
Appendix H – Flooding

Flooding Section - Blue Earth County Water Management Plan

Definitions

Flood Mitigation Actions

Flash Flooding

FEMA National Flood Insurance Program

Flooding Goals and Strategies



Blue Earth County Water Management Plan 2017-2026 Flooding Section



Appendix H — Flooding
Blue Earth County Land Use Plan

Flooding

Flooding is a concern related to public safety, loss of property and infrastructure, and water quality.

There are different definitions and categories of floods and affects that can be addressed with mitigation action, such as prevention, property protection, public education and awareness, natural resources protection, emergency services and structural improvements.

Definition

The *State of Minnesota All-Hazard Mitigation Plan* definition of “flooding is the accumulation of water within a water body (e.g., stream, river, lake, and reservoir) and the overflow of excess water onto adjacent floodplains.”

The Federal Interagency Floodplain Management Task Force divides flooding in the United States into categories including the following:

- riverine floods
- flash floods
- alluvial fan floods
- ice-jam floods
- dam-break floods
- local drainage floods
- high groundwater floods
- fluctuating lake level floods
- debris flows and subsidence

In Minnesota, the most common types of flooding are riverine, flash, and local drainage.

Flood Mitigation Actions

Prevention: Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.

Property Protection: Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.

Public Education and Awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

Natural Resource Protection: Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

Emergency Services: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

Structural Improvements: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Flash Flooding

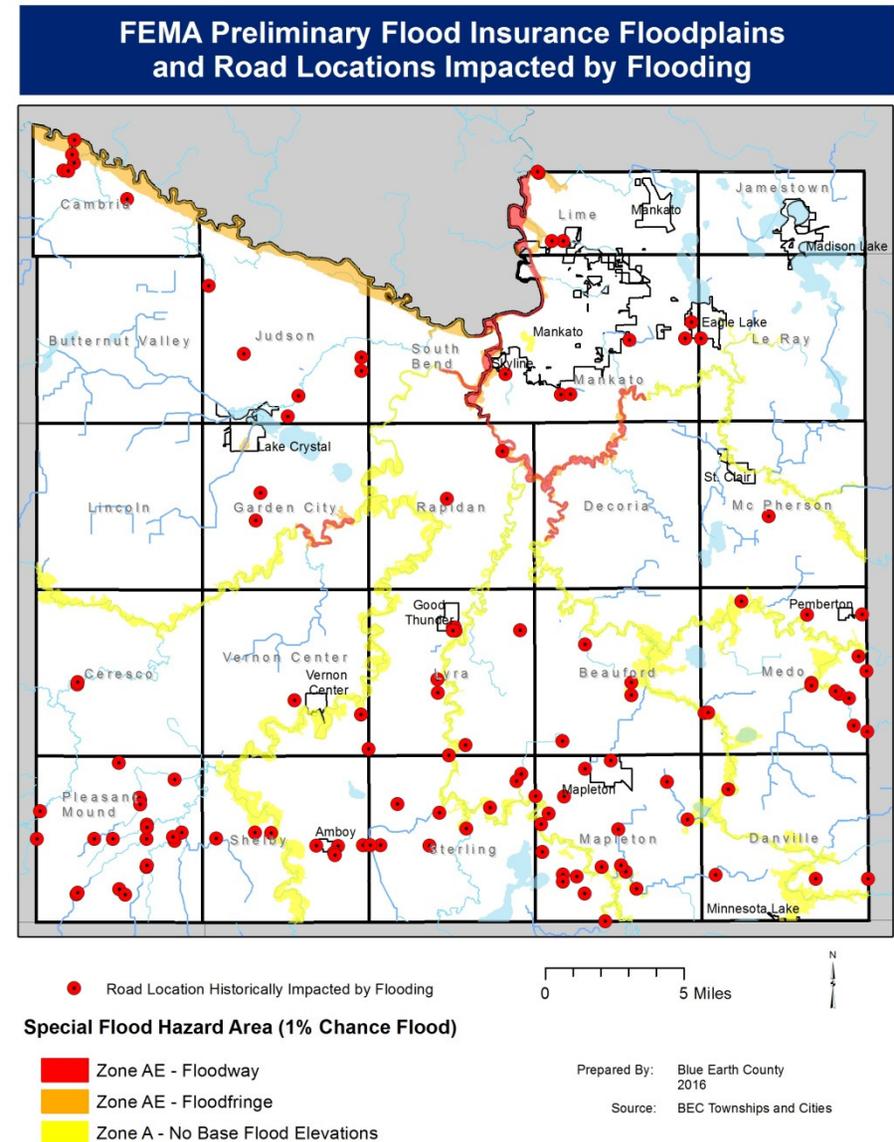
Flash flooding occurs in all areas of the county. According to the *Minnesota All Hazard Mitigation Plan*, flash flooding occurs somewhere in the state three times a year on average.

Flash floods involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage that includes the tearing out of trees, undermining of buildings and bridges, and scouring new channels. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain.

Flash flooding in the county can be most destructive in steep watersheds and in narrow valleys and ravines. Flash flooding in these areas can cause severe erosion, debris flows, damage to property and sedimentation in waterways.

- Ravines in every watershed in the county
- Indian Creek
- Little Cottonwood River
- Morgan Creek

Every municipality in the county is affected by flash floods. The map to the right displays the FEMA flood insurance floodplains and the roads impacted by flooding in September 2010. Most of the roads impacted were not in FEMA flood hazard areas.



This map depicts roads that were flooded during after the September 22-23, 2010 rain event and also roads that were reported by townships and cities as being historically impacted by flooding.

FEMA National Flood Insurance Program

Maps of Flood Zones

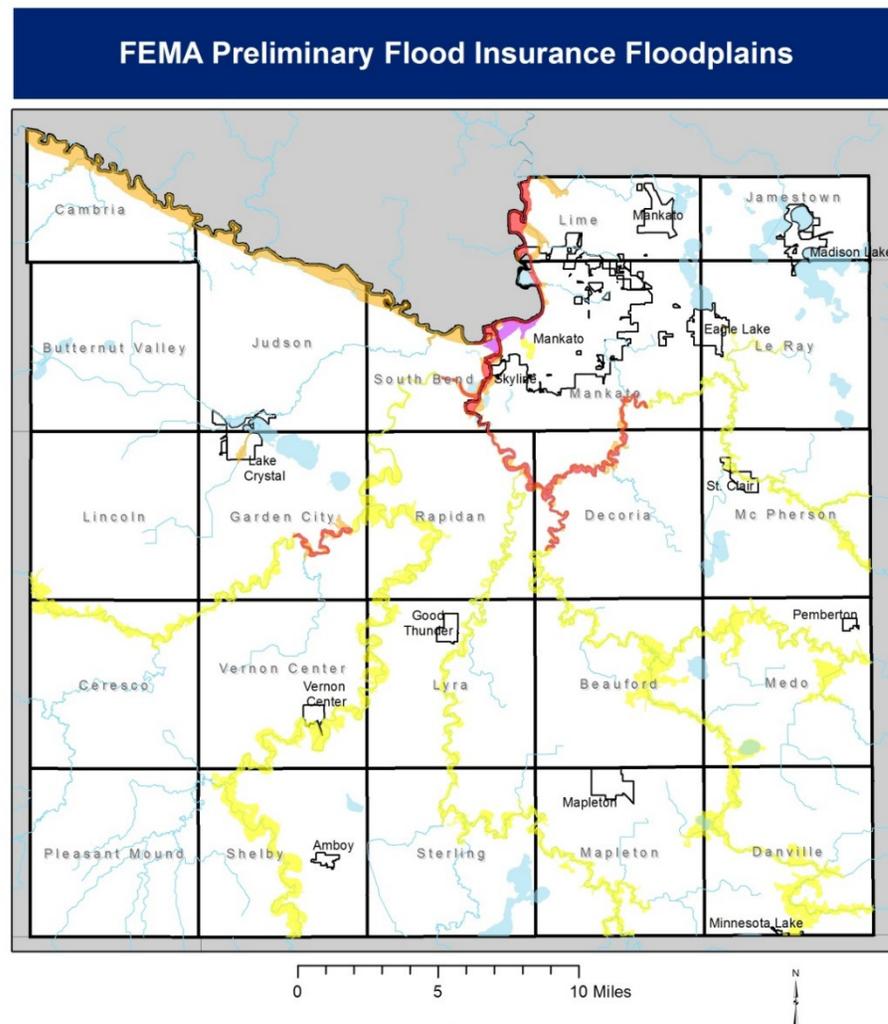
Not all waterways in the county are included in the FEMA Flood Insurance Rate Map. There are many small streams in the county which do not have areas mapped as special flood hazard areas. These areas do experience floods and flash floods. Examples of these streams in the county are Indian Creek, Perch Creek, Minneopa Creek, Morgan Creek, Rice Creek, Providence Creek, Willow Creek, and sections of the Little Cottonwood River and the Little Cobb River.

The jurisdictions with no mapped special flood hazard areas include: Amboy, Good Thunder, Madison Lake, Mapleton, and Pemberton, Butternut Valley Township, Jamestown Township, and Pleasant Mound Township.

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual chance floodplains that are determined in the FEMA Flood Insurance Study using approximate methods. The 1-percent chance flood is also referred to as the base flood or the 100-year flood. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or base flood depths are shown within this zone.

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual chance floodplains that are determined in the flood insurance study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-



annual-chance flood by levees. No base flood elevations or base flood depths are shown within this zone.

Existing Development in Mapped Flood Zones

With more than 300 miles of rivers and streams in the county, there is a relatively small percentage of existing development in special flood hazard areas. On most of the rivers in the county the flood zones are contained in deeply-incised channels. The Le Sueur River and the Maple River have the narrowest flood hazard areas.

With 29,791 acres mapped as special flood hazard areas in the county there appear to be less than forty dwellings located in the mapped areas that are within the 1-percent chance flood areas. In the unincorporated areas of the county, there are currently 29 dwellings located in the extent of a special flood hazard area. Most of the dwellings in flood hazard area are located along the Watonwan River in Garden City Township and the Minnesota River in Cambria and Judson Townships. There are also a few houses in the special flood hazard areas along the Blue Earth River and Le Sueur River. Within the cities in the county there appears to be less than five dwellings in areas mapped as special flood hazard areas on the 2011 preliminary FEMA floodplain maps.

There are 479-acres of Blue Earth County located in areas protected by levees. The Mankato-North Mankato-South Bend Township levee protects the areas along the Blue Earth River and Minnesota River. These land uses within the protected by the levee include a mixture of parks, opens space, residential and commercial development. Since they are protected by the levee, these areas are not special flood hazard areas according to FEMA.

Summary of Flood Zones in the 2011 Preliminary Flood Insurance Data for Blue Earth County

FEMA Flood Zone	Acres	Percent
Zone A - 1 % Chance Annual Flood Hazard	22,223	4.54%
Zone AE - 1 % Chance Annual Flood Hazard with Base Flood Elevations	7,568	1.55%
Zone X - Areas outside of .2% Chance Flood	458,387	93.60%
Zone X - Areas of the 0.2 % Annual Chance Flood Hazard	1,074	0.22%
Zone X - Areas Protected by Levee	479	0.10%
Total	489,731	100.00%

Map Modernization

FEMA is in the process of updating flood insurance rate maps nationwide. Digital Flood Insurance Rate Maps for Blue Earth County will be available as part of this process and maps of the floodplain will be seamless across the county rather than having individual maps for each city. The preliminary digital flood insurance rate maps have been available in the county since 2011. FEMA estimates they will finalize and approve the new maps in 2017. FEMA estimates the effective date for the new maps will be in 2018.

Map Limitations

While the maps are based on highly accurate digital elevation information, there are limitations with the accuracy of the maps. First, the elevation information used for the maps was from a LiDAR data collection that was completed in 2005. There was more recent LiDAR elevation data collected in 2012 after the FEMA prepared the preliminary digital flood insurance rate maps in 2011. There have been significant river channel changes throughout the county since that time. There are areas where rivers or streams have migrated outside

of areas that are mapped as special flood hazard areas. Secondly, not all areas of the county have detailed flood studies. Only 25-percent of the areas mapped as being in a special flood hazard area in the county have a detailed flood study. For the 75-percent of the special flood hazard areas in the county without a detailed flood study, the mapping was done using approximate methods and the maps do not include actual elevations for the 1 percent chance flood. Additionally, some of the areas of the county with detailed flood studies are based on flood models that are as old as 1986.

Flood Control

There are publicly and privately owned levees along some river floodplains in the county.

Following spring floods in the 1950s and 1960s, the Army Corps of Engineers Flood Control Project was constructed to protect parts of Mankato, North Mankato and South Bend Township along the Blue Earth River and Minnesota River.

The City of St. Clair constructed a levee along the Le Sueur River floodplain in the city to protect the wastewater treatment plant and other infrastructure from Le Sueur River flooding. St. Clair’s levee was constructed for a 100-year flood event following the 2010 flood. In 2016 Le Sueur River flood waters breached the levee as the river exceeded the 100-year flood stage and 2010 flood.

Privately owned levees and earthen berms were constructed by farmers to protect farmland along channelized river segments.

Dams

There are many publicly owned dams. The Rapidan Dam was developed to generate hydroelectric power. Some dams are designed for water storage to prevent flooding, like those in the Indian Creek watershed designed to store flood waters to reduce flooding in the

City of Mankato. Others maintain water levels for recreation and habitat. A list of dams is shown in the following table.

Dam Name	Owner	Type
Eagle Lake	MNDNR	Gravity
Cottonwood Lake Dam	MNDNR	Gravity-Earth
Perch Lake Dam	MNDNR - Fisheries	Earth
Rapidan	Blue Earth County	Other
Blue Earth River	MNDNR	Concrete-Gravity
Warren St. Detention	City of Mankato	Earth
Gilfillin Lake Outlet	MNDNR	Earth
Madison Lake	MNDNR	-
Rice Lake	MNDNR - Fisheries	Earth
McPherson 25	Rye, Gordon	Earth
Lost Marsh WMA	MNDNR - Fisheries	Earth
Lake Crystal	Blue Earth County	Sheet Pile Weir

Previous Flood Occurrences

The National Climatic Data Center (NCDC) database reported 27 flood events in Blue Earth County since 1996. The table on the following page displays a list of flood occurrences since 1996. The NCDC database goes back to the 1950s; however it has no documented flooding occurrences in the county prior to 1996. Blue Earth County has had other flooding occurrences prior to 1996. There were major spring floods in the 1950s and 1960s.

FEMA has documented significant flooding events in Blue Earth County prior to 1996. These significant flooding events fit into one of two categories:

A Major Disaster (denoted as “DR” under the “Declaration Number” column) can be a result of hurricanes, earthquakes, flood, tornados or major fires; the President then determines supplemental federal aid.

The event must be clearly more than state or local governments can handle. If declared, funding comes from the President's Disaster Relief Fund, managed by FEMA and disaster aid programs of other participating federal agencies.

An Emergency Declaration (denoted as “EM” under the “Declaration Number” column) is more limited in scope and without the long-term Federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.

FEMA Declared Flood Disasters in Blue Earth County		
Type	Declaration Date	Declaration Number
Flooding	4/11/1965	DR-188
Heavy Rains, Flooding	8/15/1968	DR-249
Flooding	4/18/1969	DR-255
Flooding, Severe Storm, Tornadoes	6/11/1993	DR-993
Flooding	6/1/1996	DR-1116
Severe Storms and Flooding	4/8/1997	DR-1175
Flooding	3/19/2010	EM-3310
Flooding	4/19/2010	DR-1900
Severe Storms, Tornadoes, Flooding	7/2/2010	DR-1921
Severe Storms and Flooding	10/13/2010	DR-1941
Severe Storms and Flooding	5/10/2011	DR-1982
Severe Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	07/21/14	DR-4182
Flooding	11/02/2016	DR-4290

Blue Earth County Previous Occurrences of Flooding		
Date	Type	Cause
6/16/1996	Flash Flood	
9/2/1996	Flash Flood	
3/15/1997	Flood	
4/1/1997	Flood	
5/1/1997	Flood	
8/9/1999	Flood	
4/1/2001	Flood	
5/1/2001	Flood	
6/9/2004	Flash Flood	
6/9/2004	Flood	
5/12/2005	Flood	
8/18/2005	Flash Flood	
10/4/2005	Flash Flood	
6/9/2006	Flash Flood	
6/16/2006	Flash Flood	
5/19/2007	Flash Flood	Heavy Rain
8/19/2007	Flash Flood	Heavy Rain
3/15/2010	Flood	Heavy Rain / Snow Melt
3/17/2010	Flood	Heavy Rain / Snow Melt
6/25/2010	Flash Flood	Heavy Rain
6/26/2010	Flash Flood	Heavy Rain
9/23/2010	Flash Flood	Heavy Rain
9/23/2010	Flood	Heavy Rain
3/21/2011	Flood	Heavy Rain / Snow Melt
6/21/2013	Flash Flood	Heavy Rain
6/16/2014	Flash Flood	Heavy Rain
6/17/2014	Flash Flood	Heavy Rain
6/18/2014	Flood	Heavy Rain
9/21/2016	Flood	Heavy Rain

Flooding Goals and Strategies

Goal: Protect public safety and property in flood prone areas of the county.

Goal: Ensure resilience to extreme rainfall events.

There is a greater understanding of the location of floods and the potential for flash floods in the county as the result of experiencing numerous flood and flash flood occurrences since 2010, updated climate data and water quality research related to near channel erosion in local watersheds.

Near channel erosion is a widespread problem in the county addressed in a separate section of this plan. Stormwater management is addressed in a separate section of this plan.

POLICY STRATEGY: PREVENTION.

The most cost effective way to protect public safety and property is to prevent development in areas where there is a reasonable expectation of floods or the effects of flash floods. The City of St. Clair, for example, has adopted land use development policies to ensure landowners do not develop land, construct berms or otherwise place fill in Le Sueur River floodplains.

Action: Revise floodplain ordinances to prohibit filling or new dwellings in the General Floodplain and Flood Fringe District and to conform to the County Zoning Ordinance which requires lots to have the required buildable area outside of floodplains.

STRATEGY: NATIONAL FLOOD INSURANCE PROGRAM.

Prevent losses from flood hazards through implementation of the National Flood Insurance Program, updating floodplain Maps, and updating floodplain ordinances.

Action: Adopt the preliminary FEMA Flood Insurance Rate Maps when they are approved by FEMA.

Action: Revise floodplain ordinances to conform to FEMA/MNDNR standards and to properly reference the updated floodplain maps.

STRATEGY: FLOOD INUNDATION.

Action: Assess whether additional flood studies or flood inundation models are needed on streams, rivers, or ditches in the county that do not have FEMA identified floodplain boundaries like the Little Cottonwood River, Morgan Creek, and Minneopa Creek.

STRATEGY: WATER STORAGE CAPACITY.

Action: Maintain the existing water storage capacity in the floodplain by preventing further development and fill from being added to the floodplain.

Action: Increase the water storage capacity at or below 100-year flood elevations and in areas with known flood inundation to help minimize the severity and frequency of flooding and high water by targeting wetland restorations and water storage in floodplain areas.

STRATEGY: FLOOD PROTECTION STRUCTURES.

The City of Mankato, South Bend Township, and the City of St. Clair flood protection structures protect infrastructure, development and public safety in floodplain areas.

The most cost effective way to minimize the effects of flash floods is to design and establish natural and structural stormwater management systems to manage heavy rainfall.

Action: Support protection and maintenance of flood control levees and other projects protecting infrastructure in the City of St. Clair.

Action: Support protection and maintenance of flood control protection systems, flood walls and pumping systems managed by the City of Mankato and South Bend Township on the Minnesota River at Mankato, Blue Earth River at Mankato and in the Indian Creek watershed flowing through Mankato.

Action: Increase water retention in the Indian Creek watershed to reduce ravine erosion and sedimentation in flood control systems on Indian Lake Road, Rasmussen Woods and Pleasant Street gate well.

Action: Prevent flooding in municipalities by maintaining, constructing and updating flood control protection systems, stormwater infrastructure and critical facilities.

STRATEGY: WATERSHED MANAGEMENT.

Increase water storage to enhance stormwater storage within and draining to developed areas.

Action: Increase water storage by restoring wetlands and developing green infrastructure to increase water storage in watersheds with developed/developing land use.

Action: Increase water storage in drainage system watersheds and ravine watersheds with subsurface tile drainage outlets.

STRATEGY: NATURAL RESOURCE PROTECTION.

Actions that, in addition to minimizing losses from floods and flash floods, preserve or restore the functions of natural systems.

Action: Increase water storage by restoring wetlands and developing green infrastructure to increase water storage in watersheds with developed/developing land use.

Action: Increase water storage in drainage system watersheds and ravine watersheds with subsurface tile drainage outlets to reduce erosion and sedimentation that may reduce water storage capacity in wetlands, stormwater ponds and other water storage basins.

Action: Restore channelized stream corridors to provide flood water storage and attenuation, wildlife habitat and nutrient assimilation functions.

Action: Protect and restore forests and perennial vegetation to protect soils, increase the water holding capacity of soils and increase evapotranspiration while also providing wildlife habitat and nutrient assimilation.