S. Department of Health and Human Services (HHS) released a comprehensive plan for responding to a possible pandemic (Minnesota Department of Health 2009). Numerous state, local, and private entities have defined responsibilities to fulfill in the event of pandemic. For instance, the Department of Public Safety is responsible for organizing and coordinating a statewide response to a pandemic and the Minnesota Department of Health along with the Countryside Public Health and other local healthcare providers will work to minimize the impact of a pandemic on human health. To date, pandemics have not occurred in Yellow Medicine County or in the State of Minnesota.

ADD TO THIS LIST

H1N1Influenza. H1N1 Influenza, otherwise commonly known as Swine Flu, was first detected in April 2009. From April 15, 2009 to July 24, 2009, states reported a total of 43,771 cases of H1N1 flu throughout the country (Minnesota Department of Health 2009). Of the reported cases, 5,011 people were hospitalized and 302 people died. H1N1 is likely to be transmitted through human-to-human spread of disease by coughing or sneezing of infected persons. Symptoms of H1N1 flu are similar to standard influenza including fever, cough, sore throat, body aches, chills, headaches, and fatigue. Some hospitalized patients claimed nausea, vomiting, and/or diarrhea as additional symptoms. One major concern with an H1N1 flu outbreak in Yellow Medicine County is the lack of vaccines available for the county population. The government created a tiered allocation for vaccines by first protecting those who are essential to handle the outbreak response and care providers, second those who maintain essential community services, third children and workers at greatest risk of infection due to job nature and lastly those who maintain homeland and national security (flu.gov). To date, there have been no known occurrences of H1N1 flu in Yellow Medicine County. Vaccines are readily available to the general public through hospitals, clinics, and some big-box stores. Visit countrysidepublichealth.org, CDC.gov, flu.gov for more information.

Smallpox. Smallpox has not been an issue in the United States for more than 50 years, but with the threat of terrorism this disease has been thrust to the forefront of public concern. Smallpox has not been found within Yellow Medicine County from 2003 – 2008 (Minnesota Department of Health 2009). Smallpox is a serious, contagious, and sometimes fatal infectious disease. There is no specific treatment for smallpox, and the only prevention is vaccination. The name *smallpox* is derived from the Latin word for “spotted” and refers to the raised bumps that appear on the face and body of an infected person.

There are two clinical forms of smallpox. Variola major is the severest and most common form of smallpox, with a more extensive rash and higher fever. There are four types of variola major smallpox: ordinary (the most frequent type, accounting for 90 percent or more of cases); modified (mild and occurring in previously vaccinated persons); flat; and hemorrhagic (both rare and very severe). Historically, variola major has an overall fatality rate of approximately 30 percent; however, flat and hemorrhagic smallpox usually are fatal. Variola minor is a less common presentation of smallpox, and a much less severe disease, with death rates historically of 1 percent or less.

Tuberculosis. Tuberculosis (TB) is a disease spread from person to person through air. TB usually affects the lungs, but can also affect other parts of the body, such as the brain, kidneys or spine. TB germs enter air when a person with TB of the lungs or throat coughs or sneezes. When a person inhales air that contains TB germs, he or she may become infected. People with TB infection do not feel sick and do not have any symptoms; however, they may develop TB at some time in the future. The general symptoms of TB include feeling sick or weak, weight loss, fever and night sweats. The symptoms of TB of the lungs include coughing, chest pain and coughing up blood. Other symptoms depend on the part of the body that is affected. TB

occurred in one case in 1990, 1998, 2000, 2004, and 2006 in Yellow Medicine County (Minnesota Department of Health 2009).

Hepatitis A. Hepatitis A is an enterically transmitted viral disease that causes fever, malaise, anorexia, nausea, and abdominal discomfort, followed within a few days by jaundice. The disease ranges in clinical severity from no symptoms to a mild illness lasting one and two weeks to a severely disabling disease lasting several months. In developing countries, hepatitis A virus is usually acquired during childhood, most frequently as a symptomatic or mild infection. Transmission can occur by direct person-to-person contact; exposure to contaminated water, ice or shellfish harvested from sewage-contaminated water; or from fruits, vegetables, or foods eaten uncooked, which can become contaminated during harvesting or subsequent handling. Hepatitis A has not occurred in Yellow Medicine County since 1995 (Minnesota Department of Health 2009).

Influenza (Flu). Influenza is a contagious disease caused by the influenza virus. It attacks the respiratory tract in humans (nose, throat and lungs). The flu usually comes on suddenly and may include these symptoms: fever, headache, tiredness (can be extreme), dry cough, sore throat, nasal congestion and body aches.

Influenza types A or B viruses cause epidemics of disease almost every winter, however not all cases are reported. In the United States, these winter influenza epidemics can cause illness in 10 to 20 percent of people and are associated with an average of 20,000 deaths and 114,000 hospitalizations per year. Getting a flu shot can prevent illness from types A and B influenza. Influenza type C infections cause a mild respiratory illness and are not thought to cause epidemics. The flu shot does not protect against type C influenza. There was a flu outbreak in a long-term care facility in 2002 – 2003; otherwise there was no recording of flu outbreaks within group quarters. No influenza cases were reported to the Minnesota Department of Health from 2003 – 2008, however, it is important to note that physicians are not mandated to report this information and not all persons receive treatment for influenza (Minnesota Department of Health 2009).

West Nile Virus (WNV) The virus made its first appearance in Minnesota in July 2002. In the fall of 2003, the first West Nile death in Minnesota was reported. As of July 2009, Minnesota has reported 2559 human cases of West Nile and a total of seven deaths. Yellow Medicine County has experienced four cases of West Nile Virus from 2002 to July 2009, with a single death (Minnesota Department of Health 2009).

Most people with the West Nile virus will experience only mild symptoms – or no symptoms at all. Less than one out of every 150 people who become infected will become severely ill. However, in some cases, West Nile can cause encephalitis, an inflammation of the brain. Approximately 10 percent of these encephalitis cases are fatal. Symptoms of the illness usually show up two to 15 days after being bitten. They can include headache, high fever, muscle weakness, stiff neck, disorientation, tremors, convulsions, paralysis and coma. People who suspect that they may have West Nile are recommended to see a physician.

Minnesota Department of Health encourages citizens to protect themselves from West Nile virus by:

- Use a good mosquito repellent, containing no more than 30 percent of the active ingredient DEET.
- Wear long-sleeve shirts and long pants if you have to spend time in an area where mosquitoes are biting.
- Avoid outdoor activities at dusk or dawn, when mosquitoes are feeding.
- Eliminate possible mosquito-breeding sites on and around your property – including items like old tires, buckets, clogged rain gutters, cans and other containers, and anything else that can hold a small amount of water. Change the water in birdbaths and horse troughs at least weekly.

A vaccine has been developed for horses and veterinarians encourage horse-owners to vaccinate their animals. A human vaccine against the virus is currently in development.

Source: Minnesota Department of Health

Monkey Pox Monkey pox is a rare viral disease that occurs mostly in central and western Africa. It is called “monkey pox” because it was first found in 1958 in laboratory monkeys. Monkey pox was reported in humans for the first time in 1970. In early June 2003, monkey pox was reported among several people in the United States. Most of these people got sick after having contact with pet prairie dogs that were sick with monkey pox. This is the first time that there has been an outbreak of monkey pox in the United States and Yellow Medicine County was not affected (Minnesota Department of Health 2009).

In humans, the signs and symptoms of monkey pox are like those of smallpox, but usually they are milder. Another difference is that monkey pox causes the lymph nodes to swell. About 12 days after people are infected with the virus, they will get a fever, headache, muscle aches, and backache; their lymph nodes will swell; and they will feel tired. One to three days (or longer) after the fever starts, they will get a rash. The rash develops into raised bumps filled with fluid and often starts on the face and spreads, but it can start on other parts of the body too. The bumps go through several stages before they get crusty, scab over, and fall off. The illness usually lasts for two to four weeks.

People can get monkey pox from an animal with monkey pox if they are bitten or if they touch the animal’s blood, body fluids, or its rash. The disease also can spread from person to person through large respiratory droplets during long periods of face-to-face contact or by touching body fluids of a sick person or objects such as bedding or clothing contaminated with the virus.

Source: Center for Disease Control 2009

La Crosse Encephalitis. La Crosse encephalitis is a viral illness transmitted to people through the bite of an infected mosquito. Most people infected with this virus will have either no symptoms, or a mild flu-like illness. A small percentage of people (especially children) may develop encephalitis (inflammation of the brain). Approximately one to three percent of these

encephalitis cases are fatal, and another 15 percent of patients have long-term nervous system problems.

Most of the severe cases start with headache, fever, nausea, and lethargy. The illness may rapidly progress into disorientation, seizures, and coma. There is no treatment for the illness other than supportive care until the illness is over. Severe cases occur primarily in children; the average case age is six years old, and no cases have been reported in Yellow Medicine County (Minnesota Department of Health).

SARS. Severe acute respiratory syndrome (SARS) is a viral respiratory illness that first emerged in China in November 2002, and later spread through international travel to 29 countries. On October 1, 2003, the Centers for Disease Control and Prevention (CDC), reported that there were 164 probable and suspect SARS cases in the United States, of which only eight had laboratory evidence of SARS. There were no deaths due to SARS in the U.S. Most of the U.S. SARS cases were among travelers returning from other parts of the world with SARS. There were 11 suspect and probable SARS cases investigated by the Minnesota Department of Health; many of these individuals had an alternative diagnosis that could explain their symptoms. Yellow Medicine County has not reported any SARS cases (Minnesota Department of Health 2009).

In general, SARS begins with a high fever (temperature greater than 100.4° F. (38.0° C.). Other symptoms may include headache, an overall feeling of discomfort, and body aches. Some people also have mild respiratory symptoms at the outset.

Doctors suspect SARS if a patient has a fever of 38.0° C. or 100.4° F., respiratory symptoms and history of travel to a SARS affected area or close contact with a known SARS patient within 10 days before the fever or respiratory symptoms started. Since the initial symptoms of SARS are similar to influenza or other respiratory illnesses, a high level of suspicion and an accurate history is needed to differentiate SARS from other illnesses.

E. coli. *E. coli* O157:H7 is one of hundreds of strains of the bacterium *Escherichia coli* and one case was reported in 2003 and two others in 2008 (Minnesota Department of Health 2009). Although most strains are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness. *E. coli* spreads during slaughter and organisms can be thoroughly mixed into beef when it is ground. Bacteria present on the cow's udders or on equipment may get into raw milk. Among other known sources of infection are consumption of sprouts, lettuce, salami, unpasteurized milk and juice, and swimming in or drinking sewage-contaminated water. Bacteria in diarrhea stools of infected persons can be passed from one person to another if hygiene or hands washing habits are inadequate.

E. coli O157:H7 infection often causes severe bloody diarrhea and abdominal cramps; sometimes the infection causes non-bloody diarrhea or no symptoms. Usually little or no fever is present, and the illness resolves in five to 10 days. In two to seven percent of people, particularly children under five years of age and seniors, the infection can lead to kidney failure.

Of the two to seven percent, a small percentage is life threatening or can lead to lifelong consequences.

Prevention includes cooking all beef and taking care to keep from ingesting bacteria from raw meat which includes washing hands and surface areas that are touched by raw meat. For additional information on preventative measures, visit the Minnesota Department of Health website.

Pertussis. Pertussis, or whooping cough, is a contagious respiratory disease caused by the B. Pertussis bacterium, spread by coughing or sneezing. Thick mucus builds up in the lungs and clogs air passages, triggering violent coughing spells. It can be quite serious, especially for young infants with tiny air passages. The fatality rate is highest in infants under six months of age. The effects of toxins in the B. Pertussis bacteria can produce high fever, convulsions, brain damage and death. Permanent damage can include continuing seizure conditions, mental retardation, learning disabilities, and chronic illness.

Severe cases of whooping cough may require hospitalization, respiratory support, and nutritional and rehydration therapy. There is no medicine to cure whooping cough but antibiotics are often used to reduce the spread of the disease to others as well as treat secondary infections such as pneumonia, bronchitis, and otitis media (inner ear infections). In the past, these secondary infections often caused many of the deaths, which occurred after a child had whooping cough. Pertussis causes about nine deaths per year in the United States. Pertussis vaccine is now available for children up to adults age 65, this vaccine does lose its effectiveness over time and booster doses are necessary to continue prevention. While most adults handle whooping cough as another cold, this can be a difficult disease for those who are at high risk such as those with asthma. Yellow Medicine County reported one case in 2003, nine cases in 2004, four in 2005, and an additional four cases as of 2008 (Minnesota Department of Health 2009).

Animal Health

Wildlife diseases are a major area of concern in colonial water birds or major concentrations of waterfowl. Diseases, such as Newcastles Disease or West Nile, exist in the wild and outbreaks will occur. However, the extent to which animals die or disease is spread can be minimized through early identification.

Mad Cow Disease (Bovine Spongiform Encephalopathy, BSE). Mad Cow Disease is the layperson's name for Bovine Spongiform Encephalopathy (BSE), a transmissible, slowly progressive, degenerative, fatal disease affecting the central nervous system of adult cattle. According to the FDA the only way to transmit BSE is if the animal has contact with meat processed food; they cannot transmit it cow to cow.

BSE is a disease that affects cattle. However, there is a disease similar to BSE called variant Creutzfeldt-Jakob Disease (vCJD), or vCJD, which is found in humans. There have been a small number of cases of vCJD reported, primarily in the United Kingdom, occurring in people who consumed beef that may have been contaminated. (As of June 2008, there have been a total of approximately 208 cases of vCJD worldwide.) There is strong scientific evidence

(epidemiological and laboratory) that the agent that causes BSE in cattle is the agent that causes vCJD in people.

BSE has been of great concern since 1986, when it was first reported among cattle in the United Kingdom. At its peak, in January 1993, almost 1,000 new cases per week were identified. The outbreak in the United Kingdom may have started from the feeding of scrapie-contaminated sheep meat-and-bone meal to cattle. Scrapie is a disease of sheep that is related to BSE in cattle. There is strong evidence that the outbreak in cattle was amplified to common treatments, such as heat, to reduce or eliminate its infectivity or presence. According to the FDA, milk and milk products from cows are not believed to pose any in the United Kingdom by feeding rendered bovine meat-and-bone meal to young calves.

The federal government in 2002 aggressively surveyed 20,000 animals for BSE. The first case of BSE was reported in December of 2003, in a sick animal that came from a farm in Mabton, Washington, about 40 miles southeast of Yakima. It was a so-called "downer" animal, meaning it was unable to walk when it reached the slaughterhouse, which under USDA rules triggers automatic testing. The FDA is taking several steps to eradicate this disease from cattle and prevent vCJD in people.

Foot-and-Mouth Disease. Foot-and-Mouth Disease (FMD) is a severe, highly contagious viral disease of wild and domestic animals. It primarily affects cattle and pigs, but infections can also occur in sheep, deer and other cloven-hooved animals. A rule of thumb is sheep are carriers, pigs are amplifiers and cows are indicators. Infections in humans are extremely rare. The disease has not been reported in the United States since 1929. However, an outbreak of foot-and-mouth disease is occurring in the United Kingdom and has received considerable attention in the media recently.

FMD is considered the most costly of all animal diseases. It is often necessary to conduct wholesale slaughter of animals wherever there is an outbreak. Second, no animals from an area not declared free of the disease may be moved to other locations or used in trade except as processed food subjected to high temperatures. It is also one of the most contagious animal diseases. The virus is spread not only animal to animal through the air, it can attach to truck tires and clothing and equipment in mechanical transmittal.

In cattle, the first symptoms include dullness, refusal to feed and a fall in milk production. From there the symptoms expand to blisters on tongue, gums, muzzle, nostrils, teats and the spaces between the hoof segments, sometimes crippling the animals. In other animals there may be fewer signs of the disease and, in some cases, animals die without showing any symptoms.

For additional information on Foot (Hove) and Mouth Disease, look on the web at www.fas.org/ahead/disease/fmd/.

Chronic Wasting Disease. Chronic wasting disease, CWD, is another wildlife disease that has received much attention in Minnesota and Wisconsin in the past few years. This is a degenerative brain disease similar to "mad cow disease" that affects elk and deer. It can be spread to wild herds from captive herds or vice versa. At this point there is no recorded

occurrence of CWD in wild deer in Minnesota. However, one of the most important means of ensuring that the disease is not spread is to ensure all captive cervidae (elk and deer) farms are registered with and licensed by the Minnesota Department of Agriculture.

Rabies. Rabies is a disease that has been identified particularly in the southwest and western Minnesota and can be found in numerous animals. Occasionally human exposure occurs due to interaction with infected animals.

Brucellosis. Brucellosis is a bacterial disease found in animals and predominately affects farm workers, veterinarians, and others that work often with animals.

Relationship to Other Hazards – Cascading Effects

Associated with Other Disasters. Infectious disease outbreaks can occur as primary events themselves, or they may be secondary events to another disaster or emergency such as a terrorist attack, biological accident or natural hazard event.

Riots/Civil Disturbances. If an epidemic event were to occur, deaths, fear and misinformation could trigger large-scale riots, panic and lawlessness. Infectious diseases have the potential to be local, regional, statewide or national in scope and magnitude.

Plans and Programs for Infectious Diseases

Emergency Operations Plan. Yellow Medicine County currently has an emergency operations plan known as the Yellow Medicine County Emergency Operations Plan. This plan outlines procedures for county and local governments for contacting appropriate state and federal agencies, guidelines and strategies for dealing with infectious diseases, and command structures with the County Health Department and the Emergency Manager for Yellow Medicine County. Public education lies with public health as well. Much of the information is coordinated with the Center for Disease Control and Prevention and the Minnesota Department of Health.

Emergency Response Plan. Response plans are incorporated into the Emergency Operations Plan and are added as needed. Countryside Public Health maintains emergency response plans and the state provides a framework as new plans are necessary. (As an example, the Foot and Mouth Disease Emergency Response Plan was written March 2002 and adopted into Yellow Medicine County's Emergency Operations Plan.)

Cooperation with State Health Department. Countryside Public Health works with the Minnesota Department of Health to address infectious diseases that are listed in Chapter 4605.7040 Disease and Reports (such as Encephalitis, Hepatitis, Influenza, Lyme Disease, Tuberculosis and Syphilis). If any of these or other listed diseases should appear in Yellow Medicine County, the county works in cooperation with both the state health department and the Centers for Disease Control and Prevention.

Notification. Communication between Countryside Public Health, the Minnesota Department of Health and the Center for Disease Control operates 24 hours, seven days a week depending on where an outbreak first occurs. Countryside Public Health, Yellow Medicine County Answering

Point and the County Emergency Manager receive health alerts via email and fax with instruction with how to proceed. Hospitals, clinics, city administrators, emergency managers and county commissioners are notified by both Countryside Public Health and the Minnesota Department of Health.

Health Alert Network. The Health Alert Network is being developed as part of Center for Disease Control's (CDC) Public Health Emergency Preparedness & Response Program. The Health Alert Network also coordinates and maintains CDC's Public Health Emergency Preparedness & Response Website (<http://www.bt.cdc.gov/>). The Health Alert Network (HAN) is a nationwide, integrated information and communications system serving as a platform for distribution of health alerts, dissemination of prevention guidelines and other information, distance learning, national disease surveillance and electronic laboratory reporting, as well as for CDC's bioterrorism and related initiatives to strengthen preparedness at the local and state levels. When complete, the Health Alert Network ensures:

- High-speed, secure Internet connections for local health officials, providing access to CDC's prevention recommendations, practice guidelines, and disease data.
- Capacity for rapid and secure communications with first responder agencies and other health officials.
- Capacity to securely transmit surveillance, laboratory, and other sensitive data.
- On-line, Internet- and satellite-based distance learning systems.
- Early warning broadcast alert systems.
- Public health agencies achieve high levels of organizational capacity.

Vaccination Program. Minnesota Vaccine for Children (MVFC) is a program that is set up for children in lower income families without insurance. This covers children so they can be vaccinated for infectious diseases. MNVFC is also available at local clinics. The program is designed to assist families of need in protecting their children from infectious diseases.

Quarantine/Isolation Plan. The state is ultimately responsible to handle quarantine/isolation issues. Countryside Public Health has developed a Quarantine/Isolation Plan that would provide follow-up to those in isolation/quarantine and ensure their basic needs are met.

Program Gaps or Deficiencies for Infectious Diseases

Countryside Public Health has a plan in place with multiple ways to reach the public. This plan requires and receives continuous review, constant monitoring and updates as necessary.

Fire

Urban fires are blazes that spread through structures, posing danger and destruction to property. These fires include any instance of uncontrolled burning which results in structural damage to residential, commercial, industrial, institutional or other properties in developed areas. Fires can occur in any community, and pose threats year round.

History of Fires in Yellow Medicine County

According to the State Fire Marshal Division through the fire reporting system updated in 2007, Yellow Medicine County had reported that they lost 11 civilian lives in a 30-year period to fires. Fires have occurred throughout the entire county (see Table 38). However, fires are more probable in the cities due to the density and number of both residential and commercial structures. Cooking, electrical failure and chimneys cause many of the residential fires, in Yellow Medicine County.

Table 35. YMC and Community Breakdowns of Fire-related Information in 2012

Community	Total Fire Runs	Total Other Runs	Total Dollar Loss
Yellow Medicine County	78	44	\$1,230,850
Canby	20	3	\$344,500
Clarkfield	6	6	\$102,000
Echo	2	0	\$0
Granite Falls	28	1*	\$115,650
Hanley Falls	5	3	\$301,700
Hazel Run	*	*	*
Porter	6	11	\$30,000
St. Leo	4	2	\$0
Wood Lake	7	0	\$337,000

* No data submitted.

Source: MN Dept of Public Safety's "Fire in Minnesota: Annual Report 2012"

One major fire in the county took place at the Liquor Store and Café in Echo in 2012. The fire began in the liquor store and proceeded to cause damage to the café as well.

Relationship with Other Hazards – Cascading Effects

Service Disruptions. Major fires can completely destroy structures, including essential public facilities. Utilities such as electric and gas lines can be damaged and even destroyed.

Health Risks. Destruction or damage to essential infrastructure such as water and wastewater facilities can cause public health risk. Firefighting is a high risk job and puts a person in danger of harm at any time.

Hazardous Materials. Many times hazardous materials are highly flammable causing fires to spread rapidly and increasing danger to human lives in the event of explosion.

Plans and Programs for Fires

Fire Districts and Departments. Structure fires are served by local fire districts and fire departments and each district is responsible for fires within their boundaries; however, they often work together on larger fires. All fire departments in the county are on the city level, but they are also a part of the West Central Firefighters Association (which includes fire departments in the surrounding counties).

West Central Firefighters Association. A group of fire departments agreed to make available to each other fire-fighting equipment and personnel in the case of emergencies. Each fire department has the legal authority to send its fire-fighting equipment and personnel to other communities.

Zoning. The Yellow Medicine County Zoning Department controls development of new construction, including the enforcement of safety restrictions like setbacks, coverage, depth, and structure height requirements. The county building inspector is responsible for all new construction.

State Training. County firefighters participate in mandatory firefighting training classes offered by the state.

Evacuation Plans. Evacuation plans exist in the all cities.

Program Gaps or Deficiencies for Fires

- Currently, the only evacuation plans exist in the county emergency operations plan. Cities in the county do not have plans readily available for local residents.
- Currently, some alleys are not adequate to handle fire trucks. The alleys should be identified and widened in the future to provide adequate protection to every property in the county.

Hazardous Materials

Hazardous materials are chemical substances, which if released or misused can threaten the environment and/or health of a community. These chemicals are used in industry, agriculture, medicine, research, and consumer goods throughout Yellow Medicine County. Hazardous materials are found in the county in the forms of explosives, flammable and combustible substances, corrosives, poisons, and radioactive materials.

A hazardous material spill or release poses risks to life, health, and property. An incident can force the evacuation of a few people, a section of a facility, or an entire neighborhood or community, resulting in significant economic impact and possible property damage. Spilled material is costly to clean up and may render the area of the spill unusable for an extended period of time. Hazardous materials incidences are generally associated with transportation accidents or accidents at fixed facilities.

History of Hazardous Materials in Yellow Medicine County

Hazardous materials exist as part of everyday life in Yellow Medicine County. These materials make life easier and more comfortable for residents throughout the county. The challenge is to use, store, and transport hazardous materials in a safe way that does not harm communities and prepare an effective response to unwanted releases of hazardous materials when they occur. A hazardous materials accident can occur anywhere at any time.

Meth labs are most often located in rural or semi-rural areas. Yellow Medicine County is a rural area and could be a potential area for meth lab hazards, although to date there have not been any Meth Labs uncovered in Yellow Medicine County.

The major concern for hazardous materials events for fixed facilities is primarily in the cities of Wood Lake, Clarkfield, Canby, Hanley Falls and Granite Falls. These towns have high concentration of hazardous materials at the chemical plants. The transport of hazardous materials in Yellow Medicine County is highly unpredictable. People and property on or immediately adjacent to transportation corridors throughout the county are at higher risk than those located one mile or more from a major county corridor. Yellow Medicine County assumes that the highest risk of an incident would be to areas in proximity to both rail lines and major roads and from large quantities of hazardous materials moving into and out of Yellow Medicine County. The airport facility also provides further concern based on the possibility of an aircraft or site incident involving some sort of hazardous material.

The specific hazards created by a release are dependent on the hazardous characteristics of the material, the amount released, the location of the release, and the weather and topographic conditions in the area. Identifying specific materials and those involved in transportation can provide a more specific assessment of the vulnerability.

According to the Minnesota Pollution Control Agency (see Table 41 next page), 35 spills have occurred in Yellow Medicine County from July 2002 to December 2013. Five of the 26 hazardous material events had spills totaling over 1,000 gallons of material. Of the 35 spills, 16 took place in Granite Falls. Two communities, Hazel Run and Porter, had no reported spills during the time frame, and St. Leo had a single event in 2008 concerning 30 spilt gallons of light

fuel oil and diesel. For a complete list of all hazardous spill events and amount of product released, see Appendix 5.

Table 37. YMC Hazardous Spills from 2002-2013

City	Number of Spills	Product Type
Canby	4	Light fuel oil & diesel, Asphalt, Sewage/Wastewater, Mineral Oil
Clarkfield	5	Pesticide, Fertilizer, Manure, Diesel, Herbicide
Echo	6	Light fuel oil & diesel, Hydraulic Fluid
Granite Falls	12	Food, Mineral Oil, Light fuel oil & diesel, Paint, Sewage/Wastewater, Fertilizer, Acid/Base Chemicals, Unknown
Hanley Falls	1	Barrage & Fuel
Hazel Run	0	N/A
Porter	0	N/A
St. Leo	1	Light fuel oil & diesel
Wood Lake	2	Mineral Oil, Manure
Total	35	

Source: Minnesota Pollution Control Agency, 2014

Relationship to Other Hazards – Cascading Effects

Water Supply Contamination. If a spill occurred, potable ground water is at high risk of being polluted.

Wastewater Treatment System Failure. System failure would have direct impact on the health of humans and animals.

Transportation

Road, rail, aircraft, and pipeline all move hazardous materials presenting differing levels of risk. Transported products include hazardous materials passing from producers to users, between storage and use facilities as well as hazardous waste from generators going to treatment and disposal facilities.

The road system in Yellow Medicine County provides a network to transport both hazardous and non-hazardous material throughout the region and between local communities. Risks of a hazardous material events vary based on the classification of the road and its proximity to people and property. The risk of a major event is most severe in more populated western portions of the county and along state highways. According to the most recent findings at the Minnesota Department of Transportation, more than half of all accidents involving hazardous materials have occurred on the state roadways. Roads are a major concern in Yellow Medicine County due to the lack of information available regarding what is traveling on the road system on a daily basis.

Approximately 11% of all statewide transportation incidents involving hazardous material in 2002 were from rail transport, according to MnDOT statistics. Valve leakage and safety valve releases are sources of material spills on pressurized and general service tank cars or other hazardous materials containers such as covered hoppers, inter-modal trailers/containers or portable tanks. Leaks manifest themselves as odors or vaporous clouds from tanker top valves; spraying or splashing from tanker top valves; wetness on the side of the car; or drainage from the bottom outlet valve. Depending on the type of rail car involved, a leak or spill could result in hundreds to thousands of gallons/pounds of a substance being released.

Yellow Medicine County has two small municipally-run airports that operate a general use facility for small businesses and pleasure uses only. Large amounts of flammable liquids, lubricants, and chemicals are stored at the facility. Accidents involving aircraft and chemicals related to their operation can create a potential situation where hazardous material could be released. In addition, the risk of an incident is further increased by any hazardous cargo that may be brought into the facility for transport.

Fixed Facilities

A variety of hazardous materials exist in fixed facilities throughout Yellow County, ranging from stored flammable liquids to radioactive materials and chemical agents. Some materials are particularly lethal even in small amounts, while others require strong concentrations with prolonged exposure periods to cause harm. Businesses housing hazardous materials are listed in the Emergency Operations Plan.

Facilities storing or using hazardous materials above minimum amounts have developed and filed a Risk Management Plan with the Local Emergency Planning Committee, State Emergency Response Commission and the Environmental Protection Agency. Each plan identifies significant hazards for the facility, likely release scenario for the hazards, estimated population impacted by the release, and specific steps to take in the event of a release to protect a population from harm.

Pipelines

Currently, over 78,000 miles of pipelines are located within the state of Minnesota. Two pipelines run throughout Yellow Medicine County carrying liquid gasoline and natural gas are owned by Magellan Pipeline Company LP and Northern Natural Gas Company. Table 36 below identifies the type of commodity carried and length of pipelines by their respective owners.

Table 39. YMC Pipeline Report

Operator Name	Commodity Carried	Mileage
Magellan Pipeline Company LP	Gasoline Product	17.58 Miles
Northern Natural Gas Company	Natural Gas	64.84 Miles

Source: National Pipeline Mapping System, 2009

Methamphetamine and Clandestine Drug Labs

A clandestine drug lab (or clan lab) is a collection of materials and ingredients used to manufacture illegal drugs. Methamphetamine (meth) is the drug most commonly made in Minnesota labs. The Minnesota Department of Health (MDH) surveyed all 87 counties twice in 2005 from January to June and July to December to track the number of meth lab discoveries and received information from 75 counties. A total of 128 labs were found throughout all counties, 95 from January to June and 33 from July to December. The number of meth lab discoveries decline continued in 2006 with 73 found throughout Minnesota (Minnesota Department of Health 2006, 2007). The majority of these labs were located away from the largest population centers, in rural or semi-rural areas. There have been no meth labs found in Yellow Medicine County.

Each drug lab is a potential hazardous waste site requiring evaluation and cleanup by hazardous waste professionals, West Central Chemical - Morris. Health effects occur in people exposed to lab chemicals before, during and after the drug-making process. While many of the ingredients used to make illicit drugs are common household products, both the production process and the mixtures produced can be extremely dangerous. In Minnesota, numerous law enforcement officers and staff from health, social service and other agencies have collapsed or become ill at clan lab sites. Jail and hospital staff members have become ill from exposure to meth lab chemicals on the clothing of people living or working at lab sites. MDH has received reports of people who have moved into former lab sites and have suffered chest and respiratory symptoms months after lab chemicals were removed.

The impact of illegal drug-making labs is also felt by neighbors and occupants when labs catch fire, explode, and cause the release of chemicals and chemical waste into the surrounding environment. Finally, clan labs have been associated with increased crime in the surrounding community, including domestic abuse, theft, and child endangerment.

Roughly 50 percent of Minnesota residences where drug labs have been discovered have also housed children. Recognizing the special risks to children living in lab environments, the Minnesota legislature has recently expanded child neglect and endangerment law to include endangerment through exposure to illegal drug manufacture and sales. In 2005, the Minnesota Legislature passed a law intended to reduce the number of meth labs and increase penalties for illegal meth usage.

In many Minnesota communities, there are no laws requiring cleanup of a hazardous waste site (particularly one contaminated by non-standard use of common household products) in a private residence. The Minnesota Bureau of Criminal Apprehension is usually involved in the case and the cleanup to make sure it is thoroughly investigated and cleaned.

Plans and Programs for Hazardous Materials

State Agency Cooperation. Yellow Medicine County works directly with the appropriate state agencies to address needs for responding to and mitigating the impacts of a hazardous event.

Emergency Operations Plan. Yellow Medicine County currently has an emergency operations plan, known as the Yellow Medicine Emergency Operations Plan, which outlines procedures for dealing with hazardous material accidents, spills or releases.

Water Plan. Yellow Medicine County's Local Comprehensive Water Plan recognizes that the county's ground water is impacted by both agricultural and residential fertilizer and pesticide applications. It further recognizes the number of hazardous waste generators by minor civil division from the Minnesota Pollution Control Agency.

Environmental Health Regulations. Yellow Medicine County has worked to develop environmental health regulations and a County Safety Procedures and Policy Guide. These documents are cross-departmental plans that deal with hazardous materials, infectious diseases and food-borne illnesses. They serve to provide guidelines to protect the citizens of the county.

Training of Emergency Personnel. The Emergency Medical Services and hospitals/ER staff train annually for decontamination due to hazardous materials. All emergency personnel are trained to at least the minimum Hazardous Materials Awareness level and all first responder groups conduct the required Occupational Health and Safety Administration training on a yearly basis.

Southwest Emergency Preparedness Team (SWEPT). SWEPT maintains chempak cash in the southwest region for EMS and hospital staff to use for treatment of chemical spills or terrorism event.

Program Gaps or Deficiencies for Hazardous Materials

- The Yellow Medicine County Water Plan only addresses ground water contamination based on fertilizer or pesticide use from residential and agricultural uses. Additional detail for other hazardous substances impacting the county's ground water would provide more detailed findings regarding the overall quality and potential risks if a hazardous materials event happens.
- A county-wide warning system is in process of being implemented. As the warning system develops, the goal would be to have very few or no residents be left without warning in the event of a major catastrophe.
- Aside from those in Granite Falls, plans, policies and/or procedures are not in place to deal with a meth lab incident in the county.
- Lack of information and awareness have left the county susceptible to an accident that could impact a large area.
- Ordinances are not in place to require the landlord to be ultimately responsible for clean up in a meth lab incident. This should happen at the city and county level.
- Education by the public, business owners and landlords could prevent and deter meth labs. Posters should be distributed to local vendors to watch for patterns of meth lab purchases.
- The county has not adopted the environmental health regulations or the County Safety Procedures and Policy Guide.

Water Supply Contamination

Water supply contamination is the introduction of point and non-point source pollutants into public ground water and/or surface water supplies. Although minimal, water supply contamination does pose a threat in Yellow Medicine County.

Microbiological and chemical contaminants can enter water supplies. Chemicals can leach through soils from leaking underground storage tanks, feedlots, and waste disposal sites. Human wastes and pesticides can also be carried to lakes and streams during heavy rains or snow melt.

History of Water Supply Contamination in Yellow Medicine County

Drinking water in Yellow Medicine County comes from ground water and all cities have municipal water systems. All water plants are in good working condition and undergo annual inspections by municipal employees. Individual wells provide drinking water for rural residences within Yellow Medicine County.

Relationships with Other Hazards – Cascading Effects

Infectious Diseases. Polluted human water sources can produce illness and epidemics in both humans and animals.

Plans and Programs for Water Supply Contamination

Drinking Water Standards, Requirements. The U.S. Environmental Protection Agency (EPA), as required by the Safe Drinking Water Act of 1974, sets uniform nationwide minimum standards for drinking water. State public health and environmental agencies have the primary responsibility for ensuring that each public water supplier meets these federal drinking water standards or more stringent ones established by the state.

Public Water Supply Monitoring. The EPA requires an ongoing water quality-monitoring program to ensure public water systems are working properly. Local officials work together with the Minnesota Department of Health and the EPA to ensure that all public water supplies are safe. The EPA also requires all local suppliers to promptly inform the public if their supply becomes contaminated. Countryside Public Health Service inspects inspections of drinking water in restaurants, bars and other private businesses at least annually.

Wellhead Protection Program. Yellow Medicine County is in the process of setting up a wellhead protection plan that is required by the state of Minnesota. Four out of the 5 cities in the county have completed wellhead protection plans that comply with state and federal guidelines set up for wellheads.

Well Construction and Testing. Since 1974, all water wells (public and private) constructed in Minnesota must meet the location and construction requirements of the Minnesota Well Code. Countryside Public Health has a certified lab to test for well contamination.

Lincoln Pipestone Rural Water. Lincoln Pipestone Rural Water (LPRW) has separated their water supply into three parts to keep contamination contained and has an agreement with Marshall to supply half of their water supply, if deemed necessary. LPRW is interconnected to Canby and is working with the city of Dawson to obtain an additional supply of water.

Feedlot Pollution Prevention. Several steps are being taken to protect ground water sources from feedlot runoff. County ordinances require all feedlots within the county to participate in the state's feedlot programs. County extension services promote best management practices to minimize runoff from feedlots into rivers and feedlot locations are limited by county zoning ordinances. Expansion of existing feedlots is allowed with specific limitations.

Sealed Wells. The Yellow Medicine County Comprehensive Water Plan sets aside cost share dollars to seal abandoned wells and over 600 homeowners have utilized the funds to seal unused wells in Yellow Medicine County.

Program Gaps and Deficiencies for Water Supply Contamination

- Some feedlots with fewer than 1,000 animal units are not in compliance with MPCA rules, and operators have not been informed of some standards.
- Some Level II feedlots with fewer than 1,000 animal units have not been put into a GIS database.
- Well houses are often not locked.

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Wastewater Treatment System Failure

Wastewater treatment and disposal is an important part of our need to protect and preserve Minnesota's water resources. Although minimal, failure of wastewater treatment systems poses a potential risk in Yellow Medicine County. Numerous hazards can impact water treatment plants, including severe flooding.

History of Wastewater Treatment System Failure in Yellow Medicine County

Wastewater systems typically pose higher risks of failure during the spring when melting snow and runoff can cause flooding. To date, no wastewater treatment systems have failed in Yellow Medicine County.

Relationships with Other Hazards – Cascading Effects

Infectious Diseases. The failure of septic treatment facilities and systems can have immediate adverse impacts on human health through communicable diseases and epidemics.

Water Supply Contamination. The failure of septic treatment facilities and systems can have immediate adverse impacts on potable water supplies.

Plans and Programs for Wastewater Treatment System Failure

Certified Operators and Inspections. The Minnesota Pollution Control Agency (MPCA) requires routine inspection of all public wastewater systems and these operators are required to take state training to maintain their certified operator status. All emergency plans for facilities are located at each office and a copy is maintained at the Yellow Medicine County Emergency Management office.

State Permit Enforcement. The Minnesota Pollution Control Agency (MPCA) regulates wastewater systems. State staff in the water-quality point-source program issue permits, monitors compliance through data review and inspections, and enforce permit conditions.

Program Gaps or Deficiencies for Wastewater Treatment System Failure

- The effects severe flooding would have on wastewater plants have not been determined. Granite Falls is in the process of working on this.
- Yellow Medicine County does not have an ordinance requiring periodic inspection of individual septic tank systems; rather the county inspects systems when a new bedroom addition is added to an existing residence. The County does inspect new construction permits, design, and installation.

Civil Disturbance/Terrorism

Human-caused hazards can be intentional, criminal, malicious uses of force and violence to perpetrate disasters against people or property. They can be the result of terrorism – actions intended to intimidate or coerce a government or the civilian population to further political or social objectives – which can be either domestic or international, depending on the origin, base and objectives of the terrorist organization

Hazards can result from the use of weapons of mass destruction, including biological, chemical, nuclear and radiological weapons; arson, incendiary, explosive and armed attacks; industrial sabotage and intentional hazardous materials releases; and cyber terrorism.

History of Terrorism/Civil Disturbances in Yellow Medicine County

Yellow Medicine County has no history of terrorist or individual acts designed to cause disasters against people or property. Vandalism, assaults and other criminal acts do occur, but these isolated incidents fall within the purview of local law enforcement.

School Violence. Violence in schools has become an increasingly important topic among teachers, students, and police; focusing on bullying, school shootings, vandalism, and overall safety. Regardless of the availability of drugs, alcohol, and weapons to youth, it appears as though school incidences are decreasing. This fact is demonstrated in the Minnesota Student Surveys completed in 2001 and 2007 in Yellow Medicine County. The majority of students “strongly agree or agree” to feeling safe walking to and from school and at school.

In general, surveyed students in 6th, 9th, and 12th grade had fewer people threatened (except for 9th grade female students with a slight increase) and pushed/shoved/grabbed in the previous 12 months from 2001 to 2007. The number of incidences remained primarily constant was those students kicked, bitten, or hit with increases in these events for only 9th grade students.

From 2001 to 2007, the numbers remained consistent with how often (number of days) students brought a gun onto school property with all students reporting at least 98 percent at never bringing guns to schools and senior males at 91percent. The numbers remained constant for how often student brought non-gun weapons to school (above 90%), with all but senior males at 88 percent – a slight increase from 2001.

Relationship to Other Hazards – Cascading Effects

Cascading effects of an intentional human-caused disaster are highly dependent on the specific mode used and asset targeted. Many of these have been detailed in the technological hazards portion of the plan covering dam failure and hazardous materials incidents. Fires and secondary explosions are possible with explosive attacks, and fires from arson attacks can extend beyond the intended target.

Plans and Programs for Terrorism/Civil Disturbances

Cooperation with State, Federal Officials. Yellow Medicine County officials are working with state and federal officials on domestic preparedness efforts, including with the Department of Health to ensure that health care facilities are prepared for bio-terrorism events.

School Multi-Hazard Emergency Plans. Since 2003, every school district in Minnesota has been mandated by state statute to institute multi-hazard emergency planning including at least quarterly drills and exercises. Each plan and practice is required to include prevention and response strategies – in particular to school violence. Each school implements their particular plans differently, while holding to the same basic tenets and works with their respective law enforcement.

Emergency Plans. The hospital plan, EMS Plan, Countryside Public Health Plan, and Yellow Medicine County’s Emergency Operations Plan identify the chempak cash that can be requested for treatment if chemical exposure is identified.

Program Gaps and Deficiencies for Civil Disturbance/Terrorism

- Design and operations of most facilities in the county were not developed with terrorism prevention in mind.
- Recreation facilities developed around the Del Clark Dam provide easy, unmonitored access to the structure.
- Yellow Medicine County government buildings, including the county courthouse and all city halls, have unrestricted pedestrian access.
- Most of the counties' city halls and the Yellow Medicine County courthouse do not have fire suppression systems and are not blast resistant. Newly constructed buildings have fire suppression systems.

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