CASS COUNTY MULTI-JURISDICTIONAL MULTI-HAZARD MITIGATION PLAN

2019 - 2023

Cass Fargo Emergency Management
4630 15th Avenue North
Fargo, North Dakota 58102

EXECUTIVE SUMMARY

The threat of natural hazards is keenly felt by many in Cass County. Recent experiences with floods and severe weather have elevated mitigation to the forefront of elected official's agendas. To that end, the county and its cities have prepared this update to its multi-jurisdiction multi-hazard mitigation plan, per Federal Emergency Management Agency (FEMA) requirements. A steering committee comprised of representatives of city and county departments examined the goal and objective statements from the 2014 version of the plan and evaluated whether these were still applicable in light of the County's changing hazard profile. The committee concurred that all of the goals and objectives remained unchanged, except for increasing participation in the Community Rating System was added as an objective.

1) Encourage County and local planning related to hazard mitigation
2) Enhance the public's awareness of hazards
3) Reduce the impact future development has upon potential losses and vulnerabilities
4) Reduce impacts of flooding and geotechnical hazards to people and property
5) Mitigate the effects severe summer and winter weather has upon people and property
6) Mitigate the effects strong winds have upon people and property
7) Reduce impacts of drought and wildland fires on communities

Mitigation aims to reduce a community's exposure to hazards and to enhance its resiliency. If a disaster were to occur, the extent of damage and dislocation would be minimized. As a result, the recovery process will be less costly and shorter in duration. Activities which mitigate the effects of disasters can be categorized in several ways. *Construction* of infrastructure or the alteration of existing structures is the physical separate of structures from hazards or allowing those hazards to interact with structures in a manner that is not damaging. Levees, floodproofing, retrofitting buildings for high winds, and storm shelters are a few examples. *Prevention* entails directing development to areas that do not present as high of a risk or permitting only the design of structures that can better withstand disasters and protect its inhabitants. Finally, *education* is the process of informing key stakeholders and the public at-large the measures they can take since not every mitigation action will be the responsibility of governmental entities. Sharing with the public the various methods of reducing risk can empower people to take responsibility for their own properties.

SECTION I: INTRODUCTION

The threat presented by natural hazards is keenly felt by the leaders and residents of Cass County, especially given the fact that there have been 28 Presidentially declared disasters in the county since 1953. 20 of those were floods and the remaining 8 were severe winter or summer storms. The distinct possibility of a disaster occurring along with the resulting damage and disruption to normal economic and social life have led to the prioritization of undertaking efforts to prevent or reduce the impact of adverse natural events. Stakeholders from various Cass County agencies and each municipality have developed this 2019-2024 Cass County Multi-Jurisdictional Multi-Hazard Mitigation Plan, hereafter referred to simply as the "Plan".

PURPOSE

This Plan represents a coordinated effort and ongoing commitment to mitigate the potential impacts of hazards that continue to be experienced in Cass County. In the wake of recent events there is a renewed commitment to maintaining this Multi-Hazard Mitigation Plan that was first adopted on May 21, 2001. Updates were formally approved in 2009 and 2014.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Mitigation activities may be implemented prior to, during, or after an incident. The resources and information within the mitigation plan establish a foundation for coordination and collaboration among agencies and the public in Cass County, identify and prioritize future mitigation projects, and assist in meeting qualifications for federal assistance programs. This Plan works in conjunction with other county plans, including municipalities, townships', and the county's comprehensive plans and emergency operations plans.

SCOPE

The geographic scope of this plan encompasses all of Cass County, both its incorporated municipalities and unincorporated rural areas. Jurisdictions analyzed include Alice, Amenia, Argusville, Arthur, Ayr, Briarwood, Buffalo, Casselton, Davenport, Enderlin, Fargo, Frontier, Gardner, Grandin, Harwood, Horace, Hunter, Kindred, Leonard, Mapleton, North River, Oxbow, Page, Prairie Rose, Reile's Acres, Tower City and West Fargo.

The planning process identified mitigation actions that would eliminate or reduce the impact of natural disasters. If implemented, the actions would enhance the resiliency of communities and allow them to bounce back quicker and more robustly after a disaster, if one were to occur. Mitigation aims to break the cycle of damages and repairs, as well as reducing repeated losses and the financial burden of rebuilding time and time again.

LAWS AND AUTHORITIES

This Plan has been developed in accordance with the Disaster Mitigation Act of 2000, Public Law 106-390. The Disaster Mitigation Act of 2000 provides the legal basis for mitigation planning requirements as a condition of mitigation grant assistance. The Disaster Mitigation Act of 2000 also established a new requirement for local mitigation plans, hereby providing guidance to the planning process in the development of this Plan. Nothing in this Plan supersedes or contradicts the Disaster Mitigation Act of 2000 or any other Federal, State or Local laws.

PLAN STRUCTURE AND CONTENTS

This document is organized into six sections beginning with the introduction that outlines the purpose of the plan, its scope, and the laws and authorities guiding mitigation planning. Section Two describes the process through which the plan was updated, including how input from the public and stakeholders was collected and incorporated into the plan.

Section Three gives the reader a brief overview of Cass County including its people, natural features, land use and transportation infrastructure. All of these factors influence the risk assessment provided in Section Four.

Section Four includes a discussion of natural hazards most likely to affect Cass County. These are dam failure, drought, flood, severe summer storm, severe winter weather, urban fire, wildland fire and geologic hazards. Each hazard is further broken down into subcategories of description, location, extent, previous occurrences, probability of future events, and the designation of a risk class. Location describes the geographic areas within the planning area that are affected by each hazard. For several identified hazards, the entirety of the county has an equal chance of being affected. Therefore, location information is most relevant when considering dam failure, flood, and geologic hazards. Extent is the strength or magnitude of the hazard. Although extent defines the characteristics of the hazard regardless of its effect on people and the built environment, potential impacts that refer to these effects are also included in this section. Previous occurrences describe historic incidences with the natural hazards. These occurrences have been compiled from national, state and local data sources. The level of detail may vary per the data source. Probability of future events is a compilation of statistical data based on past events and trends and experiences of local officials knowledgeable of the subject matter. The risk classes defined in the previous version of the plan were also reevaluated and included in this section. The risk class rating system used ranges from A to D, with A signifying the greatest risk. The steering committee thoroughly discussed the ratings for each hazard and felt the existing classification scheme was still accurate. Below are brief descriptions of each risk class.

Figure 1.1 Hazard Risk Assessment Classification

A	High risk condition with the highest priority for mitigation and contingency planning
B	Moderate to high risk condition with sufficiently high consideration for further mitigation
C	Low to moderate risk condition with some consideration for further mitigation
D	Low risk condition with not given a great deal of planning consideration

Section Five lists the overarching goals of the county's mitigation strategy. These align closely with the State of North Dakota's goals. Several objectives described therein are an ongoing effort through the plan's effective period and beyond.

Section Six has a section for the county and for each city that describes their unique vulnerabilities, the capabilities of the jurisdiction, and the proposed mitigation actions. Each jurisdiction was asked to prioritize which of the action items were more pressing. This does not mean the project will necessarily be accomplished before others. The vagaries of funding, the technical feasibilities of the projects, and the capacities of the cities can translate into an ever changing workplan.

SECTION II: PLANNING PROCESS

The oversight of this plan update was done by a steering committee made up of representatives from city and county departments. One role of this committee was to lead the development of a plan that is embraced by all jurisdictions and is within the realm of political, technical, and financial feasibility. Many of the county representatives work extensively with rural communities and thus had insights into needs in the unincorporated county and smaller jurisdictions.

In an effort to ensure continuity, some members of the steering committee were involved in the previous two update processes. Table 2.1 lists all of the steering committee members and Table 2.2 is an attendance record of all steering committee meetings.

Table 2.1 Steering Committee

Name	Position	Agency Represented
Kay Anderson	GIS Manager	Cass County
Jason Benson	County Engineer	Cass County
Jody Bertrand	Senior Engineer	Fargo
Mitch Calkins	Program Manager	Lake Agassiz Regional Council
Hali Durand	Planner (until October 2018)	Cass County
Pierre Freeman	Code Enforcement Officer	West Fargo
Jeremy Gorden	Engineer	Fargo
Josh Hassell	Engineer	Moore Engineering, Inc.
Amanda Johnson	Assistant	Cass Fargo Emergency Management
Daryl Masten	GIS Manager	Fargo
Amber Metz	Executive Director	Lake Agassiz Regional Council
Doug Murphy	Emergency Preparedness Reg. Coordinator	Fargo Cass Public Health
Mike Opat	Engineer	Moore Engineering, Inc.
Jim Prochniak	Emergency Manager	Cass Fargo Emergency Management
Leon Schlafmann	Emergency Manager	Fargo
Tom Soucy	Assistant County Engineer	Cass County
Barrett Voigt	Planner (from October 2018 onward)	Cass County
Mark Williams	Assistant Planning Director	Fargo

Table 2.2 Steering Committee Meeting Attendance

Name	8-23-18	10-26-18	1-10-19	3-5-19	5-9-19
Kay Anderson	■		■	■	■
Jason Benson		■	†		
Jody Bertrand	■	■	■	■	
Mitch Calkins	■	■		■	■
Hali Durand	■				
Pierre Freeman	■		■	■	
Jeremy Gorden	■	■	■		

Josh Hassell	■				
Amanda Johnson	■			■	■
Daryl Masten	■	■	■		
Amber Metz	■	■		■	■
Doug Murphy		■		■	■
Mike Opat		■		■	
Jim Prochniak	■	■	■	■	■
Leon Schlafmann	■		■	■	■
Tom Soucy	■		■	■	■
Barrett Voigt			■	■	
Mark Williams	■	†			

† *Indicates a substitute was present at the meeting*

At the start of the process, a letter was sent to each city requesting their commitment to participate in the update of the plan. Copies of those commitment letters are found in Appendix A. The following Table 2.3 lists the elected leaders, auditors or other staff with whom initial contacts was made. Requests for information and for feedback were forwarded to the city council members' attentions. Appendix B shows the extent of each city's participation in more detail.

Table 2.3 Jurisdiction Contact List

Jurisdiction Name	Contact	Position
Cass County	Heather Worden	County Commission Administrative Assistant
Alice	Lori Schmidt	Auditor
Amenia	William Stansbery	Mayor
Argusville	Mary Howatt	Auditor
Arthur	Scott Kroeger Greg Nelson	Auditor Mayor/Floodplain Administrator
Ayr	Diane Hovland	Auditor
Briarwood	Mike Fritz John Adams	Auditor Mayor/Floodplain Administrator
Buffalo	Harmony Richman	Auditor
Casselton	Sheila Klevgard	Auditor/Floodplain Administrator
Davenport	Mark Roster	Auditor
Enderlin	Cyndee Chesley	Auditor
Fargo	Kember Anderson	Executive Assistance to City Commission
Frontier	BJ Blanchette Perry Ronning	Mayor Zoning/Floodplain Adminsitrator
Gardner	Todd Kalm	Mayor

Grandin	Tracey Dahl	Auditor
Harwood	Casey Eggermont	Auditor/Floodplain Administrator
Horace	Matt Lower Perry Ronning	Community Development Director Zoning/Floodplain Administrator
Hunter	Ben Olson Emily Murch	Mayor Auditor/Floodplain Administrator
Kindred	Tabitha Arnaud	Auditor/Floodplain Administrator
Leonard	Greg Wessels	Mayor
Mapleton	Mary Hinschberger	Auditor
North River	Troy Durham	Mayor/Floodplain Administrator
Oxbow	Stacey Fett Jim Nyhof	Auditor Mayor/Floodplain Administrator
Page	Judy Johnson	Auditor
Prairie Rose	Rick Callens Robert Staloch	Mayor Auditor/Floodplain Administrator
Reiles Acres	Shane Amundson	Mayor
Tower City	Jody Haselu	Auditor
West Fargo	Tina Fisk	Auditor

Near the beginning, LARC staff met with the cities' contracted engineers, either with Moore Engineering or with Interstate Engineering. The purpose of these meetings was to gather their technical input regarding the needs, vulnerabilities, and mitigation-related projects being planned for each city. They explained what projects from the 2014 version of the plan have been completed, were not relevant anymore, or need to remain but have the timelines and cost estimates updated.

Kick-off meetings open to the public were held at the Casselton Auditorium in Casselton on October 3, 2018 and Northport Library in Fargo on October 4, 2018. Notification was published in the Cass County Reporter. Email invitations were also sent to all local jurisdictions' mayors and auditors. A copy of the notice follows as Figure 2.1.

Figure 2.1 Notice of Public Meeting

Notice of Public Open House

Cass County Emergency Management is updating the county's Multi-Hazard Mitigation Plan. This plan will describe the strategy to lessen the impact of natural disasters upon lives and property. To kick off the process, two public open houses will be held to describe the purpose of the plan and to gather input on past performance of mitigation activities and possible future actions.

Interested individuals are encouraged to stop by between the following times:

Wednesday, October 3 from 7 to 8:30 pm at the Casselton Auditorium, 702 1st St N, Casselton, ND.

Thursday, October 4 from 6 to 7:30pm at the community room of the Northport Library, 2714 N. Broadway, Fargo, ND.

If special accommodations are necessary, please call Mitch Calkins at 701-235-1197.

It is imperative that the multi-hazard mitigation plan be integrated with and does not work at cross purposes with existing plans. To that end, a range of plans were examined in order to find what nexus, if any, there was to natural hazard mitigation. If mitigation-related elements were found in those documents, these were brought up with the relevant stakeholders during the outreach process. It should be noted that many of the smaller towns do not have adopted plans. Table 2.4 lists the plan and policy documents that were examined and how it contributed to the mitigation plan development. As these come due for revision, the planning team will share relevant information and contribute feedback to the greatest extent possible. This will ensure that natural hazards, and measures to mitigate the effects thereof, are adequately considered during those planning processes.

Table 2.4 Plans Examined and Incorporation into Mitigation Plan

County-wide	Contribution
Red River Basin Commission's Long Term Flood Solutions	County's mitigation actions as it relates to flood control
Cass County Comprehensive & Transportation Plan	County's profile, vulnerabilities to all hazards, and potential mitigation-related action steps
Cass County Comprehensive Highway Plan 2018-2022	County's profile and potential mitigation-related action steps
Fargo-Moorhead Alternate Route & Traffic Incident Management Guidebook	The vulnerability of the transportation network as it relates to hazards
Traffic Operations Incident Management Strategy	The vulnerability of the transportation network as it relates to hazards

Transportation Improvement Program 2018-2021	Potential mitigation actions for transportation network
Emergency Operations Plan	Vulnerabilities that would hinder response efforts
Subdivision Ordinance	Capabilities of the county to regulate development in risky areas
Long-Range Transportation Plan	Potential mitigation action steps
Argusville	**Contribution**
Flood response plan	Vulnerabilities that would hinder flood response efforts
Casselton	**Contribution**
Comprehensive plan	City profile and potential mitigation actions
Emergency operations plan	Vulnerabilities that would hinder response efforts
Storm water management standards	Capability to regulate development in manner that prevents aggravating flooding
Enderlin	**Contribution**
Ransom County Multi-Hazard Mitigation Plan	Potential mitigation actions
Fargo	**Contribution**
Downtown InFocus	Profile for downtown core, vulnerability assessment for all hazards, and potential mitigation actions
Go2030 comprehensive plan	City profile, vulnerability assessment for all hazards, and potential mitigation actions
Floodproofing standards	Capability to regulate floodproofing standards and basement exemption.
Prioritized Comprehensive Flood Mitigation Plan	Potential mitigation actions for flooding
Subdivision and land use zoning ordinances	Capabilities to regulate development in risky areas
Emergency Operations Plan	Vulnerabilities that would hinder response for all disaster event types
Fargo Park District	**Contribution**
Long Range Capital and Maintenance Plan	Vulnerabilities of Park District's facilities to all hazards and potential mitigation actions

Fargo Public Schools	Contribution
Long Range Facility Plan	Vulnerabilities of School District's facilities to all hazards and potential mitigation actions
Frontier	**Contribution**
Zoning Ordinance	Capability of city to regulate development
Gardner	**Contribution**
Zoning Ordinance	Capability of city to regulate development
Harwood	**Contribution**
Flood Emergency Plan	Vulnerabilities as it relates to ability to respond to flooding
Horace	**Contribution**
2028 Comprehensive Plan	City profile, vulnerabilities for all hazards, and potential mitigation actions
Oxbow	**Contribution**
Land Development Code	Capability to regulate development in risky areas
Tower City	**Contribution**
Zoning ordinances	Capability to regulate development in risky areas
West Fargo	**Contribution**
Drought Contingency and Emergency Water Management Plan	Vulnerability assessment as it relates solely to drought and potential mitigation actions
Zoning ordinance	Capability to regulate development in risky areas
West Fargo 2.0 comprehensive plan	City profile, vulnerability assessment for all hazards, and potential mitigation actions

The quality of a hazard mitigation plan can be traced to the quality of the outreach conducted in its formation. To that end, LARC staff endeavored to directly contact as many stakeholders as possible. The steering committee agreed that one-on-one conversations was the method that would have the most success.

Compared to the previous version of the plan, more effort was placed upon contacting a diverse range of stakeholders. This included social service agencies, special-purpose governmental entities, owners of critical infrastructure, neighborhood coalitions, and environmental groups. In total, 56 different organizations responded to requests for information and to answer questions on what mitigation concerns they have with their operations.

LARC staff attended other meetings where pertinent stakeholders were present, such as regularly scheduled city

council meetings, the Cass County Local Emergency Planning Committee, and the Cass County Township Officers Association. A list of those stakeholder groups and experts who were informed of the plan and who offered input can be found in Table 2.5

Table 2.5 Responding Stakeholders

City or contracted engineers for each jurisdiction	Fargo Planning Department	West Fargo Planning Department
Horace Community Development Director	Fargo Public Works	West Fargo Public Works
Cass Rural Water District	ND Department of Transportation	North Dakota State Fire and Tornado Fund
Fargo Fire Department	Harwood Area Fire and Rescue	West Fargo Fire Department
Fargo Police Department	MATBUS (public transportation)	Hector International Airport
Housing Authority of Cass County	Northern Cass Public School District	Fargo Public School District
Central Cass Public School District	Kindred Public School District	Cass County Electric
Xcel Energy	Sanford Health	VA Medical Center
Essentia Health	BNSF	Red River Regional Dispatch Center
Jefferson Area Neighborhood Association	Horace Mann Area Neighborhood Association	Cass County Historical Society
Riverkeepers	Cass County Soil Conservation District	Fargo Park District
North Dakota State Climatologist	Lutheran Social Services	AARP
FM Coalition for the Homeless	Southeast North Dakota Community Action Agency	NDSU Extension Service
NDSU	Rush River Water Resource District	Cass County Jail

In cooperation with staff from the North Dakota Department of Emergency Services and Cass Fargo Emergency Management, two Community Coffee sessions were held on March 7th, 2019. The first was with 26 students enrolled in the NDSU emergency management program; the second was with 23 New American representatives at the offices of Lutheran Social Services. This unique outreach method consisted of presentations from DES staff about their experiences with hazard mitigation planning and the lessons they have learned throughout the years.

LARC staff followed with its own presentation specifically about the Cass County Multi-Hazard Mitigation Plan. Participants were asked to rank the hazards according to its location and extent of impact. Both audiences offered valuable input not only when it comes to mitigation, but also for the other phases of emergency

management. Going forward, this technique for speaking with stakeholders should be continued in the plan maintenance phase due to the valuable discussions that were had.

PLAN MAINTENANCE

Mitigation plans are meant to be living documents whereby alterations are made as hazard conditions change, projects are completed, new project ideas start being considered, as funding sources change, as laws are adopted, and as vulnerabilities change due to population changes or continued land development. Maintenance of the plan keeps its value as a guidepost for communities.

Therefore, the steering committee commits itself to reviewing the plan once a year over the five-year period of the plan. It is believed the membership steering committee will remain, although new members can be added as deemed appropriate. At the annual review sessions, the steering committee will monitor goals, objectives, and action items as well as evaluate the effectiveness of the county's and cities' mitigation efforts. Reviews of the plan will take place upon the conclusion of a disaster event, in order to find what action steps should be taken and in what priority. This will be done in addition to the normal annual review if time permits.

Cass County staff and its partners will continue doing public outreach as part of plan maintenance. In addition to the preparedness messages that are disseminated on a regular basis, messages regarding the mitigation steps individuals, households, and businesses can take will also be shared through various media including radio, television, social media, and in-person meetings or presentations. Continuing lines of communication with the public, stakeholder groups, and cities will aid in the implementation of mitigation actions as well as shed light on any new strategies that should be employed.

PLAN INTEGRATION

Cass Fargo Emergency Management staff will ensure this mitigation plan will be referred to during the crafting of other plans. This will be accomplished through Cass Fargo Emergency Management staff responding to invitations to participate or provide input and by assisting local governments and special districts. The benefit will be that the separate plans do not conflict, but rather align in a manner whereby the implementation of actions will bring about benefits that touch upon different domains, hazard mitigation included.

As the regional planning agency for the area, Lake Agassiz Regional Council will be actively involved in planning efforts where appropriate. Additionally, FM Metro COG – the Metropolitan Planning Organization (MPO) for the Fargo-Moorhead area – will receive this mitigation plan so that they can refer to the document during their planning processes. Upon approval, the plan will be distributed to each city's engineer so that it can be consulted

during the creation of new capital improvement plans.

The other types of plans in which hazard mitigation has a nexus is listed in the following table, along with a description of how these are connected.

Table 2.6 Plan Integration

Plan	Connection
Continuity of Operations	In the event of a disaster, governments must continue a basic level of services to maintain public order, health, and safety. A significant potential exists for staff to be dislocated, buildings damaged, and demands for assistance increase. Finding alternative methods of continuing services, maintaining chains of command, and keeping track of expenditures are elements in this type of plan. The hazard identification and city-specific vulnerabilities can be examined to find weak spots in the governments' disaster contingencies.
Disaster Response	Disaster-specific response plans lay out the actions various governmental entities and voluntary organizations undertake to limit the damage caused by the disaster as it is occurring (e.g. building sandbag levees for flooding), as well as rescuing those who are affected. Areas with higher-than-normal vulnerability that makes evacuation more challenging is one element that should be noted. Mitigation actions that reduce the challenge of evacuation, or the need to evacuate in the first place, can and should be listed within this plan document.
Disaster Recovery	Disasters are inevitable. The way in which a community rebuilds is a decision, however, that can be determined before a disaster strikes. The mitigation action steps from this plan can be implemented during the recovery phase. Changes to policy would ensure development occurs in areas deemed safe and in a manner that is better able to withstand hazards. Rebuilding infrastructure to a higher standard is possible given that federal aid dollars may be available.
Comprehensive Plan	As the name implies, comprehensive plans take an all-inclusive look at a community and delineates a course of action to manage changes which are undergoing and those that are anticipated to occur. These are long-range, general in scope documents which guide the physical development of the city according to the social, cultural, and economic goals of residents. Conforming these to the mitigation plan would entail that the growth priority areas where

	future infrastructure expansion and development will occur does not happen in areas of high-risk, such as floodplains for example. Any goals in the comprehensive plan targeted towards uplifting those disadvantaged socio-economically speaking should take into consideration how those populations are differently affected by disasters. North Dakota law requires comprehensive plans address emergency management. Cass County's new comprehensive plan fulfills that requirement.
Capital Improvement Plan	These are short-range plans that identifies infrastructure improvements, a tentative schedule of construction, and financing options. The benefit of this plan lies within it laying out a realistic and fiscally responsible course of action for a jurisdiction's infrastructural needs. As it relates to mitigation, the hazard profiles and vulnerability assessments should be referred to in order to make sure that infrastructure is not extended into risky areas.
Small-area or neighborhood plans	These are planning efforts focused solely on a specific neighborhood. Often initiated by residents, these examine the issues most pertinent to them including but not limited to housing, public safety, managing development pressures, capital improvements, and so on. These efforts would be aided by examining the vulnerability assessments as it relates to their neighborhoods.
Transportation	Often tied into comprehensive and capital improvement plans, transportation planning looks at the current and projected needs for all modes of transportation. These documents should reference the vulnerability assessments found in this hazard mitigation plan and ensure that roads, rail, trails, and so on aren't extended into areas in the floodplain.
Housing Needs Assessments	The availability, affordability, and condition of the housing stock is often a concern among local elected officials and community leaders. These analyses should also take into consideration the ability of the housing stock to withstand flooding and high winds. Examining this through the lens of socio-economic vulnerabilities will find what types of households are better prepared and which will need extra attention in implementing mitigation measures for their properties.

Upon the final adoption of this plan by each jurisdiction, copies will be sent to each city council, auditor, and other staff. They will be encouraged to not only reference the plan as needed, but also review on a regular basis. These reviews will examine whether the hazard profile has changed and whether the mitigation actions will need to be updated to reflect that change.

It should be noted that there is a trend among federal agencies to incentivize having the project mentioned in multiple plans. Applications can be scored better if it is demonstrated the project in question cuts across domains and tackles multiple issues.

Upon the North Dakota Department of Emergency Services and FEMA Region VIII's approval, the plan will be formally adopted by all jurisdictions in Cass County, including the Cass County Commission and each city council or commission. A sample adoption resolution follows as Figure 2.2. Executed resolutions for all jurisdictions can be found in Appendix C.

Figure 2.2 Adoption Resolution

RESOLUTION NO. _____

RESOLUTION TO ADOPT THE MULTI-HAZARD MITIGATION PLAN

A RESOLUTION OF THE _____ TO ADOPT THE 2019 CASS COUNTY MULTI-JURISDICTIONAL, MULTI-HAZARD MITIGATION PLAN

WHEREAS, the ____ recognize the threat that natural hazards pose to people and property within Cass County, North Dakota; and

WHEREAS, the Cass County Commission and participating city councils have prepared a multi-hazard mitigation plan, hereby known as 2019 Cass County Multi-Jurisdictional, Multi-Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the as 2019 Cass County Multi-Jurisdictional, Multi-Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Cass County from the impacts of future hazards and disasters; and

WHEREAS, adoption by the ____ demonstrates a commitment to hazard mitigation and achieving the goals outlined in the 2019 Cass County Multi-Jurisdictional, Multi-Hazard Mitigation Plan.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL, THAT:

The ____ adopts the as 2019 Cass County Multi-Jurisdictional, Multi-Hazard Mitigation Plan.

ADOPTED by a vote of _____ in favor and _____ against, and _____ abstaining, this _____ day of _____, _____.

APPROVED:

By: _____
Mayor

ATTEST:

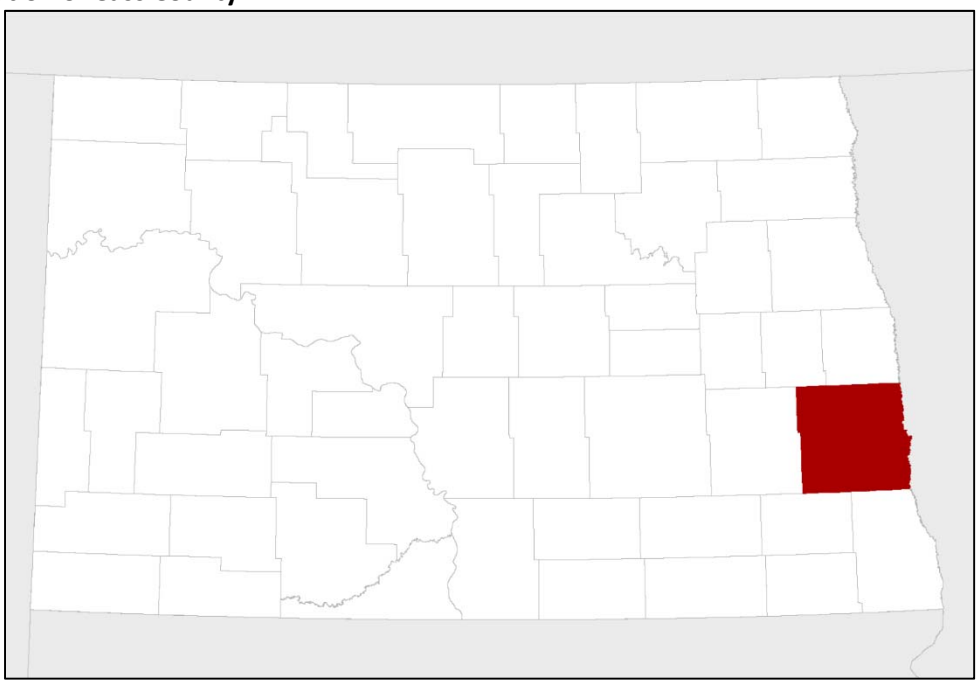
By:_____
Auditor

SECTION III: COUNTY PROFILE

Cass County is located in southeastern North Dakota in the Red River Valley. It is the most populous county in the State with the 2010 Census reporting its population at 149,788. The population for 2017 as estimated by the Census Bureau sits at 177,787, for an increase of approximately 18%.

The county seat is Fargo where over 70 percent of the population resides. The Red River of the North establishes Cass's eastern border, separating North Dakota from Minnesota. The county has a total area of over 1.13 million acres, the majority of which is dedicated towards agricultural uses.

Figure 3.1 Location of Cass County



POPULATION

The continuous population growth sets Cass County from many others in North Dakota. The diversified economy that has developed in the Fargo metropolitan area has greatly contributed to this consistent growth. Table 3.1 and Figures 3.2 and 3.3 shows the population of Cass County as compared to the rest of the state, which has seen the general trend of stagnation only until the current decade.

Table 3.1 Cass County and State of North Dakota Populations 1900 - 2010

Year	North Dakota	Cass County	Cass's Percent of State Total
1900	319,146	28,625	8.9
1910	577,056	33,935	5.8
1920	646,872	41,477	6.4

1930	680,845	48,735	7.1
1940	641,935	52,849	8.2
1950	619,636	58,877	9.5
1960	632,446	66,947	10.5
1970	617,761	73,653	11.9
1980	652,717	88,247	13.5
1990	638,800	102,874	16.1
2000	642,200	123,138	19.1
2010	672,591	149,778	22.2

Figure 3.2 North Dakota Population 1900 - 2010

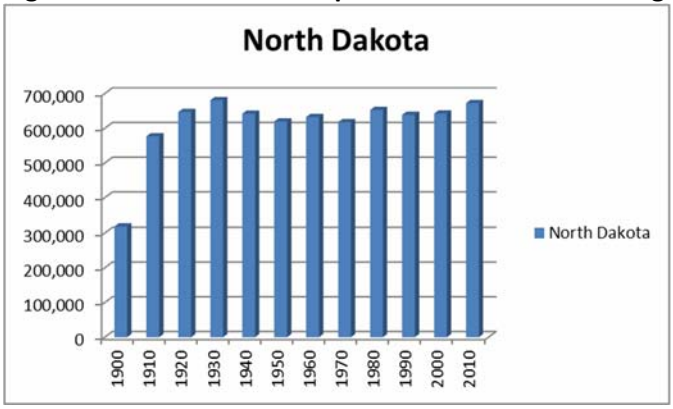
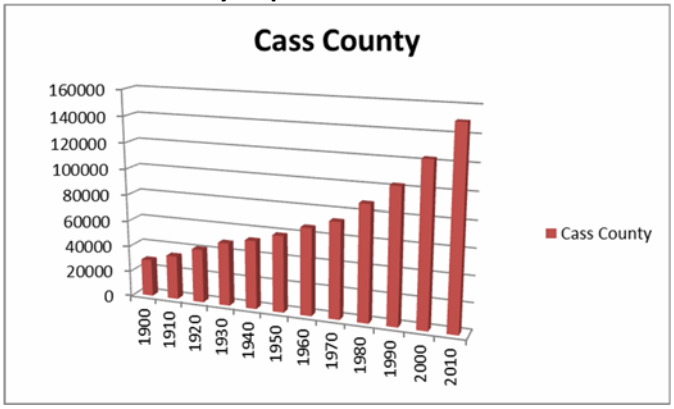


Figure 3.3 Cass County Population 1900 - 2010



Source: U.S. Decennial Census

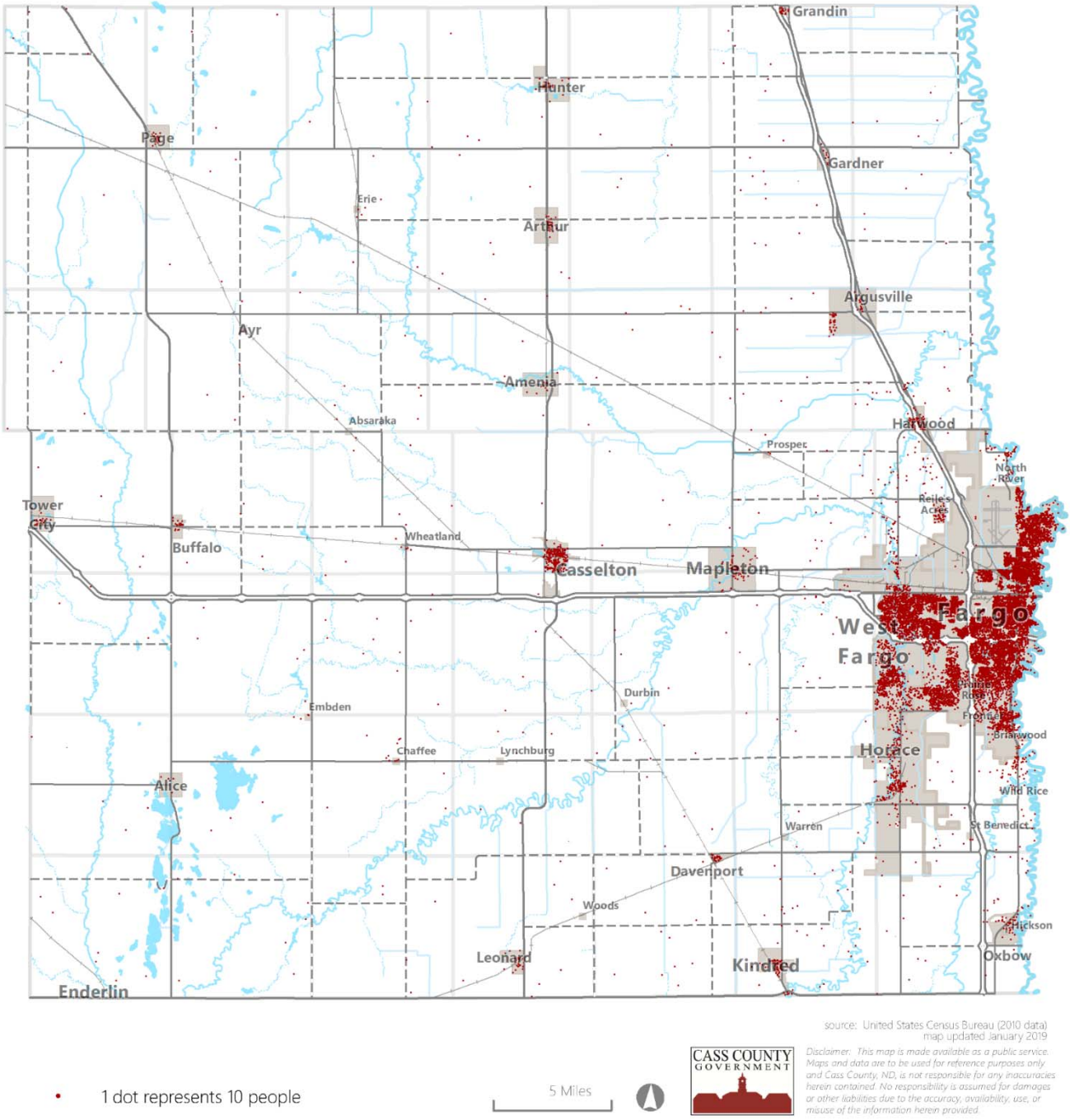
Cass County's population increased by 26,640 people, or 21.63 percent, between the years of 2000 and 2010. The population residing within municipalities increased by 28,535 people, or 25.11 percent, while the population living in rural unincorporated areas decreased by 1,895 people, nearly 20 percent. It should be noted that the state of North Dakota uses the word "city" for towns of all sizes.

Population changes in the cities from 2000 to 2010 are shown in Table 3.2. The current population density as shown in Figure 3.4 is telling of a continuing migratory trend in the county. Fargo and communities within a 30 mile commuting distance of the Fargo-Moorhead Metropolitan Statistical Area (FM MSA) are growing while the populations of communities farther from the FM MSA continue to decline.

Table 3.2 City Populations in Cass County 2000 – 2010, by population change

City	2000	2010	Change
Argusville	147	475	223.13%
Horace	915	2,430	165.57%
Reile's Acres	254	513	101.97%
West Fargo	14,940	25,830	72.89%
Mapleton	606	762	25.74%
Casselton	1,855	2,329	25.55%
Oxbow	248	305	22.98%
Harwood	607	718	18.29%
Fargo	90,599	105,549	16.50%
Kindred	614	692	12.70%
Prairie Rose	68	73	7.35%
Amenia	89	94	5.62%
Page	225	232	3.11%
Tower City	252	253	0.40%
Davenport	261	252	-3.45%
Grandin	181	173	-4.42%
Briarwood	78	73	-6.41%
Gardner	80	74	-7.50%
Buffalo	209	188	-10.05%
Leonard	255	223	-12.55%
North River	65	56	-13.85%
Arthur	402	337	-16.17%
Hunter	326	261	-19.94%
Frontier	273	214	-21.61%
Ayr	23	17	-26.09%
Alice	56	40	-28.57%

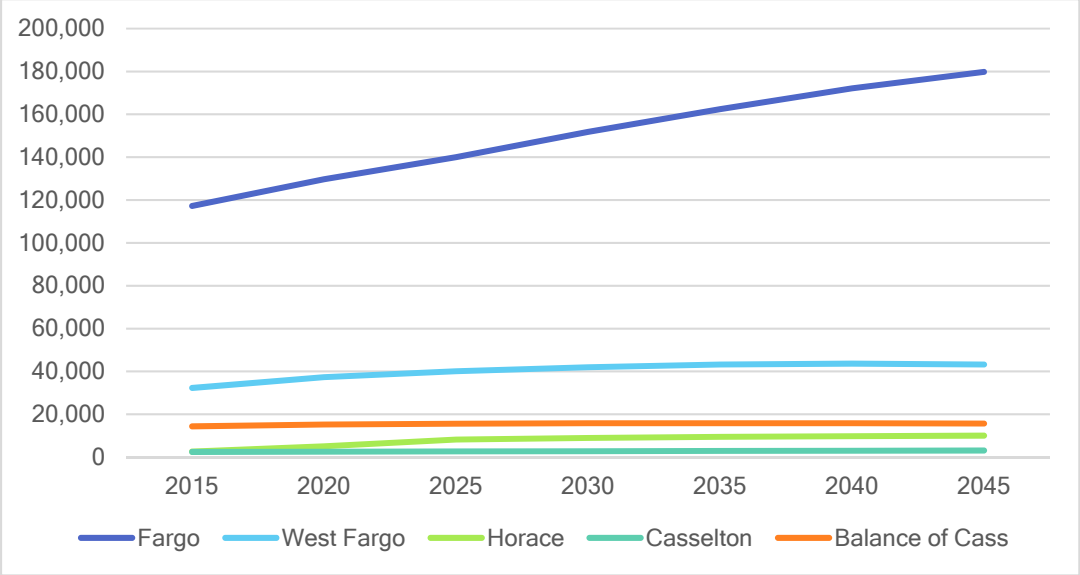
Figure 3.4 Cass County Population Density as of 2010



Source: Cass County

In 2017, Fargo-Moorhead Metropolitan Council of Governments created population estimates for Cass County and its jurisdictions through the year 2045, as seen in the following chart:

Figure 3.5 Cass County Population Projections to 2045



Fargo will be the primary beneficiary of population growth with its surrounding cities also experiencing some increases, although not to the same extent. The rural portions of Cass County, however, will continue to feel the effects of the rural-to-urban migration trend. Thus, the population will stagnate, if not decline, over the next few decades.

AGE

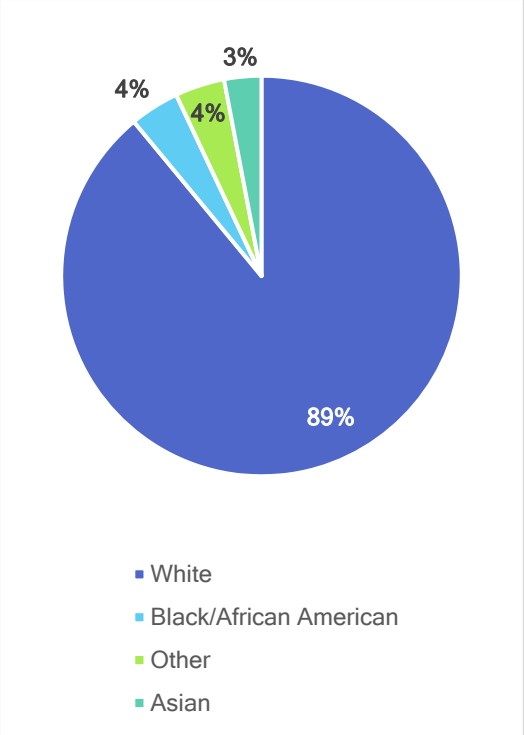
The median age of Cass County increased from 31.3 years old in 2000 to 32.2 years old in 2017, although it should be noted this is still below the median for North Dakota (35.1) and the nation (37.8). This is partly the result of the large student population attending the multiple universities and colleges in the Fargo-Moorhead metropolitan area, as well as the relatively strong economy that has allowed for the successful retention of college graduates.

The aforementioned population projections also estimated that the share of the population considered elderly (age 65 and over) will continue to increase. Baby Boomers continue to reach that age threshold as health care advances continue, allowing for longer lifespans. As of 2017, 10.9% of Cass County are elderly, and increase from 9.6% in 2010. In emergency management, the elderly is viewed as a subpopulation that is particularly vulnerable to the impacts of disasters. Additionally, those with disabilities may also have a disproportionate exposure to impacts of disasters. Mitigation best practices state that these and other demographic subpopulations should be examined separately during the risk assessment and mitigation strategy crafting processes.

RACE

Cass County has a predominantly Caucasian population as seen in the following chart. However, it has become more diverse over the years. In 2000, the county consisted of 96% white and by 2010 it was 94%. The share of the population that are Hispanic increased from 1.2% in 2000 to 2.0% in 2010 and 2.4% in 2016. An active refugee resettlement program has made Fargo home to one of the highest New American populations for a city of its size. Families have come from the Middle East, Sub-Saharan Africa, and the Balkans. The latest data from 2017 show that 8.2% of Fargo's population is foreign-born. Language barriers will then have to be addressed by translating hazard mitigation information into both print and audio formats. New Americans tend to utilize smart phones for Internet access more, meaning websites should be mobile friendly.

Figure 3.6 Racial Composition of Cass County



HOUSEHOLDS

There are 70,460 households in Cass County, 91% of which were in the cities of Fargo, West Fargo, and Horace. The average household sizes for select cities are presented below:

Table 3.3 Average Household Sizes for Select Cities

City	Avg. Household
Argusville	3.1
Casselton	2.7
Fargo	2.3
Harwood	3.0
Horace	3.1

Kindred	2.7
Mapleton	3.2
Reiles Acres	3.6
West Fargo	2.6
Remainder of Cass	2.5

Fargo and West Fargo have lower household sizes, perhaps indicative of its younger population that have yet to form families. Among renters across the county, the average household size is 1.89; for homeowners the average size is 2.65. A little over quarter (27 percent) of households have children under the age of 18. This is a slight decline since 2000 where 30 percent of households had children under 18.

Whether a household has access to a vehicle or not is relevant to emergency managers since it is a proxy indicator of the resources a household possesses that would allow for them to evacuate in case of an emergency. The vast majority of households in Cass County have access to at least one vehicle (93.2%). Almost 7% of households do not have any vehicles available. Crafting mitigation strategies with the location of those households in mind will lead to the examination of the vulnerability of alternative transportation options.

INCOME

It is generally believed that households with higher incomes will have more resources available to not only respond to a disaster, but also to engage in mitigation actions in the first place. The spatial distribution of higher compared to lower-income households helps guide mitigation actions by focusing on those areas that may need extra assistance in implementation. The chart below details three incomes statistics by city. Median household income is the number by which half of households are above and half are below. Mean household income is the average and can be a more skewed measurement. The poverty rate is the percentage of individuals who fall below the poverty rate line based on their household size and income, as determined by the federal government.

Table 3.4 Income Characteristics by Jurisdiction (2017)

Jurisdiction	Median Household Income ($)	Mean Household Income ($)	Poverty Rate (%)
Cass County	58,026	79,729	11.2
Alice	38,750	51,675	4.5
Amenia	74,375	67,202	3.7
Argusville	105,313	117,088	1.4
Arthur	57,222	98,378	1.9
Ayr	†	†	†
Briarwood	†	†	†
Buffalo	68,472	76,010	2.4
Casselton	69,858	82,256	3.3
Davenport	66,250	70,326	7.5

Enderlin	55,500	63,916	10.0
Fargo	50,561	71,030	13.9
Frontier	123,750	128,512	†
Gardner	33,750	48,135	5.6
Grandin	65,625	71,500	1.0
Harwood	93,750	104,523	1.1
Horace	110,870	140,022	1.8
Hunter	64,821	91,309	12.4
Kindred	81,000	94,381	10.6
Leonard	60,125	79,165	5.1
Mapleton	78,487	87,477	1.6
North River	122,500	120,011	†
Oxbow	136,932	189,612	†
Page	56,607	67,401	4.5
Prairie Rose	113,125	121,238	†
Reiles Acres	128,125	144,523	1.2
Tower City	47,212	63,951	7.6
West Fargo	76,925	95,247	6.9

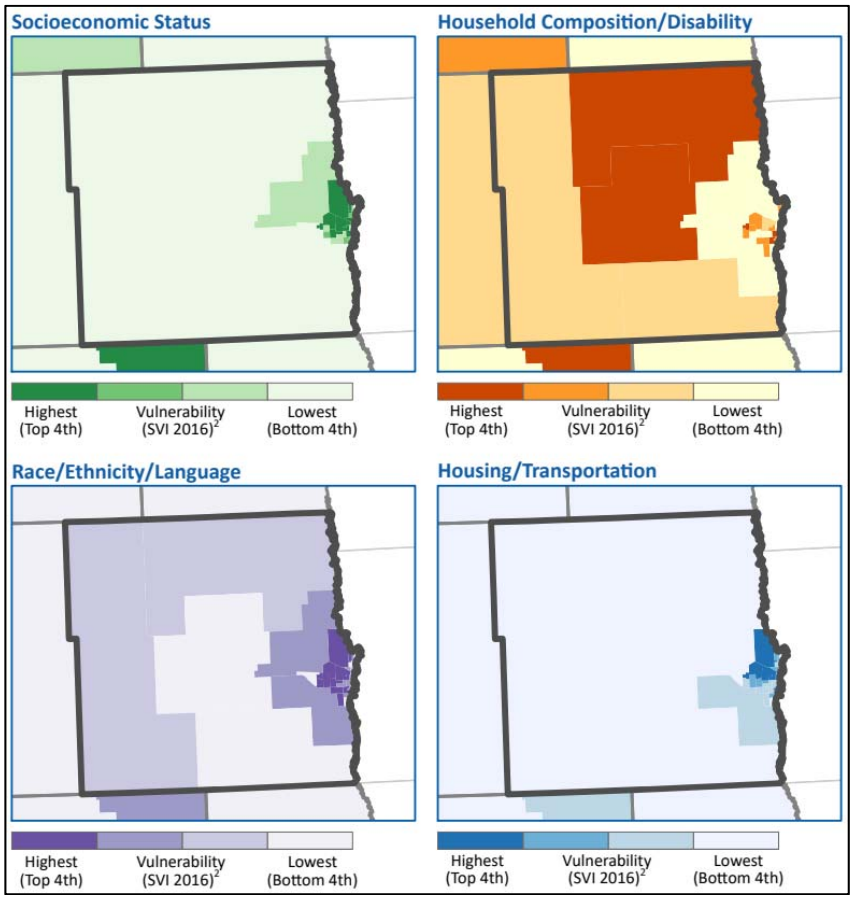
† *Data not available due to small sample size and confidentiality*

SOCIAL VULNERABILITY INDEX

The resiliency of a community is found in its ability to withstand and bounce back after the occurrence of a natural disaster. One method of measuring resilience is through the Social Vulnerability Index (SVI) developed by the US Centers for Disease Control. It uses 15 variables at the census tract level to help local leaders better understand what portions of their communities may need for support for disaster response and hazard mitigation. The variables are grouped into four themes that summarize the extent to which an area is socially vulnerable to hazards: socioeconomic status contains poverty, unemployment, per capita income, and no high school diploma; household composition and disability contains age 65 and over, age 17 and younger, single-parent household, age 5 and over with a disability; race/ethnicity/language contains minority share, and English language ability; housing and transportation contains multi-unit residential, mobile homes, crowding, no vehicle, and group quarters. These four categories are summarized into one composite score. Below are maps exhibiting the overall score and the four subcomponent scores.

Figure 3.7 CDC's Social Vulnerability Index overall score, 2016

Figure 3.8 CDC's Social Vulnerability Index theme scores, 2016



The areas of higher social vulnerability are found mainly in Fargo, particularly in the central and northern parts of the city. The areas of lower socio-economic status are in downtown Fargo, the neighborhoods around West Acres Mall, and around the NDSU campus. It should be noted for the last one that college students often report low incomes, but they are not be considered low-income as commonly understood given that many still receive support from parents and student loans. In Fargo and West Fargo, there are several mobile home parks that affect the data since mobile homes are an important source of affordable housing. Mobile homes, also called manufactured housing, are more vulnerable to high winds and storms than stick-built housing.

The household composition and disability category show that central and northern parts of the county are more vulnerable. This is partly a result of the older-than-average population found in those communities. The presence of a nursing home or assisted living facility appeared to affect this score. Older individuals may be less mobile in responding to the need to evacuate. Those housing facilities for the elderly should pay extra attention to mitigation, given evacuation of that population is more difficult and requires more time.

The race, ethnicity, and language measurement find that many of the same neighborhoods with the highest vulnerability scores in the socio-economic category are also high in this one as well. The neighborhood around West Acres Mall has become home to New Americans, many of whom are renting. Therefore, it will have to be recognized that those residents do not own their dwelling and are unable to implement many mitigation actions.

The housing and transportation indicators show that the areas of highest vulnerabilities are in downtown and north Fargo plus the core neighborhoods in West Fargo. These areas of contain a higher proportion of apartment buildings. Around NDSU those cater to students, while the downtown Fargo contains apartments geared towards those seeking a more urban-style living arrangement. Fewer people than average in those census tracts own a vehicle. West Fargo's area of higher vulnerability is due, in part, to the mobile home park that is located there.

RIVERS

Five rivers comprise the major components of Cass County's surface drainage system: Red River of the North, Sheyenne River, Maple River, Rush River and Wild Rice River. Other significant tributaries include Swan Creek and Buffalo Creek. Rivers play a vital role in irrigation, recreation, and municipal water supplies in the County. The very flat nature of the Red River Valley, the minimal gradient of the rivers, and the northerly flow of the Red River of the North make the area prone to extensive and prolonged flooding during the spring melt.

The Red and Sheyenne Rivers serve as the primary water sources for the metropolitan area while the smaller outlying communities obtain it from groundwater. Protecting the quality of those rivers is undoubtedly

important. The drinking water has been consistently found safe after going through the treatment process. The rivers' tributaries experience water quality problems that are caused by the area's agricultural operations as well as the continued urban development.

LAKES, RESERVOIRS, AND WETLANDS

Cass County has 32 lakes found mostly in the west and southwest averaging 42 acres in size. 10 artificially created lakes average 36 acres in size. These lakes and reservoirs provide flood protection, irrigation, and recreational opportunities. The remaining sources of surface water found in the county are wetlands which are valuable for surface and subsurface water storage, nutrient cycling, retention of sedimentation, and plant and wildlife habitats. The fertile soils found in wetland areas make them productive areas for farming and resulted in drainage and removal of many acres of wetlands. Many of these wetlands are now protected by federal and state laws. According to the National Wetlands Inventory, Cass County has 21,036 acres of wetlands (excluding lakes and rivers). Of this area 7,693 acres are permanently or semi-permanently flooded.

AQUIFERS

The county has several larger aquifers being utilized for agricultural, residential and commercial use to varying degrees. These possess limited additional development possibility. The aquifers in the county are the West Fargo Aquifer System (WFAS), the Page Aquifer, and the Sheyenne Delta Aquifer.

The West Fargo Aquifer System is made of multiple loosely related aquifer units located in the Fargo metro area from Argusville through West Fargo down to the Wild Rice River. This roughly encompasses the same areas being developed over the years. These nine aquifer units share similar characteristics and are loosely connected, meaning changes in one unit could likely be somewhat transmitted to the other units. The individual channels of the WFAS were created during different times of glacial melting traveling through the valley that predated the Red River Valley as we know it. As a result, this aquifer system is covered by glacial lake clays of the bottom of Lake Agassiz. This layer of clay ranges from 60-90 feet, thus greatly inhibiting the recharge rate of the aquifer.

A positive side benefit is the chance of contamination and the spreading of pollution is reduced. The main drawback is the finite source of water that is ultimately available. The profile of the water in the WFAS indicates the majority of the water has characteristics of cold water precipitation, rather than mixture of cold and warm water precipitation. The fact that the area only receives a small portion of precipitation in the form of snow indicates the water in the WFAS dates back to the cold water trapped during the glacial melts, meaning little apparent modern day recharge has occurred.

The declining levels in the WFAS's finite amount of water suggest little potential for new users to utilize the

aquifer. The WFAS has experienced some of the largest water declines in the area. As a result, proper planning of new development will need to find other sources of water and in the future current users of the system will likely need to find alternative water sources, principally from surface water.

The Page Aquifer is located in the northwest portion of the county and extends into Traill and Steele counties. This aquifer was primarily used as municipal water supply for the town of Page. Since 1976 approximately 15,000 acres of land have been supplied water for irrigation from the Page Aquifer. This aquifer has received significant recharge since 1993 following the droughts of the 1980s. If managed in a sustainable manner, this aquifer can service new users for years to come.

The Sheyenne Delta Aquifer is a large and substantial aquifer located in southern Cass, northern Richland, northeastern Sargent, and eastern Ransom counties. While this is a large aquifer, the majority of it is located outside the county, limiting its usefulness for Cass County.

Cass County also has smaller and less significant aquifers with lower potential and water output. These tend to be more greatly affected by climatic extremes. Included in this group are the Tower, Bantel, and Dakota aquifers.

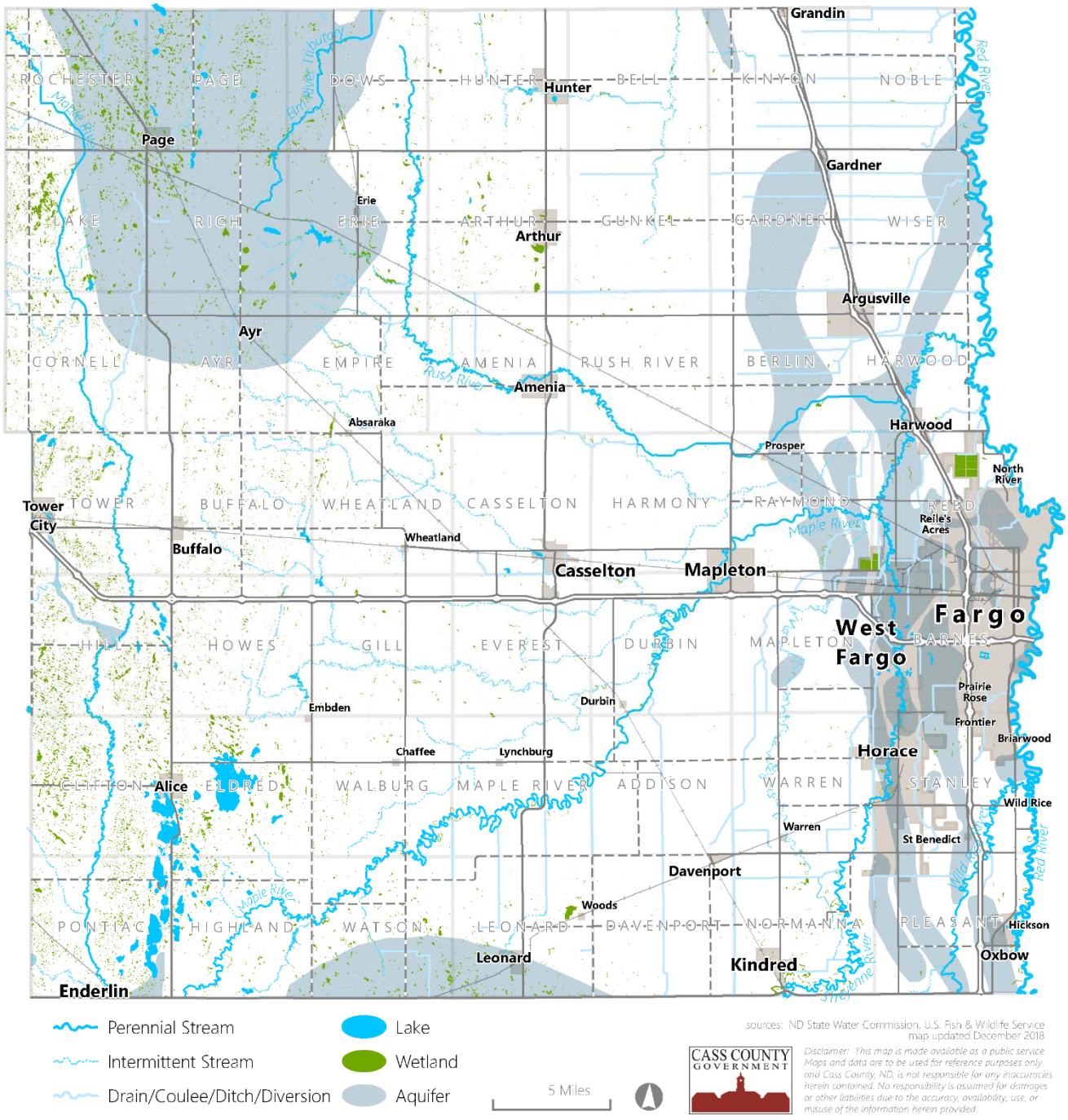
The Tower Aquifer located in western Cass County supplies the water needs of Tower City. This shallow aquifer is very vulnerable to climatic extremes and experienced declining water levels during the 1980s and early 1990s drought conditions. Since 1993, the aquifer has begun a period of recharge, but its small size limits its usefulness to supplying only the current water requirements of Tower City.

The Bantel Aquifer's use has been limited to domestic and stock wells in southwest corner of Cass County. Fortunately, this aquifer has a higher recharge rate.

The Dakota Aquifer is the deepest aquifer in Cass County, with some wells in western portions of the county descending 800 feet, covering areas from the eastern to western borders of Cass County. The water in this aquifer contains high amounts of saline and mineralization, deterring its use for only limited applications.

The data points to the conclusion that groundwater resources are limited, inaccessible, or of poor quality. The slow rate of recharge makes it relatively easy to overdraw. Only the Page Aquifer has any potential for new users. To accommodate future growth and meet increasing water demands, water will be primarily drawn from surface sources. The region has been experiencing a wet cycle over the past few decades. Historical records show this is not a permanent condition. Therefore, contingency planning for droughts and implementing mitigation measures if of concern. A map of the hydrologic features in Cass County follows.

Figure 3.8 Cass County Hydrology

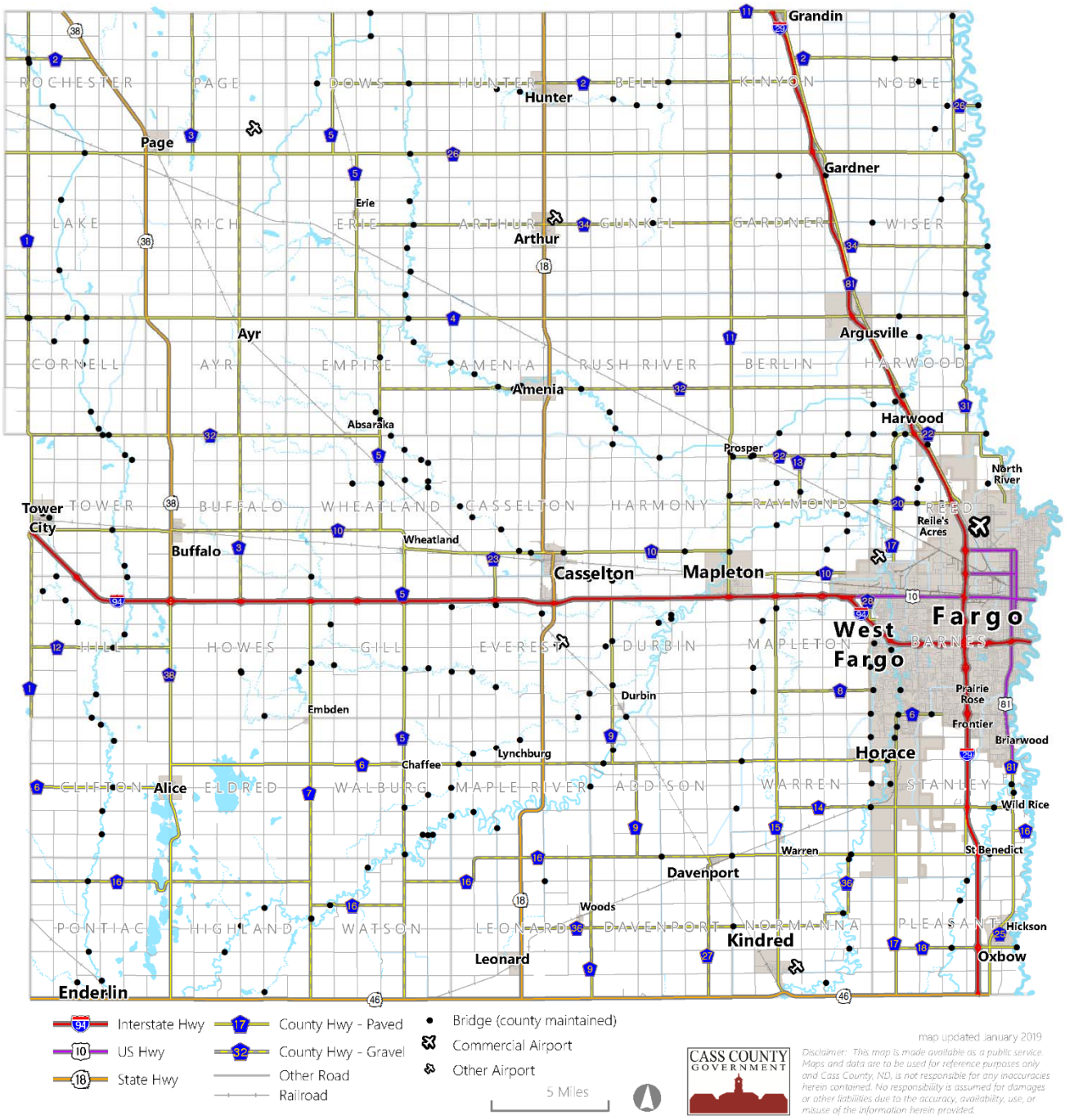


TRANSPORTATION

It is important to understand transportation and its connection to all phases of disasters. Although a more direct link can be drawn between transportation and preparedness and response. there is potential for mitigation actions to have a significant impact on this crucial infrastructure. Reducing the transportation network's exposure to risk can rectify most problems that would occur if a disaster were to hit. Details on area highways

and roads, railways, air service and mass transit are included in this section. Figure 3.9 below is an overview of Cass County transportation.

Figure 3.9 Cass County Transportation System



HIGHWAYS AND ROADS

Cass County is served by two Interstate Highways: north and southbound Interstate 29 and east and westbound Interstate 94 intersect in Fargo. The state highway classification system identifies state highways as Principal Arterials and Major Arterials. Interstate Highways, Principal Arterials and Major Arterials in Cass

County are outlined in Table 3.5 and shown on the previous map.

Table 3.5 Principal Arterials and Major Arterial Highways in Cass County

Road	Classification	Cities in Cass Served	Traffic Count (Average annual daily traffic in 2015)
I-29	Interstate	Grandin, Gardner, Argusville, Harwood, Fargo	10,400 – 65,145
1-94	Interstate	Fargo, West Fargo, Mapleton, Casselton, Buffalo, Tower City	11,555 – 78,170
Hwy 18	State highway	Leonard, Casselton, Amenia, Arthur, Hunter	830 – 4,170
Hwy 38	State highway	Buffalo, Page	515 – 905
Hwy 46	State highway	Enderlin, Leonard, Kindred	1,140 – 2,020

Source: ND Department of Transportation

Cass County is also served by a system of county, township and municipal roads. These make up over 90 percent of road miles in the county. Increasing costs to materials and labor have increasingly strained many government's budgets, as they work to continue keeping the road network in good shape. According to a study conducted by the Upper Great Plains Transportation Institute in 2017, 24% of Cass County's roads are in "very good" shape. 62% are considered "good" while the remaining 15% is considered "fair". The same study found a need to invest approximately $287 million into unpaved (i.e. gravel) roads over the next twenty years. Paved roads need $124 million. $31.6 million will be necessary to rehabilitate or replace the county's 49 bridges. $2.5 million will need to go towards preventative maintenance.

Floods in 2009, 2010 and 2011 caused considerable damage to county and township roads, and although Federal Emergency Management Agency's (FEMA) Public Assistance funding has covered a majority of the repair costs, local budgets cannot cover significant repair costs.

RAIL

The expansion of rail westward across the country was a major impetus of the settlement of Cass County. Today, it is served with both freight and passenger rail service. Amtrak's Empire Builder route stops in Fargo. In fiscal year 2018, approximately 18,700 passengers departed or arrived at the Fargo station. The Burlington Northern Santa Fe (BNSF) and the Canadian Pacific (CP) Rail System provide mainline freight service to major cities in the region including Fargo, Casselton, and Mapleton. The Red River Valley and Western (RRVWRR) short line railroad provides localized service to rural communities along 577 miles of track formerly owned by BNSF,

including the ethanol plant at Casselton. The vast majority of RRVWRR's customers are agriculturally related and many were threatened with the loss of rail service when the region's main line railroads were abandoning branch lines in rural areas.

AIR SERVICE

Hector International Airport in Fargo is the region's largest and only airport served by major air carriers. Allegiant, American, Delta, Frontier and United Airlines provide daily passenger service to Minneapolis, Denver, Phoenix, Chicago, Dallas, Las Vegas, Los Angeles, Atlanta, and Orlando. Six fixed base operators are located at Hector International Airport and provide charter air service, flight school, and aircraft maintenance and repair. The county is also served by five general aviation airports, detailed in the following table.

Table 3.6 General Aviation Airports, Cass County, ND

Airport	Ownership	Runway	Surface/Condition	Services
Arthur (1A2)	Arthur Airport Authority	Runway 17 – 3100x85 ft.	Turf/Fair	Tiedowns
Casselton (5N8)	Casselton Regional Airport Authority	Runway 13/31– 3900 x 75 ft.	Concrete/Good	Hangars, Tiedowns, Fuel, Major Airframe
Kindred (K74)	Kindred-Davenport Regional Airport Authority	Runway 11/29 – 3300 x 60 ft.	Concrete/Good	Tiedowns, Fuel, Major Airframe, Major Powerplant
Page (64G)	Leased to Page Regional Airport Authority	Runway 17/35 – 2600 x 30 ft.	Asphalt/Fair	Tiedowns, Fuel, Major Airframe, Major Powerplant
West Fargo (D54)	West Fargo Airport Authority	Runway 18/36 – 3300 x 50 ft.	Asphalt/Good	Tiedowns, Hangars, Major Airframe, Major Powerplant, Bottled Oxygen

MASS TRANSIT

Metro Area Transit (MATBUS) is a fixed-route and demand-response transit agency operated by the cities of Fargo and Moorhead, MN serving both cities plus West Fargo and Dilworth, MN. Boardings have increased fairly consistently since 2008 with most of the growth coming through the free rides offered to students on the area's colleges and universities.

Beyond ridership figures, the system has served an important role during flood fights in recent years. The cities of Fargo and Moorhead have relied heavily on volunteers and their ability to fill and place sandbags to create the necessary temporary levees to protect core infrastructure. MATBUS personnel and their fleet are a critical factor in mobilization and implementation of the flood fight effort. Valley Senior Services and Handi-Wheels

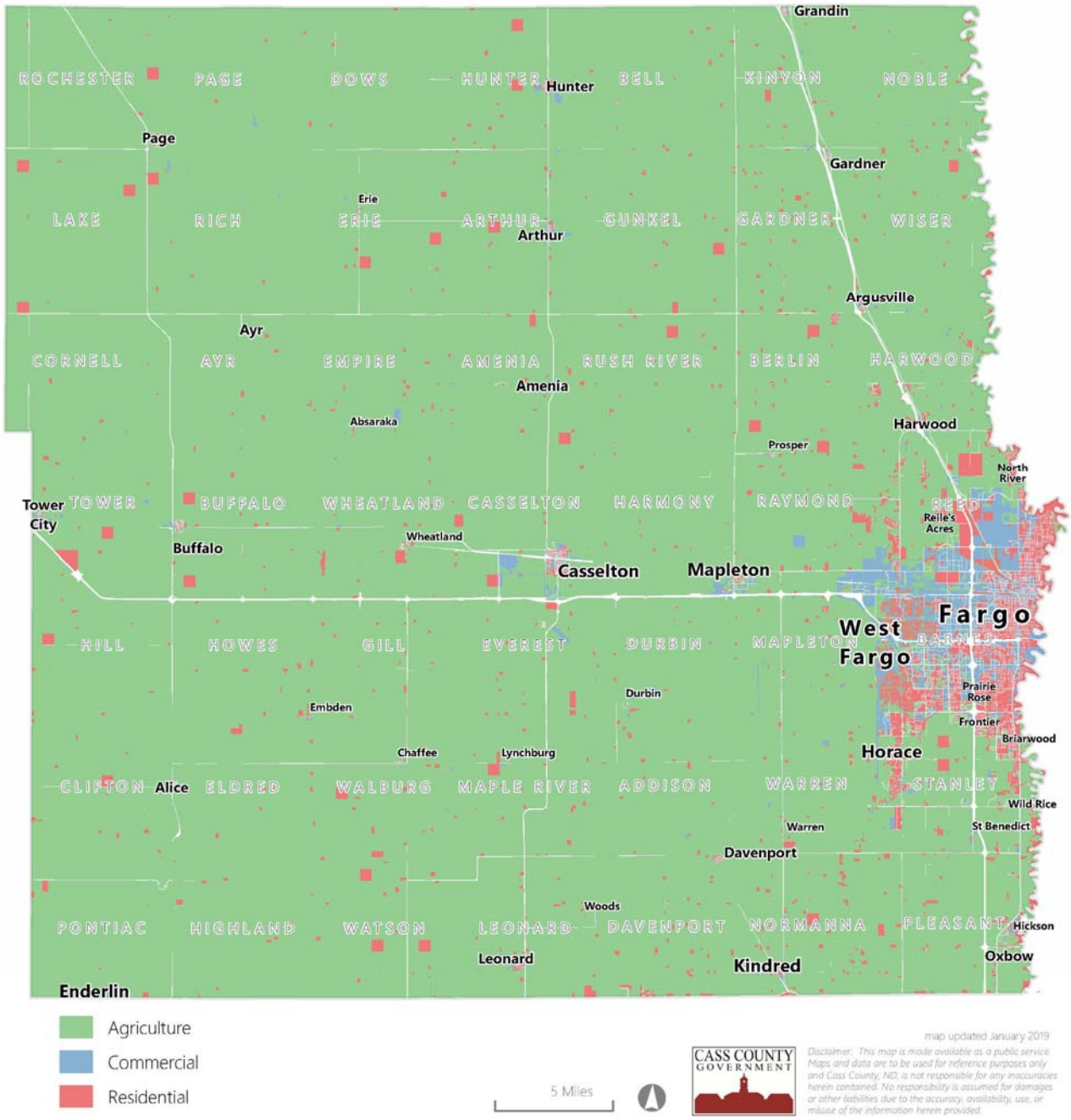
Transportation Inc are organizationally separate demand-response services for elderly and disabled clients.

LAND USE

Cass County has an area of approximately 1,131,000 acres. The county is roughly square in shape spanning around 44 miles east to west and 42 miles north to south.

Three general land use categories are used to classify land use in the county in ascending order commercial, residential and agricultural. Figure 3.9 is a visual representation of the land use in Cass County.

Figure 3.9 Cass County Land Use



CLIMATE

Cass County has a continent climate with four distinct seasons. The variability of the county's weather is due it being located within the intersection of three major air masses: cold dry air coming from the polar region, warm moist air coming up from the Gulf of Mexico, and cooler moist air that originates in the Pacific. During the winter polar air mass dominates; in the summer the other two interact.

The average annual temperature is 42.3° with the coldest average temperature being in January (9°) and the warmest in July (71°). Typically, Cass County experiences 12 days above 90° and 178 days below 32°. Figures 3.10 and 3.11 shows how the temperature and precipitation varies during the year.

Figure 3.10 Average High and Low Monthly Temperatures

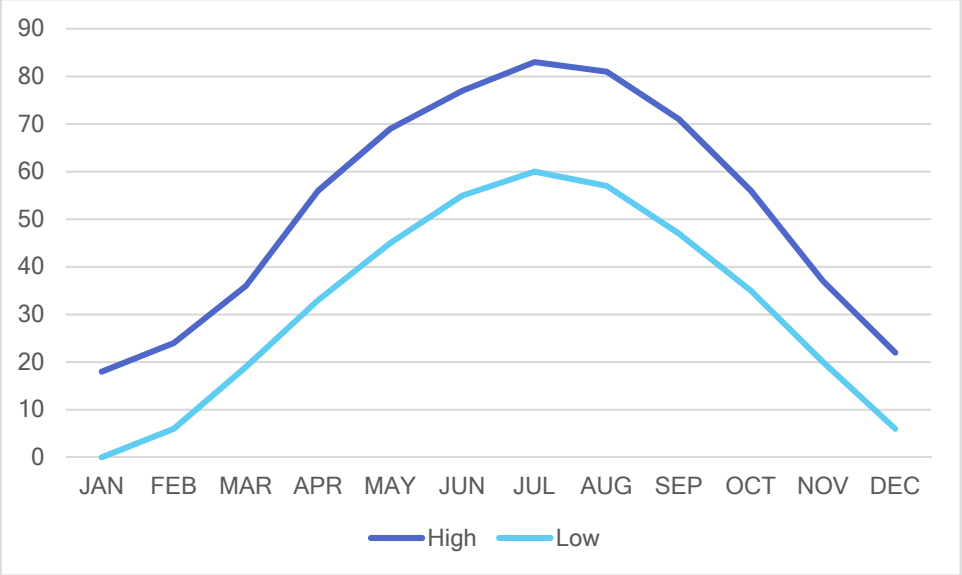
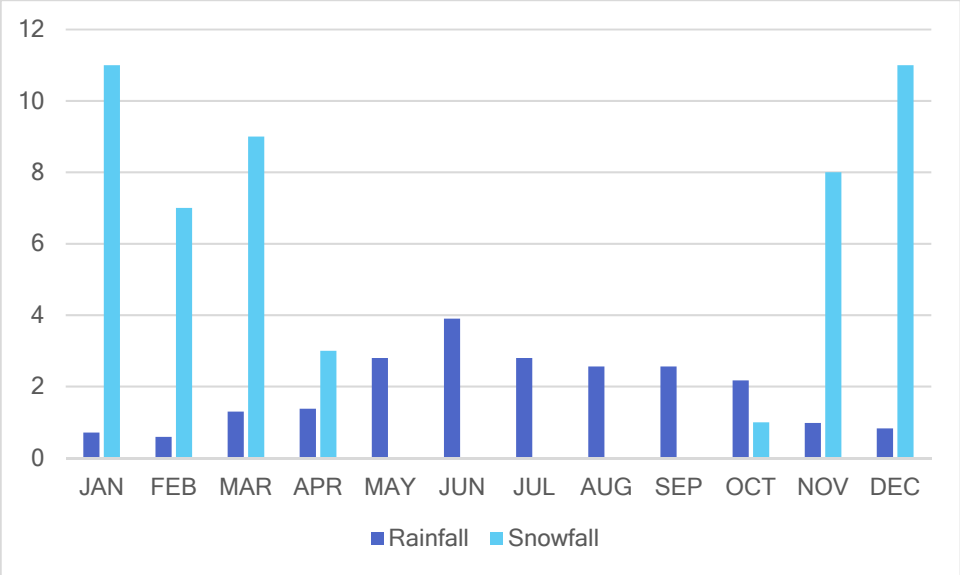


Figure 3.11 Average Monthly Precipitation



The county has been experiencing a wetter than normal period over the past decade and half, which is directly related to the incidence of severe floods. The larger-scale climatic trend is an increase in precipitation, namely in the fall (September through November). The silver lining is that the precipitation is occurring before the onset of winter, which makes predictions of spring flooding potential easier.

The Fourth National Climate Assessment issued by the federal government in late 2018 predicts that the northern Great Plains is more prone to dramatic climatic variability. Models show an increase in the number of heavy precipitation events as well as the number of days above 90°. Precipitation projections show only modest changes, but the high degree of interannual variability of swings between flooding one year and drought the next that makes planning and mitigation more difficult. In fact, the Red River watershed, river flows during the highest annual flood event have been increasing by about 10% per decade since the 1920s.

Reservoir and groundwater storage are expected to be increasingly important as buffers acting against increasing vulnerability to water shortages. This is still the case even with increases in precipitation, given that the warmer temperatures are expected to increase evaporative demand thus leading to more frequent and severe droughts.

While the longer growing season will benefit agriculture in the short term, in the longer term ever increasing temperatures will negatively affect yields. The range of invasive species will expand thus leading to more crop loss. As temperatures increase and the area becomes more arid, the type of crop grown will shift from corn and soybeans towards wheat and grass.

Human health will be adversely affected as extremely hot and cold days can be dangerous; particularly so to the elderly, those with health issues, and lower-income individuals. For example, the increase in the number and duration of heat waves will impact those prone to heat stress and other heat-related health problems (e.g. dehydration, cardiovascular strain, and respiratory problems). Climate change may also increase the length and severity of pollen season for allergy sufferers. That season has grown longer as the first frost in the fall is coming later and later.

Everything considered, the lesson for elected officials and emergency management professionals is that there is an increasing need to plan and prepare for more extreme weather, not to mention the need to prepare for a climate that will swing drastically from year to year. For example, mitigation of the impacts of flooding and of drought will need to be pursued concurrently.

SECTION IV: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The focus of this plan is solely on natural hazards. Drought, flood, severe summer storms, severe winter storms, urban fire, wildfire, and geological hazards are examined in this plan. Since dams are manmade structures but yet are closely tied to flooding hazards, dam failure is also included. Each hazard is described one-by-one with the description, location, extent, previous occurrences, and probability of future events all analyzed.

This hazard identification and risk assessment section focuses on hazards from a county-wide perspective. Unique features, risks, and vulnerabilities that exist in individual jurisdictions can be found along with each community's mitigation actions in Section VI.

Dam Failure

A dam is any artificial barrier, including appurtenant works, which impounds or diverts water. Dam failure is defined as a sudden, rapid, and uncontrolled release of impounded water that can create a potentially significant downstream hazard. The purpose of dams includes storage of water for irrigation, hydroelectric power generation, flood control, water supply, fire protection, recreation, and wildlife habitat. Should a dam fail, the consequences are determined by the potential loss of life and downstream property damage it may cause. This can be extensive if significant numbers of houses and property would become inundated. The water released from the dam could very well reach high velocities, meaning people will not have much time to get out of harm's way. The most likely reasons for dam failure in Cass County are either hydrologic inadequacy and seepage related problems.

Hydrologic Failures – Hydrologic failures are typically associated with flood events. A hydrologic failure may occur due to dam overtopping or excessive spillway erosion. A dam can be overtopped during a flood event due to insufficient reservoir storage and insufficient spillway capacity. Earthen dams are particularly susceptible to failure when overtopped since earthen material may erode relatively easily. Some dams have an earthen auxiliary spillway designed to carry excess flows during a flood event. Since these are earthen spillways, some erosion can be expected, but under certain conditions excessive erosion can occur.

Seepage Failures - All dams have some seepage occurring through the structure and foundation. Seepage, if uncontrolled, can erode material from the embankment of an earthen dam and lead to complete failure of the dam. Piping is a specific seepage problem which occurs when erosion starts at the point where seepage is exiting the downstream slope or foundation, then works backwards toward the upstream slope. Internal erosion, another type of seepage failure, occurs when water flowing through the dam causes erosion along a crack in

the embankment or foundation, or along some other discontinuity or preferential flow path in the embankment, such as along a spillway conduit. Tree roots and animal burrows can also provide paths for seepage. Seepage failures can occur during the course of normal operations but can also occur during flood conditions when reservoir levels are abnormally high.

LOCATION & VULNERABILITY ASSESSMENT

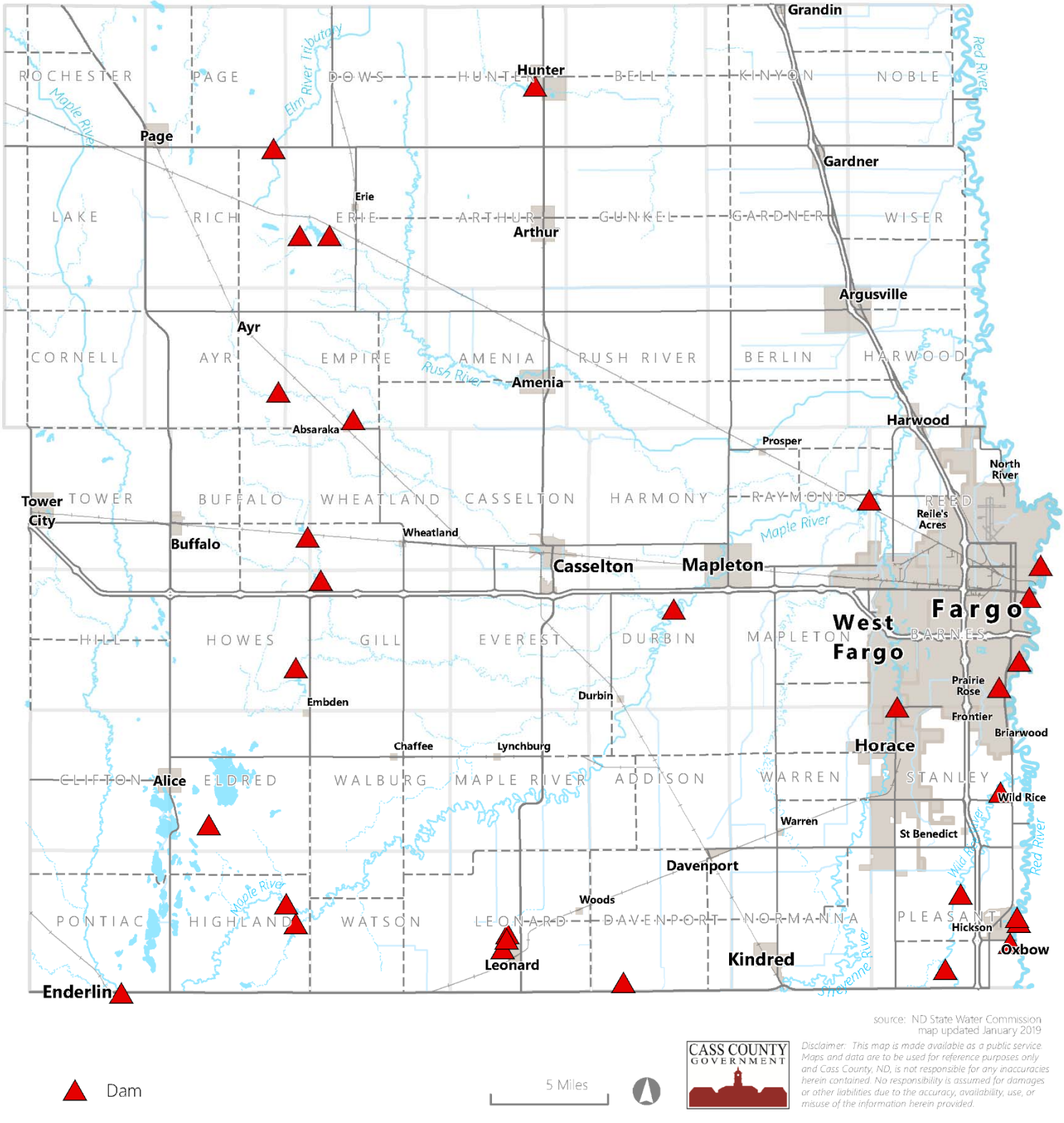
The Dam Inventory managed by the North Dakota State Water Commission includes 27 dams within the County. The majority of these dams are located in the Maple River and Red River basins. A full listing of Cass County dams follows as Table 4.1. Figure 4.1 is a map showing the dam locations.

Table 4.1 Dams in Cass County

Structure Name	Purpose	Owner	Year Built	Hazard Class	Potential Impacts
Hickson Dam	Water Supply	City of Fargo	1937	Low	Parkland and greenway
George Leher Dam	Fish & Wildlife	George Leher	1995	Low	Agricultural land
Claudia Souba Dam	Other	Claudia Souba	2010	Unknown	Agricultural land
Wayne Lunder Dam	Flood Control	Wayne Lunder	2005	Low	Agricultural land
Albert Lemke Dam 1	Irrigation	Albert Lemke	1976	Low	Agricultural land
Albert Lemke Dam 2	Irrigation	Albert Lemke	1976	Low	Agricultural land
Leonard Golf Club Inc.	Irrigation	Leonard Golf Club Inc.	1988	Low	Golf course
Maple River Dam	Flood Control	Cass County Joint WRD	2006	High	14th, 16th, 17th, and 18th Streets SE; 133rd Ave SE; and BNSF rail east of Page
Maple River Dam (T-180)	Flood Control	Maple River WRD	1985	High	Agricultural land
Sheyenne River Diversion	Water Supply	SE Cass County WRD	1972	Medium	Undetermined portions of West Fargo
Wild Rice Dam - Cass	Recreation	SE Cass County WRD	1934	Low	Agricultural land
Harvey Kemmer Dam	Fish & Wildlife	Harvey Kemmer	1989	Low	Agricultural land
Fargo 4th St South Dam	Water Supply	City of Fargo	1929	Medium	Low head dam with minimal impact
Fargo Dam 32nd Ave S Dam	Water Supply	City of Fargo	1933	Low	Low head dam with minimal impact
Rose Coulee Dam	Other	City of Fargo	2003	Low	Low head dam with minimal impact
Brownlee Dam	Recreation	Maple River WRD	1934	Low	Agricultural land
Swan Buffalo Detention Dam #5 (Garsteig Dam)	Flood Control	Maple River WRD	1961	High	I-94, RRVW Railroad, Cass Highway #5, and 36 homes.
Swan Buffalo Detention Dam #8 (Embden Dam)	Flood Control	Maple River WRD	1968	High	Cass Highway #7 and #5, RRVW Railroad, and 33 homes.
Fargo 12th Ave N Dam	Water Supply	City of Fargo	1933	Low	Low head dam with minimal impact
ND No Name 227	Livestock	Maple River WRD	1934	Low	Agricultural land
Magnolia Dam & State GMA	Fish & Wildlife	ND Game & Fish Dept.	1908	Low	Agricultural land, BNSF Railroad
Swan Buffalo Detention Dam #12	Flood Control	Maple River WRD	1960	High	Cass Highway #32, 10 homes, and 1 business.
Eckart Dam	Livestock	Donald Eckart	1978	Low	Agricultural land
Brewer Lake 2	Fish & Wildlife	ND Game & Fish Dept.	1982	Low	Agricultural land
Erie Dam	Recreation	Rush River WRD	1970	Medium	Cass Highway #5
Elm River Detention Dam #3	Flood Control	North Cass WRD	1962	Medium	14 homes
Hunter Dam	Water Supply	City of Hunter	1960	High	Undetermined portion of Hunter

Source: ND State Water Commission

Figure 4.1 Dams in Cass County



EXTENT

Dams are classified based on the potential hazard to life and property should the dam suddenly fail. The hazard rating is not an indicator of the condition of the dam or its probability of failure. The following categories are described in the North Dakota Dam Design Handbook:

Low Hazard	These dams are located where there is little possibility of future development such as rural or agricultural areas. Failure of low hazard dams may result in damage to agricultural land, township and county roads, and non-residential farm buildings. No loss of life is expected if failure occurs.
Medium (Significant) Hazard	These dams are located in predominately rural or agricultural areas where failure may damage isolated homes, main highways, railroads, or cause interruption of minor public utilities. The potential for the loss of a few lives exists if the dam fails.
High Hazard	These are dams located upstream of developed and urban areas where failure may cause serious damage to homes, industrial and commercial buildings, and major public utilities. There is a potential for the loss of more than a few lives if the dam fails.

North Dakota Century Code Section 61-03-25, which became effective in 2015, states that owners of a high-hazard or medium-hazard dam shall create and periodically test an emergency action plan that shall be implemented in the case of an emergency. The aforementioned data on the potential impacts of dam failures came from those emergency action plans submitted to the State Engineer. These plans are on file in the County's Emergency Management office.

PREVIOUS OCCURANCES

There have been no incidents of dam failure within Cass County, however due to previous events throughout the United States it remains a hazard. There have been a couple of non-failure incidents at the Swan Buffalo Detention Dam No. 12 (aka Absaraka Dam). In both springs of 2009 and 2010, the emergency spillway was damaged as a result of high water flows.

PROBABILITY OF FUTURE EVENTS

Although history would suggest a low probability of dam failures of occurring, changes in climatic conditions and the amount of precipitation, not to mention increases in flooding, makes dam failure a notable risk to areas of Cass County.

According to the ND State Water Commission, two dams are known to not meet current safety standards for spillway capacity, which relates to the risk of overtopping during an extreme precipitation event. Those are the Hunter Dam and Swan Buffalo Detention Dam No. 5 (aka Garsteig Dam). Thus far, neither dams have experienced a problem related to the spillway capacity. Two dams, the Elm River Detention Dam No. 3 and Maple River Dam T-180, were inspected and found to have some deteriorating of the principal spillway outlet pipes that may require repairs in the future.

Proper maintenance and routine inspections will keep the risk of dam failure low. Dams owned by units of government will need adequate appropriations for maintenance and enhancement projects. According to the American Society of Civil Engineers North Dakota Section, the grade assigned to the condition of dams was a "D", the lowest among all the categories of civil infrastructure examined. Across the state, 73% of the high-hazard dams have a condition assessment rating in the National Inventory of Dams. Of those, half are considered deficient and do not meet accepted safety standards in some way.

RISK CLASS

C	Low to moderate risk condition, sufficiently high to give consideration for further mitigation. Risk rating is unchanged since last plan.

Drought

Drought is an insidious, slow onset natural hazard that is the result of severe below-average precipitation for a prolonged period of time. The impacts that occur are a result of the interplay between the natural event (i.e. precipitation deficiencies caused by climate variability) and the demand placed on water resources by people. Reduced cropland productivity, increased fire potential, reduced water source levels, damage to flora and fauna are all direct impacts of drought. This can lead to reduced agricultural sector income, unemployment due to water-demanding industrial plant closures, reduced tax revenue, and farm foreclosures due to defaulting loans.

Drought can be defined in four ways. First, meteorological drought is defined on the basis of the degree of dryness, often compared to the average amount and upon the normal seasonal wet and dry cycles for a given location. Second, agricultural drought links the meteorological conditions to the extent of impact upon agriculture. Even if precipitation is below average, existing soil moisture as well as drawn water sources – rivers and aquifers for example - can sustain plant growth for period of time. Third, hydrological drought is measured by the effect deficient precipitation has upon surface or subsurface water supplies. These effects usually lag meteorological and agricultural droughts, but nonetheless if conditions persist can easily affect water used for drinking, irrigation, industry, and recreation. Fourth, socioeconomic drought incorporates the aforementioned three but is measured by the impact those conditions have upon the ability for economic goods to be met. In extreme cases, social order can be threatened as competition over scarce water resources increases.

LOCATION

Drought can easily affect the entire planning area and all participating jurisdictions in any given year. Agriculture is most likely to be impacted first and foremost. Therefore, rural areas of the county are likely to experience the effects of drought more often. Persistent drought conditions over a longer period of time will be necessary to cause the changes to the water supply municipalities and industries depend on.

The US Drought Monitor, hosted by the National Drought Mitigation Center at the University of Nebraska, maps the extent of drought across the nation. Data are updated each Thursday. Information about ground water - including hydrographs, recent water levels and chemistry conditions - can be found at the State Water Commission's website. Daily streamflow conditions are maintained by the US Geological Survey.

EXTENT

Drought is a creeping phenomenon that is pervasive in nature. The effects of drought are slowly accumulated and tend to persist over long periods of time. Drought's effects on agriculture depend on time of year, timing of precipitation, amount of stored soil moisture, type of crop, stage of growth, and meteorological variables

such as temperature, humidity, and wind. Precipitation deficits as little as four to six inches can cause severe agricultural drought conditions.

A number of secondary hazards are generally associated with drought. Rural grassland fires increase due to dry vegetation. Reduction in vegetation will expose the soil to wind erosion. Reduced flow characteristics adversely affect chemical quality of lakes and rivers. Sediment transport regimes in streams and rivers are altered. Deterioration of water quality results in increased plants and animal mortality. Stagnant pools along rivers provide favorable habitat for insects, particularly mosquitoes. When rain does come the dry and unstable topsoil are susceptible to runoff and flooding. Fortunately, with Cass County's flat topography, the potential for landslides is minor and would affect only a few properties.

Determining whether conditions warrant drought status versus an extended dry spell can be difficult to determine. However, a typical drought in Cass County would begin with snowfall low in moisture content, lower spring precipitation accompanied by warmer than normal temperatures and windy conditions. At this point, normal spring greening does not occur, causing a shortage of natural livestock feed. Farmers' plans for spring planting would most likely change. Fire danger to grasslands begins to increase. Growth and production of cash crops and feed grains become questionable. Continued drought negatively affects farm income, ultimately affecting agriculture-related businesses. Besides crop loss, recreational opportunities are limited. Water supplies for industries such as food processing may become constrained over time, thus threatening their operations. Eventually, public drinking water supplies could be affected, resulting in a direct impact to most people. Drought can easily cause serious economic problems for the entire state.

VULNERABILITY ASSESSMENT

Agriculture, a vitally important economic sector, has the greatest vulnerability to drought. According to the 2017 Census of Agriculture, there were 784 farms in Cass County totaling 1,126,085 acres. The market value of agricultural products sold by county producers was around $439 million. Purchasing crop insurance is a mitigation tool commonly used by farmers. However, it does not always make the farmer financially whole. The economic ripple effect will be keenly felt by many communities, particularly the rural ones that do not have as diversified of an economy.

The following are entities, listed by jurisdiction, that are economically important for their community and whose facilities are more reliant upon an abundant and steady source of water. Drought conditions will present a greater challenge for these facilities compared to other commercial businesses. These are the businesses which

were required to obtain a permit due to the amount of water needed for their operations. Irrigation permits are not included within this table.

Table 4.2 Facilities Particularly Vulnerable to Drought by Jurisdiction

City	Facilities	Type of Business	Appropriated Acre-Feet	Source	Basin
Rural Cass County	Rolling Green Family Farms	Animal Feeding Operation	80.6	Ground	Maple
Casselton	Sinner Bros & Bresnahan	Ag Processing	20	Ground	Lower Sheyenne
Fargo	Cass Clay Creameries, Inc.	Ag Processing	200	Ground	Upper Red
West Fargo	Cargill, Inc.	Ag Processing	175	Ground	Upper Red
	Central Livestock	Livestock auction	80	Ground	Lower Sheyenne

The one notable heavy user of water not in the above table is the Tharoldson Ethanol plant in Casselton. This is due to the fact that the plant purchases treated wastewater from the City of Fargo, thus negating the need to withdraw water from aquifer sources. The permit Fargo received from the State Water Commission that allowed the diverting of treated wastewater away from being discharged into the Red River towards the ethanol plant was approved with junior status. This means if a drought were to hit the region and upstream communities need the water, the state could order Fargo to stop delivering to the ethanol plant.

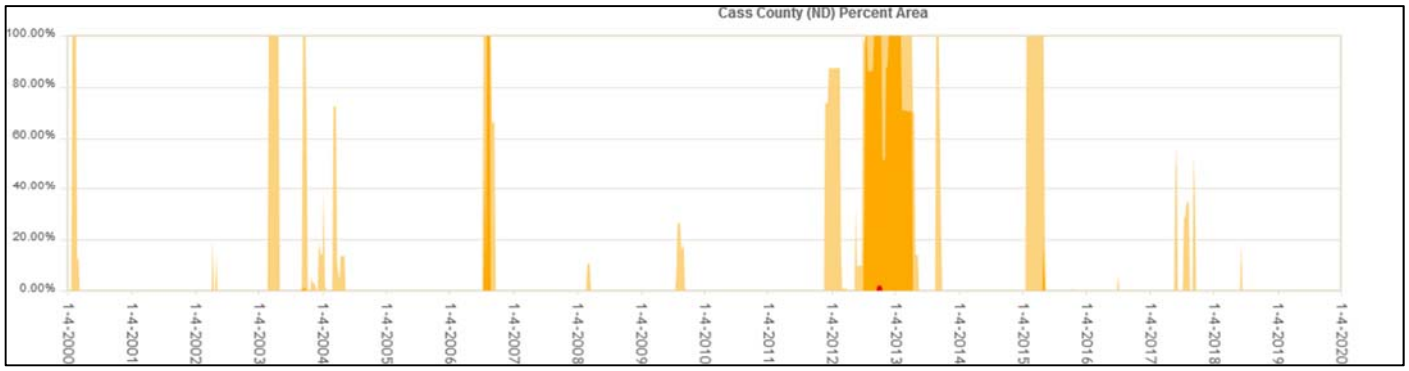
Individual vulnerability to the effects of drought differs based on one's socio-economic status. Those with lower incomes are less able to implement water conservation measures such as installing efficient faucets or appliances and switching to drought-resistant landscaping. If water utilities have to increase rates to cover higher costs for drawing and treating water, those households will feel the financial pinch first. Water utilities should pay attention to how drought response affects those households and what kinds of assistance can be offered. The income data presented in the county profile section provides a rough image of those communities that may have higher vulnerability to drought based on the ability of households to afford water.

PREVIOUS OCCURANCES

The following chart from the US Drought Monitor illustrates the percent of Cass County that exhibited drought conditions going back to beginning of 2000. The darker orange represents "severe drought" and the red represents "extreme drought". Fortunately, Cass County hasn't had a time when it reached the "exceptional drought stage". From the spring of 2012 through spring of 2013, the county was in a drought along with large portions of the nation. Agricultural losses were widespread across the Great Plains, North Dakota included. More recently, in 2017 the county experienced a drought relatively minor compared to elsewhere in the state. Although the growing season began with sufficient moisture, near-record low precipitation in the months of May through July – which is typically the wettest months of the year – led to significant impacts upon

agriculture.

Figure 4.2 Percent of County Under Drought Conditions



Source: The National Drought Mitigation Center

The previous severe drought lasted from 1988 to 1992. The first two years of the drought were particularly bad for the middle part of the United States with significant crop loss and wildfires. It is believed that the 1988-1992 drought was the second most severe drought in North Dakota since the 1930s, which remains the most severe drought ever. In fact, the Red River stopped flowing nearly every year of that decade. Those environmental conditions of scant rainfall, extremely hot temperatures, and the return of grasshoppers challenged many farmers' incomes. Years upon years of poor crop yields and prices caused many farmers and the towns that they supported to vanish.

The 1930s serve as a warning sign for the residents of Cass County. The water sources upon which the economy, not to mention day-to-day life, depends upon is vulnerable. If a ten year drought akin to the 1930s were to occur today, it would create a $25 billion impact upon the economy. Implementing long-term, perennial reductions in water use will make a community more resilient and adaptable in the face of an extreme drought.

PROBABILITY OF FUTURE EVENTS

The climate has been in a wet cycle over the past decade, so drought has not been in the forefront of most peoples' minds. However, the cycle will inevitably change and the county could be facing years of deficient precipitation. Given that the population continues to grow and the demand for water will increase accordingly, attention is being given to the probability of droughts occurring in the near future. This is especially pertinent since many communities utilize surface water as their source. The volume of water in aquifers will not be a suitable one-for-one replacement in a long-term scenario. Under present climate conditions and the realistic projected growth scenarios, the water supplies – according to the City of Fargo and the Cass Rural Water Users District - are deemed adequate.

To that end, the Lake Agassiz Water Authority was created by the North Dakota Legislature in 2003 to shepherd the securing of an alternative water supply for when eastern North Dakota is gripped by a severe drought. The Red River Valley Water Supply Project will draw water from the Missouri River near Washburn and convey it via a 165 mile, 72" main transmission line to a site on the Sheyenne River north of Valley City. The project is estimated to cost approximately $1.2 billion.

RISK CLASS

A	High risk condition, highest priority for mitigation and contingency planning. All areas in Cass County are at the same risk of this hazard. Risk rating is unchanged since last plan.

Flooding

The incidence of flooding has shaped the county in many facets throughout history. While access to the Red River was the primary draw for the early settlers who found the Red River to be a valuable transportation route, the fact that towns were built upon the bottom of an ancient glacial lake bed comprised of soils heavy in clay with a miniscule change in topography has always meant floods were an ever-present concern. The periodic flooding of rivers is entirely a natural process; problems arise when alteration of the floodplain and inappropriately designed or located development puts people and property into harm's way.

In Cass County, floods occur along rivers and streams as well as areas that are poorly drained or with oversaturated soil. As the county's population continues to grow and cities expand outward, increases in imperious pavement and non-native turf sends more runoff into the rivers and streams. Building in the floodplain reduces the surface area available to absorb precipitation. Tilled crop land and installation of drain tile also contribute to the amount of water sent to rivers, exacerbating the problem even more.

The peak time for riverine flooding is during the transition from winter into spring. If the soil enters winter with high moisture content and the amount of snowfall was higher than normal, conditions are ripe for flooding to occur. Additional precipitation falls on the still-frozen ground and thus enters streams and rivers relatively quickly. Temperatures warmup in the southern part of the Red River Valley first. Water will be backed up as it runs into ice jams as the river flows north.

Several types of flooding can and do occur in Cass County: riverine flooding, levee failure, ice jam flooding and flash flooding. Ice jam flooding occurs in winter and early spring months during thawing periods.

Riverine Flooding – Riverine flooding originates from a body of water - typically a river, creek, or stream - as water levels rise to a point that exceeds its normal capacity and onto normally dry land. The riverine hazard areas may be mapped as part of the National Flood Insurance Program (NFIP). NFIP designates the level of risk by breaking the floodplain into zones. Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain is that which has a 1% chance of flooding in any given year. Over a 100-year period, a flood of this magnitude or greater has a 63.5 percent chance of occurring. According to the Federal Emergency Management Agency, structures in the 100-year floodplain are nearly three times more likely to be damaged by flood than a major fire. Locations outside the 100-year floodplain may also experience flooding during greater magnitude floods, localized events, flash flooding, or along unmapped creeks, streams, and ditches. In fact, according to FEMA nearly 30% of all flood insurance claims are filed in such areas.

Most riverine floods are slowly emerging events that can be predicted according to the source of water (e.g.

snowmelt, rain, or controlled dam release). If implemented in a timely manner, protective measures can be implemented to reduce damage.

For this plan, the floodplain maps that were in effect as of writing were used. Preliminary, but unadopted, floodplain maps were released that reflected the flood mitigation projects that have occurred. A map based upon the completion of the Fargo-Moorhead Diversion has also been created. The steering committee felt it was prudent to use the existing floodplain data due to the uncertainty associated with not only what the final version of the preliminary maps will look like, but also the question of what form the Fargo-Moorhead Diversion will take if it proceeds towards starting construction. Cities were asked to consider flood mitigation actions that can be implemented independent or in addition to the Diversion.

It should be noted that floodplain management is not confined solely to the borders of Cass County. Instead, a basin-wide approach across two states and one Canadian province is needed. The Red River Basin Commission, an international coordination organization, created an overarching strategy to manage and mitigate flooding risk. Three principles were crafted to guide the mitigation strategy: first, nonstructural strategies must be implemented for existing development and future growth will be held to higher standards; second, levels of protection must be raised for an integrated approach for urban and rural areas, critical infrastructure, agricultural land, and emergency services; and finally, retention was recognized as a potential key to taking the peak off floods and a full recommendation of this method was recommended.

Levee Failure - Levees are earthen embankments constructed along rivers to contain, control, or divert the flow of water so as to provide protection from temporary flooding conditions. Floodwalls are concrete structures, often components of any overall levee system, designed for urban areas where there is insufficient room for earthen levees. Levees are usually engineered to withstand a flood with a computed risk of occurrence. When a larger flood occurs and/or levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in loss of life and injuries as well as damages to property and the environment.

Across North Dakota, there are hundreds of levees ranging in size from small agricultural levees that were constructed primarily to protect farmland from high frequency flooding to large urban levees that were constructed to protect people and property from larger, less frequent flooding events. For purposes of this plan, the levee failure hazard will refer to both overtopping or a breach of a levee or floodwall. Levees have not been regulated in terms of safety and design standards until relatively recently, meaning many older levees were constructed in a variety of ways that may not provide adequate protection. These older levees are typically those smaller ones built by a landowner for their property only. A majority of these structures have been built under

emergency conditions, with changing cross sections or elevations. Some lack the necessary free board, many are not strong enough, or have not been maintained properly. The presence of levees that are not built in accordance with current standards or are not intended to protect against larger floods such as the 100-year or 500-year flood can generate a false sense of security.

Ice Jams - Flooding can also result from ice collecting and blocking the flow of rivers. Ice breaking up into pieces, called floes, move along with the flowing rivers or streams. The ice floes can jam at curves, narrow places in the channel, structures, river or stream confluences, or where there is a sharp decrease in river bed gradient. This essentially creates a dam that produces backup and overflow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. According to the US Army Corps of Engineers, the types of ice jams include freeze up jams, breakup jams, or combinations of both. When an ice jam releases, the effects downstream can be similar to that of a flash flood levee failure, or dam failure. Ice jams are more prevalent on the Red River due to its northward flow into often colder areas where melting is delayed.

Flash Flood - This type of flooding occurs when precipitation falls in such a short time that the soil cannot absorb it and drainage systems, either natural or man-made, cannot carry the volume of water away as quickly as it accumulates. A flash flood is usually caused by severe thunderstorms, heavy rains on snowpack, slow moving storms, dam, dike, or levee failures, or ice jam releases. Because of the localized nature of flash floods and variables in rainfall amounts and duration, clearly defined areas prone to flash flooding are difficult to identify. FEMA's FIRM maps do not show areas susceptible to this localized flooding. Property owners may look at these maps and erroneously think that they are not exposed to a flood risk.

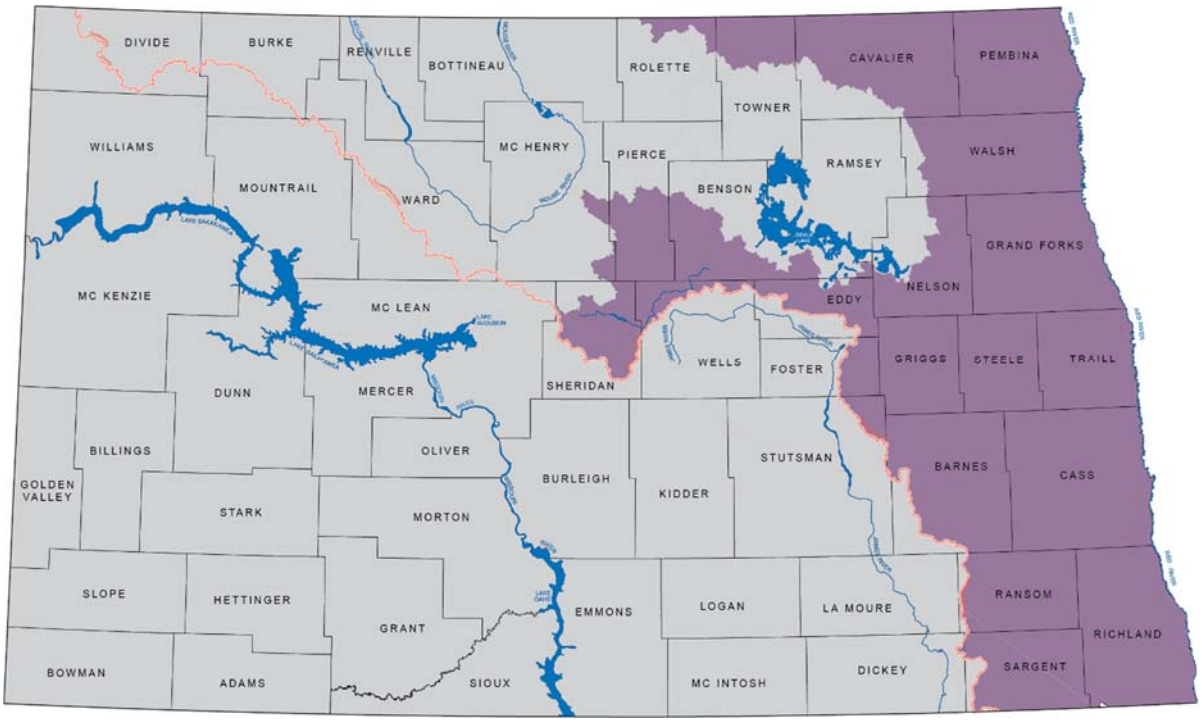
Although often more minor in the extent of impact compared to riverine flooding, flash flooding is nonetheless still a hazard to consider mitigating. The safety risks include the potential for drowning, vehicles being swept away, and damage to electrical systems. Health concerns can result from mold and mildew growth in flooded buildings, gasoline and chemicals can be spilt, and standing water is a breeding ground for mosquitos. Soils saturated for a long time can undermine building foundations. This is particularly the case with the heavily clay soils found in Cass County.

LOCATION

Cass County is located in the Red River Basin, as seen in the map in **Figure 4.3**. The Red River is the principal river of the basin. It serves as the border between North Dakota and Minnesota and winds nearly 400 river miles from its origin at the confluence of the Otter Tail and Bois de Sioux Rivers at Wahpeton, North Dakota and Breckenridge, Minnesota, north to the Canadian border. The Red River continues to flow about 155 river miles

to Lake Winnipeg in Manitoba. The valley through which the river flows is the flat lakebed of pre-historic Lake Agassiz. The very flat gradient causes widespread overland flooding when the channel capacity is exceeded.

Figure 4.3 Red River Basin



Source: ND State Water Commission

Flash flooding can occur throughout the county in poorly drained areas. However, riverine flooding is the principle concern in Cass County. Maps of the 100-year floodplains currently in effect by FEMA are presented in the Mitigation Strategy chapter along with each city.

EXTENT

Floods can be extremely disruptive to the economy and normal day-to-day life, not to mention the immense monetary losses that are possible. The extent of flood losses, expressed in dollar amounts, were estimated utilizing FEMA's Hazus software with the current floodplain maps as the data source.

In this plan, the floodplain maps that were officially adopted by Cass County, and both its incorporated municipalities and unincorporated rural areas, as of writing were used to determine each community's exposure, vulnerabilities, and potential for damage or disruption. Unlike the previous iteration of this plan, no separate floodplain modeling was done.

The number in total losses are comprised of losses in residential assets, in commercial assets, other assets (e.g. industrial, agricultural, religious, governmental, and education), and losses associated with business disruption. The loss ratio expresses the scenario-based losses divided by the total building value for a jurisdiction. This is a

gauge to determine a community's resiliency by looking at how much of the community would be affected by a 100-year (1% annual chance) flood event. Table 4.3 shows the estimated flood losses for each jurisdiction, as well as the number of critical facilities located in the floodplain. Critical facilities are those with national datasets in the Hazus inventory data, including dams, schools, police stations, hospitals, and fire stations. These are the structures that must be operational before, during, and after an emergency and which are vital to public health and safety.

Table 4.3 Flood Risk Exposure by Jurisdiction

City	Critical Facilities in Floodplain	Total Dollar Losses (in thousands)	Loss Ratio
Alice	0	0	0
Amenia	0	100	1
Argusville	2	100	0
Arthur	1	0	0
Ayr	0	0	0
Briarwood	0	1,800	14
Buffalo	1	0	0
Casselton	3	500	0
Davenport	2	200	0
Enderlin	0	50	12
Fargo	45	322,500	1
Frontier	0	200	0
Gardner	0	0	0
Grandin	1	0	0
Harwood	2	8,100	4
Horace	1	5,900	2
Hunter	0	100	0
Kindred	1	900	1
Leonard	1	0	0
Mapleton	2	1,900	2
North River	0	1,000	7
Oxbow	0	4,700	8
Page	2	0	0
Prairie Rose	0	200	1
Reile's Acres	0	100	0
Tower City	2	0	0
West Fargo	14	27,100	1

Table 4.4 below contains data - as of May 30th, 2019 - provided by FEMA which shows the jurisdictions that have flood insurance policy holders who have filed multiple claims for their property and the dollar amount paid out. Repetitive loss properties are defined as those insured residential buildings for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period since 1978.

Table 4.4 NFIP Repetitive Loss Properties

Jurisdiction	Total Losses	Properties	Total Payments ($)
Argusville	2	1	8,623.42
Barnes Township	11	5	50,506.67
Briarwood	3	1	489,589.72
Cass County	2	1	155,403.73
Enderlin	2	1	19,788.89
Fargo	51	20	749,089.88
Harwood	2	1	14,217.62
Harwood Township	10	5	87,161.53
Kindred	2	1	30,359.57
Noble Township	9	3	45,299.89
Normanna Township	8	4	138,819.05
Pleasant Township	13	6	309,021.42
Raymond Township	6	3	27,555.42
Reed Township	34	15	204,314.85
Stanley Township	92	34	2,980,722.75
West Fargo	22	10	113,292.18
Wiser Township	5	2	107,895.26
Total	274	113	5,531,661.85

It is not surprising to find that the city of Fargo and its adjacent townships (e.g. Reed, Harwood, Barnes, Stanley, and Pleasant) have a higher number of repetitive loss properties, given that there are more structures there to begin with. In the past, it was not uncommon for people to move out to the more rural areas of the county and build a house adjacent to rivers. Although the setting was serene and the river was an aesthetic amenity for the property owner, it did put those structures in the floodplain. Over time, properties were bought out after flood events with FEMA grant dollars and more stringent development regulations were enacted.

PREVIOUS OCCURANCES

Flooding has impacted Cass County with increasing frequency and severity in recent years. Ten of the top twenty crests have occurred since 1989 with crests in 2009, 2010 and 2011 ranking first, seventh and fourth respectively of all time. Additional detail about historical crests can be found in Table 4.5.

Table 4.5 Historical Crests for Red River of the North at Fargo

Rank	Crest	Date	Rank	Crest	Date
1	40.84	3/28/2009	11	34.41	4/2/1978
2	39.72	4/18/1997	12	33.31	5/1/2013
3	39.10	4/7/1897	13	33.26	7/4/1975
4	38.81	4/9/2011	14	33.18	4/30/2013
5	37.34	4/15/1969	15	30.88	6/9/2007
6	37.13	4/5/2006	16	30.50	4/15/1965
7	36.99	3/21/2010	17	30.16	3/22/1966
8	36.69	4/14/2001	18	29.8	3/31/1907
9	35.39	4/9/1989	19	28.79	4/16/1952
10	34.93	4/19/1979	20	28.75	4/15/1996

The County has also been included in fourteen Presidential Disaster Declarations that have included flooding in the description. The Disaster Declarations follow in Table 4.6

Table 4.6 Presidential Disaster Declarations Related to Flooding since 1989, Cass County, ND

Disaster Number	Date	Description
4118	5/29/2013	Flooding
1981	5/10/2011	Flooding
1907	4/30/2010	Flooding
1829	3/24/2009	Severe storms and flooding
1713	7/17/2007	Severe storms and flooding
1645	6/5/2006	Severe storms, flooding and ground saturation
1376	5/28/2001	Floods
1334	6/27/2000	Severe Storms and Flooding
1279	6/8/1999	Severe Storms, tornadoes, flooding, ground saturation, landslides and mudslides
1220	6/15/1998	Flooding and ground saturation
1174	4/7/1997	Severe storms and flooding
1118	6/5/1996	Flooding
1001	7/26/1993	Flooding and severe Storms
825	5/8/1989	Flooding

The following information details significant flood events including, but not limited to the situations spurring the Presidential Disaster Declarations noted above.

April 10, 1996 – Moderate to severe flooding occurred on the Red River and many of its tributaries in North

Dakota due to six months of consistent above average precipitation. In addition, heavy snow cover, with drifts up to 12 feet, lingered into early April. This combined with rapid snowmelt to produce a memorable spring flood, despite below average precipitation from mid-March through April. On April 19th at 7:00 pm, a 19 year-old man from Warroad, MN, drowned while attempting to cross the Robin Bridge over the Red River at Drayton, ND. The man unfortunately did not heed a road-closed sign. Residents along the Sheyenne River were hit particularly hard. At Kindred, Governor Schafer declared a flood disaster and activated the National Guard to assist in response and recovery.

May 17, 1996 – A flash flood in Fargo resulted in extensive basement flooding and roads closed. Property damage from this event is estimated at $100,000.

April 2, 1997 – Overland flooding due to melting snow forced the towns of Casselton, Amenia, and Mapleton to dike and sandbag. Water filled entire fields along Interstate 94 between Casselton and West Fargo, even flowing over Interstate-94 in several points. The Maple River set a new record in Mapleton on April 4th. Property damage from this event is estimated at $10 million.

April 8, 1997 – Record levels on the Sheyenne River forced the closing of Interstate 29 near Harwood. New records were set on the Sheyenne at Kindred on the 8th, West Fargo on the 9th, and Harwood on the 10th. The 600 people of Harwood, inside a newly constructed ring dike, could only leave by boat. Property damage in Cass County from this event is estimated at $100 million.

April 16, 1997 – The cresting Red River caused numerous problems in the Hickson and Fargo areas. Numerous homes along the river were flooded as the river rose to a new record for the century on the 18th, at 39.55 feet. Overland flooding caused problems along the south and southwest sides of Fargo, as water from the Wild Rice River broke out of its banks and headed overland toward Fargo. The water flowed over Interstate 29 near the Horace exit. A clay dike was built along the south side of the city to prevent this water from flooding thousands of homes. A section was also cut out of US Highway 81 to relieve the water level along the south side of Fargo. Property damage in Cass County from this event is estimated at $150 million.

April 17, 1997 – The Red River broke through a dike along South Terrace Drive in Fargo, flooding 30 homes and the Oak Grove High School. Two hundred and seventy students and their teachers and parents had sandbagged at the high school for three weeks to try to save the school.

June 18, 1998 – Three to five inches of rain fell in less than three hours across portions of Fargo resulting in a flash flood. The Fargo airport reported 3.03 inches of rain. The western edge of the city was hit the hardest. The interchange between Interstate-29 and Interstate-94 was closed due to high water. Several garages in the

basement levels of apartment buildings flooded. Major underpasses around the city also had to be closed. Property damage from this event is estimated at $250,000.

June 19, 2000 – After three to five inches of rain fell on the Casselton area, flash flooding occurred. Roughly 40 percent of the homes sustained some sort of water damage, which equated to about 200 homes. Property damage from this event is estimated at $500,000.

June 19, 2000 – A series of thunderstorms brought heavy rain to the Fargo area. A total of 6.82 inches was reported at the ASOS site at the Fargo airport. The official observer in north Moorhead reported 7.31 inches. This is believed to be a new 24-hour rainfall record for the Fargo-Moorhead area. The heavy rain halted traffic, inundated storm sewers, and knocked out electricity and phones. Approximately 20,000 customers lost power when a power station was submerged. A state of emergency was declared in the city at 3:00 am. At one point, fifty percent of the city streets were flooded. The major traffic arteries, Interstate-29 and Interstate-94, were flooded and closed for several days. The Fargodome sustained major damage when flooding along 19th Avenue North overflowed into the parking lot and into the lower level of the building. Eight to 12 feet of water, roughly 51.8 million gallons filled the bottom level. This was up to the first row of seats. There was an unconfirmed report of a man injured from a flying manhole cover that blew out from the force of the sewer line backup. Damage was particularly high at North Dakota State University, where nearly all buildings took on water. Four feet of water in the campus library damaged the periodical section. The telephone and Internet services for the campus were also disrupted. 54 percent of the residences in the city of Fargo had water damage. Property damage from this event is estimated at $100 million.

June 19, 2000 – After the six to eight inches of rain fell across eastern Cass County; the runoff affected area rivers. The Sheyenne River broke outside its banks north of Fargo, flooding the rest stop along Interstate-29. The Red River in Fargo stood at 15.64 feet late in the day on the 19th. By early on the 21st, the river rose to 22.85 feet. Several low-lying roads along the river had to be closed. One-half of the cropland in Cass County was damaged. Crop damage from this event is estimated at $20 million.

April 8, 2001 – The Maple River at Mapleton, ND crested at 14.77 feet. This crest was the third highest recorded with the National Weather Service.

April 10, 2001 – The Sheyenne River at Harwood, ND crested at 891.30 feet. This crest was the second highest recorded with the National Weather Service

April 10, 2001 – The Wild Rice River at Abercrombie, ND crested at 22.13 feet. This crest was the third highest

recorded with the National Weather Service

April 11, 2001 – The Sheyenne Diversion just on the northwest corner of West Fargo, ND crested at 22.13 feet. This was the second highest crest recorded with the National Weather Service. The non- diverted stretch of the Sheyenne River at West Fargo crested at 17.79 feet on April 4, 2001.

April 30, 2001 – Flood fight costs and damages from the flooding and overflows of the rivers in Cass County was $2.8 million. Eleven cities reported damages and flood fight costs due to flooding rivers. A lot of additional damage was averted due to extensive mitigation efforts undertaken by all of Cass County after the 1997 flooding of Cass County Rivers and just prior to the cresting of the rivers in 2001. Volunteer efforts lead by First Link in Fargo allowed for many homeowners to protect their property early enough to avert a high level of home damage. Both the City of Fargo and Cass County provided homeowners and other large residential areas with free sand and sandbags to assist in the flood fight.

April 1, 2006 - The Red River at Fargo/Moorhead rose above flood stage around 1:00 am on March 30th and remained above flood stage until around 7:00 pm on April 19th. The river peaked at roughly 37.18 feet around 2:00 am on April 5th. Unofficially, 37.18 feet would be the fifth highest modern-day river stage recorded. The third highest modern-day river stage of 891.35 feet MSL (unofficial) was recorded on the Sheyenne River at Harwood on April 3rd and the seventh highest was recorded at the West Fargo Diversion on April 3rd. Overland flooding also occurred in addition to the river flooding, with over 40 roads around the county closed due to flooding. The body of a homeless man was also found in the Red River north of Main Avenue on April 7th. Cass County received a Presidential Disaster Declaration for damages caused by spring flooding. In summary, the total public and private flood losses experienced within the Red River of the North basin through late March and April 2006 were in excess of $20 million.

March 28, 2009 – The Red River of the North crested at a record 40.82 feet. Cass County received a Presidential Disaster Declaration for damages caused by spring flooding including both Individual Assistance and Public Assistance. Volunteers filled and placed sandbags along most drains in Fargo to protect homes and other critical infrastructure. Miles of clay levees were built along the river and on streets near the river to protect the FM MSA. Approximately 3,500 people were evacuated. Up until that point, there was no historical instance requiring that level of shelter or mass care. Expenditures by the City of Fargo and Cass County total more than $15 million dollars. This does not include small cities or any private damage costs. Total losses across the state from the floods of 2009 are estimated at $623 million.

March 21, 2010 - The flood depth on the Red River at Fargo reached 36.99 feet. In the Fargo-Moorhead area

alone, about 1.5 million sandbags were put in place to protect property. Several bridges over the Red River were closed, but no major damage was reported. Emergency expenditures by the City of Fargo and Cass County total more than $7.5 million dollars. This does not include small cities or any private damage costs.

April 9, 2011 – The Red River at Fargo crested at 38.81 feet, the fourth highest crest on record. The Red River Valley began flooding on March 22nd, with Fargo reaching flood stage on March 29th. Due to a rather wet summer, Fargo experienced 150 days above flood stage this spring and finally dropped below flood stage on the 27th of August. Expenditures by the City of Fargo and Cass County total more than $13.7 million dollars. This does not include small cities or any private damage costs.

May 1, 2013 - The Red River at Fargo crested at 33.22. Predictions were much worse than the flood experienced therefore damage was minimal. The City of Fargo and Cass County still spent more than $3 million dollars primarily in preparation.

April 8, 2019 – The Red River crested at 35.03 feet. Predictions for major flooding were made due to record snowfall occurring in February and two major snowstorms in March blanketing the area in wet, heavy snow. A second crest of 30.05 feet occurred two weeks later as the result of a large snowstorm event. On April 5th, the Fargo/Cass County Tactical Operations Center opened on a 24-hour basis. Officials had requested assistance from the North Dakota National Guard. Additional officers from the North Dakota Highway Patrol were requested to assist with flood-related calls. Boat teams began 12-hour shifts. The Salvation Army and American Red Cross were placed on standby. In total Cass County and the City of Fargo have spent approximately $2 million in response and recovery costs.

PROBABILITY OF FUTURE EVENTS

Considering the extensive history of flooding in Cass County the probability of an event in any given year is fairly high. Experiencing flooding that warranted Presidential Disaster Declarations fourteen times in the past 25 years shows that a major flood has occurred more frequently than once in every two years. As expected, the more frequent events have a low impact, and the high impact events occur less frequently. However, in recent history the County has experienced several high impact events which has thrusted this hazard to the forefront in terms of attention and mitigation. Numerous and substantial mitigation projects have significantly reduced the extent of potential damages going forward.

Since it is predicted with reasonable certainty that anthropogenic climate change will lead to an increase in precipitation overall as well the likelihood of high-intensity events, flooding in Cass County can become more severe. The implementation of new standards after the major floods of 2009 and 2011 by cities and the county

has prevented risky patterns of development and increased the protection level for structures, particularly houses.

NFIP COMPLIANCE

Cass County recognizes the importance and value in the National Flood Insurance Program. The county, together with cities and townships that participate in NFIP, are responsible for administering regulations concerning development in the floodplains. Residents are encouraged to purchase flood insurance, whether or not they are in a mapped floodplain. In the designated high-risk flood zones, over a standard 30-year mortgage there is a 25 percent chance of flooding. The graphic below (Figure 4.7) shows the number of policies per jurisdiction that has had a claim in the past.

Figure 4.7 NFIP Policy Count by Jurisdiction as of May 30, 2019

City	Number of Policies
Amenia	0
Argusville	2
Briarwood	11
Casselton	5
Enderlin	2
Fargo	3,206
Frontier	4
Harwood	75
Horace	47
Hunter	0
Kindred	1
Mapleton	5
North River	10
Oxbow	5
Prairie Rose	9
Reiles Acres	37
West Fargo	170

Township	Number of Policies
Amenia	0
Barnes	1
Berlin	2
Davenport	1
Durbin	6
Gardner	1
Harwood	31
Mapleton	5
Noble	6
Normanna	23
Pleasant	24
Raymond	9
Reed	20
Stanley	63
Walberg	0
Warren	4
Wiser	6

The Community Rating System is a voluntary program that encourages jurisdictions to adopt and implement floodplain management activities that exceed the minimum NFIP standards. Besides the chief benefit of enhancing the community's resiliency when it comes to floods, those property owners will receive a discount on their flood insurance premiums according to the class rating the local government has achieved. CRS classes are rated from 9 to 1 with 1 being the highest level. Jurisdictions can improve their ranking via engaging in more of the any nineteen creditable activities in four categories: public information, mapping and regulations, flood damage reduction, and warning and response.

Fargo, with a Class 5 rating, is the only community in Cass County participating in the CRS. Joining the CRS may be more difficult for smaller communities to participate in, given that it requires staff time to enroll and maintain certification, not to mention the administration of any new regulations. However, many communities may already be engaging in activities that qualify for CRS points. If a city tracks its building permits in the floodplain, checks Elevation Certificates as they come in, has open space in the floodplain, and enforces at least a few regulations exceeding NFIP minimums, then CRS participation can be relatively straightforward. One action step for the county mentioned in this plan is to assist cities and townships with setting up a new or enhancing their floodplain management program, as resources will allow.

The County has implemented procedures to address specific NFIP requirements and regulations. The Cass County Flood Damage Prevention Ordinance authorizes the County Engineer to grant and deny development permit applications in accordance with its provisions. When issuing building permits it is ensured that new development does not cause increased flooding elsewhere and new buildings will be built according to the current BFE. Within city limits or its extraterritorial boundary, the permits will come from the city according to its policy. Those townships participating in NFIP have their own regulations.

Residents are provided information on flood hazards, floodplain map data, flood insurance and proper construction measures. An interactive floodplain map can be found on the County's website.

RISK CLASS

A	Given the high probability of flooding occurring and the potential for severe damage to property, not to mention the threat to lives, flooding – in all types – will remain the highest priority for mitigation and contingency planning.

Geological Hazards

Geologic hazards in Cass County usually have not been a major source of concern, but the potential exists for the occasional landslide affecting properties built too close to the river.

Landslide - A landslide is the movement of rock, soil, artificial fill, or a combination thereof on a slope in a downward or outward direction. The primary causes of landslides are slope saturation from intense rainfall, snowmelt, or changes in ground-water levels. This is seen most often on steep slopes, earthen dams, as well as the banks of lakes, reservoirs, canals, and rivers.

Riverbank slumping are a form of landslides and can occur along the rivers and streams of Cass County. The riverbank soils are inherently weak and the natural flow of the river as it meanders cause it to change move over time. Urbanization has artificially accelerated riverbank slumping by creating instability through activities such as placing homes and structures too close to the riverbank in a way that adds pressure to the bank and increases soil hydration through increased storm water runoff, use of irrigation systems that saturate the soil and decrease its strength, adding weight to the riverbank with structures, retaining walls, and riprap, and planting shallow-rooted vegetation. Attempts to mitigate riverbank slumping through bank stabilization techniques are not always successful. Rather, building structures away from the river, planting deep rooted stabilizing vegetation, and limiting the use of irrigation as well as siting septic drain fields away from the river are all practices that would limit the damage caused by this natural process.

There are four types of riverbank erosion. The first is called *rotational slump* whereby oversteepened slops that are naturally found on the outside of meanders along the Red River have blocks of earth move downward, sometimes rapidly. Trees and landscaping will rotate with the block. The second is *flow stump* is when the earth drops vertically into the river instead of rotating downward. Trees and landscaping will still remain vertical, albeit at a lower elevation then they were previously. The third is *creep*, which is the very slow downslope movement of earth towards the river. This process is imperceptibly slow, typically only a few centimeters a year. The final is *earthflow* that is described as the downslope movement of earth that results in a lobe-shaped landform. These are very localized and occur more frequently in extremely high soil moisture conditions.

Earthquake – Earthquakes are a very minor concern given that the area sees some of the least seismic activity in the United States, due to being located in the middle of a tectonic plate. An earthquake is the sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. Over millions of years, huge plates slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free suddenly causing the force to be felt on the surface.

LOCATION

Cass County is not located on a major fault line or other high probability geologic hazard area thus the main geologic threat is along the waterways throughout the County. Bank slumping is a concern that has sparked set back requirements and riparian projects where possible.

EXTENT

Riverbank slumping is typically a creeping phenomenon caused by a number of natural forces. Over the years, human interaction has accelerated the problem. Impacts to the built environment are what cause this natural occurrence to be considered a hazard. Impacts to community infrastructure are the main concern to the County and local jurisdictions followed closely by effects experienced by individual residents. The extent of riverbank slumping is typically limited towards single property owners.

A geotechnical evaluation can be performed by engineering firms to study soil stability, the impacts of a landslide on the integrity of any structures nearby and the likelihood of future movement in landslide locations. This is the best way to determine potential impacts.

PREVIOUS OCCURENCES

A condo complex and approximately 12 residences have been identified in West Fargo with slumping issues along the Sheyenne River. Other areas in the County have been identified where riparian projects may be a solution or buildings may need to be acquired and removed or relocated to areas further from the unstable riverbanks. These areas are primarily along the Red River, Sheyenne River and Wild Rice River in the unincorporated County.

PROBABILITY OF FUTURE EVENTS

Flood-related property buyouts have removed many of the structures that were highly exposed. The adoption of larger setbacks should reduce the building of structures in risky locations too close to the river. To prevent future problems, outreach can be done to educate property owners that still live near the river on best practices. That will give people a better understanding of rivers and how they function, so wise management decisions with our river ecosystems can be made by landowners and government entities.

RISK CLASS

B	Moderate to high risk condition, risk addressed by mitigation and contingency planning. Geologic hazards were not identified in the previous plan. Unstable soils and slumping along rivers have been a concern in recent years in many areas throughout the County.

Severe Summer Storms

Cass County's continental climate entails warm summers that, along with the highest precipitation of the year, can create the right conditions for which severe storms can develop. These include tornadoes, hail, downburst, straight-line winds, lightening, intense heat, and flash flooding rains.

Tornado - A tornado is a violent rotating column of air extending from a thunderstorm to the ground. A tornado starts as a cloud within the thunderstorm, composed of condensed water vapor. A tornado forms when a change in wind direction and increase in wind speed with increasing height creates a horizontal spinning effect in the lower atmosphere. This area of rotation may be two to six miles wide, extending through much of the storm. Most tornadoes form within this area of strong rotation when the rising air within the thunderstorm updraft tilts the rotating air from horizontal to vertical. Tornadoes may appear nearly transparent until the circulating wind in the funnel reaches the ground and picks up debris that eventually darkens the whole funnel. "Missiles" is the term that refers to the debris picked up by the wind that is projected with enough force to damage, and even penetrate, parts of buildings. In general, the stronger the wind the larger and heavier the missiles it can carry, thus increasing the risk of severe damage accordingly.

Tornadoes can vary greatly in shape, size, and wind speed. 88% of tornadoes have wind speeds of less than 110 miles per hour (mph) and a lifetime of less than ten minutes. These weak tornadoes result in less than five percent of tornado deaths. Tornados commonly move from southwest to northeast, but tornadoes have been known to move in any direction. The average forward speed is 30 mph but may vary from nearly stationary to 70 mph. Approximately 11 percent of all tornadoes have wind speeds between 110 mph and 205 mph and result in nearly 30 percent of all tornado deaths. These strong tornadoes may last 20 minutes or longer. Less than one percent of all tornadoes have resulted in 70 percent of all tornado deaths. These violent tornadoes can be over a mile wide with documented rotating winds of more than 250 mph, and they can have lifetimes exceeding one hour and stay on the ground for over 50 miles.

Hail – Hail is precipitation in the form of a lump of ice that forms during some thunderstorms. Hail occurs when strong rising currents of air within a storm, called updrafts, carry water droplets to a height where freezing occurs. The ice particles grow in size, finally becoming too heavy to be supported by the updraft and fall to the ground. Hailstones are usually round but can be conical or irregular in shape. They can range from pea size to the size of grapefruit, and large hailstones can fall at speeds faster than 100 mph. Hail tends to fall in swaths that range from a few acres to an area ten miles wide and one hundred miles long. Most hail events, however, affect only relatively small areas.

Downbursts – Downbursts form along the leading edge of a thunderstorm. Downbursts are intense

concentrations of sinking air, which can fan out upon striking the earth's surface, producing damaging horizontal winds also referred to as straight line winds. These strong winds can produce damage similar to a tornado. Downbursts are more common than tornados but are commonly mistaken for tornados. Downbursts can overturn mobile homes, tear roofs off of houses, and topple trees. People who are outdoors, such as campers, are particularly vulnerable.

Straight Line Winds – Straight-line winds are responsible for most thunderstorm wind damage. These winds occur most often at the leading edge of a storm. They do not tend to last long but can approach 100 mph. Straight-line winds can have much the same effect on structures as tornadoes; the primary difference between the two phenomena is the lack of rotation in straight-line winds. Strong sustained winds and gusts accompanying severe thunderstorms can last for several hours, causing significant damage to crops, buildings, power lines, and trees. Unlike the more localized damaged caused by tornados, straight-line winds affect a larger geographical area that makes response and restoration of services take longer.

Lightning – Lightning is produced by the interaction of charged particles that produce an intense electrical field within the cloud of a thunderstorm. The earth is normally negatively charged with respect to the atmosphere, but as a thunderstorm passes over the ground, the negative charge in the base of the cloud induces a positive charge on the ground below for several miles around the storm. The ground charge follows the storm like an electrical shadow, growing stronger as the negative cloud charge increases. Air is a poor conductor of electricity which insulates the cloud and ground charges preventing a flow of current until huge electrical charges are built up. Lightning occurs when the difference between the positive and negative charges becomes great enough to overcome the resistance of the insulating air and to force a conductive path for current to flow.

Lightning can cause fatalities, injuries, and property damage directly and indirectly. It can strike humans, animals, aircraft, buildings, equipment, and the surface of the earth causing death and destruction. Lightning can trigger other hazards including fires, power surges, interruption of communications, downed power lines, and exposure to noxious gas due to vaporization of materials. Computer equipment is especially vulnerable to damage from power surges.

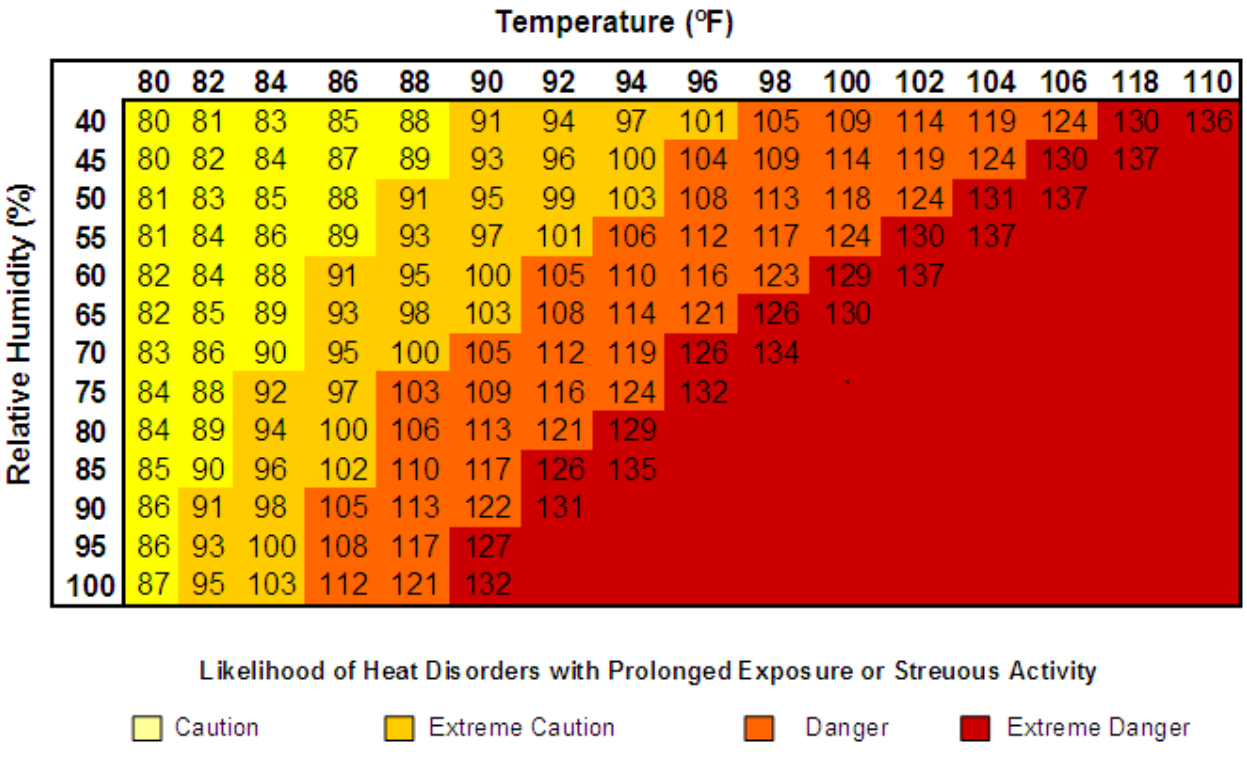
Extreme Heat – Extreme heat, commonly called "heat waves", is defined as temperatures that hover ten degrees or more above the average high temperature for the region and last for several weeks. Depending on the severity and duration, heat waves can create or provoke secondary hazards including dust storms, droughts, wildfires, water shortages, and brownouts.

The direct danger posed by heat is the effect it has upon the body's functions. Heat illnesses generally have to

do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a salt imbalance caused by too much sweating. When heat gain exceeds the level of heat that the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat- related illness may develop. People who are elderly, young, chronically ill, on certain medications or drugs, have respiratory problems, or are afflicted with weight or alcohol problems are particularly susceptible to heat reactions. The areas where a prominently cooler climate prevails, such as Cass County, are more vulnerable to extreme heat than areas with people who are more accustomed. One important contributor to increased morbidity are consecutive days with very warm evenings with little wind, meaning there is no relief to be found.

Figure 4.4 shows the Heat Index (HI) as a function of heat and relative humidity. The HI describes how hot the heat and humidity combination make it feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the HI rises so do health risks. When the HI is 90°F, heat exhaustion is possible with prolonged exposure and physical activity; from 90° to 105°F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity; from 105° to 129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity; and from 130°F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.

Figure 4.4 Heat Index



Source: National Weather Service

Most summer storms occur during the hottest months and may be tied with other summer-specific hazards. Lightning in thunderstorms may spark wildfires. When coupled with strong winds, these fires can quickly spread. Slow-moving thunderstorms often trigger flash floods due to the extended duration of heavy rainfall. The heavy rain, hail, strong winds, and tornadoes in summer storms may become problematic for ground and air travelers. Such conditions can cause accidents and could possibly lead to a hazardous material release such as storage tanks being overturned and punctured, or hazardous lagoon walls are compromised or simply overtopped. Should winds be strong enough, they can take down power and communication infrastructure and lead to long-term outages.

LOCATION

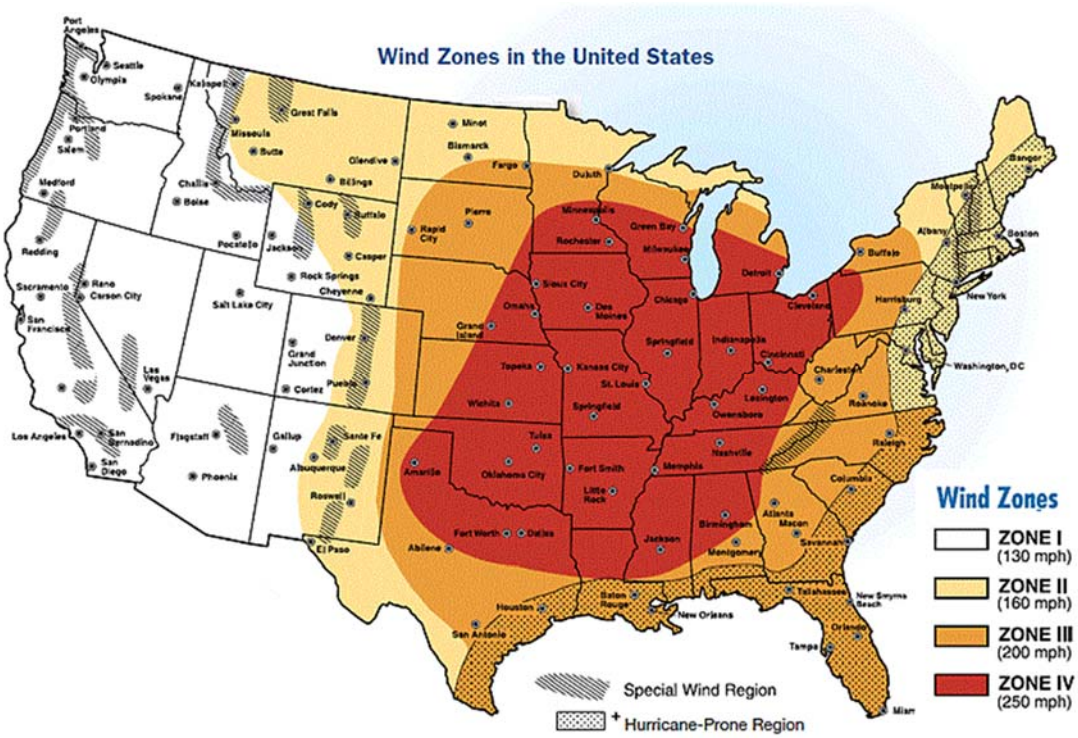
Cass County is not large enough nor has varied topographical features that will create noticeable differences in the geographical distribution of summer storm hazards. Instead, the vulnerabilities are based more on socio-demographic characteristics as well as the sturdiness of buildings.

EXTENT

Reported severe summer weather over the past several decades provide an acceptable framework for determining the magnitude of summer storms that can be expected and should be planned for. The Fourth National Climate Assessment released by the federal government in November of 2018 predicts that global average temperature increases between 2 and 4 degrees Fahrenheit will lead to increased incidence of heat waves. Summertime precipitation is not anticipated to increase under the low-emissions scenario but can be reduced 10-20% in the high-emissions scenario. The frequency of heavy precipitation events will increase about 50% by 2050 under the high-emissions scenario. The lesson is that past experiences with severe summer weather may not be an adequate predictor of future conditions. Mitigation planning should be adjusted accordingly.

As seen on the following wind zone map, Cass County is located right on the transition between zones with the northern part of the county being in Zone II (160 mph) while the southern half of the county including Fargo lies in Zone III (200mph).

4.5 U.S. Wind Zone Map



Source: FEMA

The potential for tornadoes of that wind speed magnitude highlights how important it is that residences, businesses, and public buildings have interior safe rooms or specially designed shelters. Over time, the building codes created by the International Code Council and subsequently adopted by the State and local jurisdictions have led to structures more resilient to the effects of storms. If a city, county, or township elects to adopt and enforce building codes, it must adopt (with amendments geared towards local conditions) and enforce the State Building Code which is currently comprised of the International Building Code, International Residential Code, International Mechanical Code, and International Fuel Gas Code along with some energy conservation standards.

Home Rule Cities may adopt something other than the State Building Code, but none have done so at this time. It should be noted that even if a structure is compliant with the latest building codes that does not necessarily mean the building will be functional after a natural disaster. Instead, it will only mean the building won't catastrophically fail in a manner that endangers inhabitants.

With that in mind, a method – albeit an imperfect one – to gauge the vulnerability of a community's housing stock is to look at the year houses were built according to Census data. This does not reflect any modifications that have been made to the structure that would make it more resistant, therefore it will overstate the extent of vulnerable structures. Data on commercial and other types of structures were not readily available. For each city in the mitigation actions section, the relative age of houses will be mentioned if it is observed that a higher-

than-normal vulnerability is present. It will also be observed whether there are mobile home parks that will need to be specifically addressed in terms of mitigation action steps.

Specially designated storm shelters for the public are rare throughout the county. Those with the highest potential for being caught unawares of oncoming severe weather are those using municipal parks and campgrounds with no nearby buildings that are normally accessible to the public. Several cities have identified the construction of storm shelters as action items in this plan. The following are towns whose parks do not have storm shelters: Argusville, Davenport, Enderlin, Gardner, Leonard, Tower City.

There are several campgrounds and RV parks throughout the county. People patronizing these locations are especially vulnerable to severe summer weather, particularly so as dangerous storms can develop very quickly. The ones that have adequate buildings or structures nearby are the RV park in Casselton and West Fargo at the fairgrounds. The campground at Lindenwood Park is located near the information center, which functions as a shelter. The RV park in Buffalo has no such structure that guests can turn to.

PREVIOUS OCCURANCES

According to the Hazards and Vulnerability Research Institute at the University of South Carolina there have been 287 occurrences of summer storm phenomena in Cass County since 1960, with thunderstorms being the most common. The most significant instance of severe summer weather to hit Cass County happened June 20, 1957. A F5-level tornado that touched down in north Fargo and had cut a swath of destruction across 100 blocks. 329 homes were destroyed with some of them being completely swept off their foundations. A thousand more were damaged. 12 people were killed, mostly in the working-class Golden Ridge neighborhood that contained modest but cheaply built homes. Only few had basements.

A list of notable summer storm occurrences in the past 30 years is presented below.

Table 4.8 Notable Severe Summer Storm Occurrences since 1989

Date	Description
Thunderstorms (including straight-line winds)	
6/22/1992	Severe thunderstorm producing hail and an F1 tornado caused $6 million in damages
7/31/1993	Severe thunderstorm with heavy rains causing flash flooding causing nearly $1 million in damages
7/1/1997	Severe thunderstorm with straight-line winds causing power lines to be blown down causing only $200,000 in damages
8/5/1997	Thunderstorm with strong winds peaking at 41 knots according to Fargo ASOS. A building under construction was blown down causing only $200,000 in damages

7/4/1999	Severe thunderstorm affecting a large area of Cass County produced strong winds that knocked down trees, power, lines, and buildings under construction. Significant roof damage occurred to both residential, agricultural and commercial structures. $85 million in damages was reported.
8/8/2001	Thunderstorm producing strong winds was reported in Fargo, Alice and Grandin. The storm caused down trees, power lines, grain bins and small outbuildings causing near $100,000 in damages.
6/24/2003	Thunderstorms with downburst winds over 100mph caused damage to power lines, poles, towers and other electrical structures. Trees down and residential damage were reported in Tower City, Buffalo, Ayr, Arthur and Gardner. The Cass County Commission declared a state of emergency, a preliminary damage assessment was done by FEMA but a Presidential Disaster Declaration was not issued. $1.7 million in damages resulted from the storm.
7/15/2007	Severe thunderstorm that followed a 5-7 mile swath from the northwest passing through Page, Tower City, Buffalo, and Embden areas. Hail and strong winds caused damages indicative of an F1 – F2 tornado in spots. Power lines were down leaving residents without power for hours. Trees, crops, livestock and farm buildings all contributed to significant losses totaling $3 million. A Presidential Disaster Declaration was declared.
5/20/2011	High winds hit the Fargo metropolitan area, causing trees to blow over and power to be interrupted. The monitoring station at Hector International Airport measured wind gusts up to 72 miles per hour.
6/21/2014	Numerous 3 to 5 inch diameter tree branches were broken in Argusville. Several roof panels flew off a pole shed north of town. The peak winds were estimated at 60-70 miles per hour.
6/13/2017	High wind and rains hit the metropolitan area knocking out power for 3,000 customers. Several roads were blocked by fallen trees or power pole lines.
Hail	
9/7/1997	A storm with three quarter inch hail hit several car dealerships along I-29 in Fargo, causing half million dollars in damages
7/14/1998	1.75 inch hail reported in Horace
7/17/2001	0.75 – 4.5 inch hail was reported in the areas of Lynchburg, Chaffee, Kindred, Alice and Leonard
7/10/2004	0.75 – 1.75 inch hail was reported in Kindred, Chaffee, Horace, Amenia, Casselton, and Fargo
7/12/2004	1 – 1.75 inch hail was reported in the Argusville and Harwood area
8/29/2004	1.5 – 1.75 inch hail was reported 6 miles SW of Fargo
5/20/2005	0.75 – 2.5 inch hail was reported near Casselton, Kindred, Tower City, Embden, and Chaffee
7/4/2011	A few dime to quarter sized hail fell in the Leonard area in a brief but heavy rain.
8/12/2011	A minor amount of walnut-sized hail fell west of Grandin.
8/26/2018	Early morning quarter-size to tennis ball-sized hail caused damage to a few cars and buildings in between Davenport and Oxbow. Crops were affected more so than property with several fields shredded or leveled.
Lightning	
7/1/1997	Lightning struck three workers in a sugar beet field near Davenport resulting in one fatality and two injuries.
6/1/2005	A house near Rose Creek Golf Course, Fargo was hit by lightning causing a fire.
7/6/2017	It is believed that the Casselton Heritage Center in Casselton was struck by lightning that knocked portions of its stone roof onto the ground.
Tornado	
6/5/1996	A F0 (40-72mph) tornado touched down one mile northeast of Gardner. The path was one mile long by 20 yards wide.

6/26/1997	Rapid convection produced several brief tornado touchdowns north of Fargo. A F0 (40-72mph) tornado touched down one mile west of Argusville. The width of the path was 25 yards
8/22/1999	A F0 (40-72mph) tornado briefly touched down five miles northwest of Casselton. The path was one mile long by 25 yards wide
8/28/2002	A F0 (40-72mph) tornado briefly touched down two miles north of Lynchburg. Several large tree tops were broken off. The path was less than one mile long and 25 yards wide
5/19/2004	A F1 (73-112mph) tornado briefly touched down three miles southwest of Durbin. Several trees were uprooted. The path was one mile long by 50 yards wide.
7/10/2004	A F0 (40-72mph) tornado briefly touched down two miles southeast of Horace. Numerous trees and power poles were snapped off at ground level. The path was seven miles long by 25 yards wide.
7/10/2004	A F0 (40-72mph) tornado briefly touched down two miles southwest of Wild Rice heading toward the Red River. The path was one mile long and 25 yards wide.
7/18/2004	A F0 (40-72mph) tornado briefly touched down eight miles southwest of Page. The path was less than a mile long by 25 yards wide.
7/18/2004	A F2 (113-157mph) tornado touched down two miles southeast of Tower City. The tornado knocked down high voltage power lines and three metal towers north of the City. Several farm buildings were also damaged. The path was four miles long by 100 yards wide. It caused $500,000 in damages.
7/18/2004	A F0 (40-72mph) tornado briefly touched down seven miles southwest of Buffalo. The tornado touched down in an open field with a path one mile wide by 25 yards wide.
5/20/2005	A F1 (73-112mph) tornado touched down seven miles southwest of Casselton through a construction zone on Interstate 94 dislodging temporary lane markers, twisting highway signs and flipping over lighted arrows. Interstate travel was disrupted for over an hour. The path was nearly three miles long and 75 yards wide.
5/20/2005	A F0 (40-72mph) tornado briefly touched down three miles southwest of Kindred. A dust plume was generated as the tornado touched down in an open field. The tornado tracked into Richland County with a path one mile long and 50 yards wide.
6/29/2005	A F0 (40-72mph) tornado touched down four miles southeast Kindred. The path was one mile long by 50 yards wide
9/5/2005	A F2 (113-157mph) tornado touched down two miles north of Hickson. A farmstead was hit with a 30 foot concrete silo being lifted and blown onto a machine shed. Concrete debris demolished half of the shed, trees were snapped off and the house also sustained some exterior damage. The tornado tracked intermittently along a 4 mile path with a width of 200 yards with peak wind speeds estimated at 120mph.
9/5/2005	A F1 (73-112mph) tornado touched down one mile northeast of Wild Rice. The path was two miles long by 100 yards wide that continued from Wild Rice toward the Red River and into Clay County. Signs, fences, and many trees were destroyed with debris being thrown downwind for hundreds of feet.
5/7/2006	A F0 (40-72mph) tornado was reported five miles north east of Gardner by a motorist. The path was less than a mile long by 25 yards wide.

6/5/2006	A F0 (40-72mph) tornado was reported by a deputy two miles southwest of Leonard. The path was less than a mile long by 25 yards wide.
6/14/2008	A tornado originated in Barnes County and continued with intermittent touchdowns into Cass County for about one mile. It ceased about 2 miles north of Tower City.
7/27/2010	A F1 (73-112 mph) tornado was tracked for about 2 miles to the northwest to around 4 miles west of Kindred. Significant tree damage was done to three farmsteads
7/4/2011	A small brief tornado was reported west of Grandin and northwest of Mapleton.
6/21/2014	A small tornado was spotted via radar near Argusville
9/4/2014	A F1 (73-112 mph) tornado formed near Leonard and tracked towards Kindred.
6/8/2018	A tornado was reported as touching down near Tower City and another one touched down near Kindred. No damage was reported.

PROBABILITY OF FUTURE EVENTS

Past experience can serve as a useful start in estimating the annual probability of severe summer weather. From 1960 through 2017, there have been 284 separate instances of severe summer weather leading to an average of approximately 5 events per year. A notable statistic is that 93 tornadoes have occurred in Cass County between 1950 and 2014 which averages out to more than one tornado per year. However, the vast majority of these tornados are either F0 or F1 in strength. Hotter and wetter summers due to climate change are anticipated to exacerbate the severity as well as frequency of severe summer weather. This will tax each city's infrastructure and response systems to a greater extent than before.

RISK CLASS

B	Moderate to high risk condition, risk addressed by mitigation and contingency planning. All areas in Cass County are at the same risk of this hazard. Risk rating is unchanged since last plan.

Severe Winter Storms

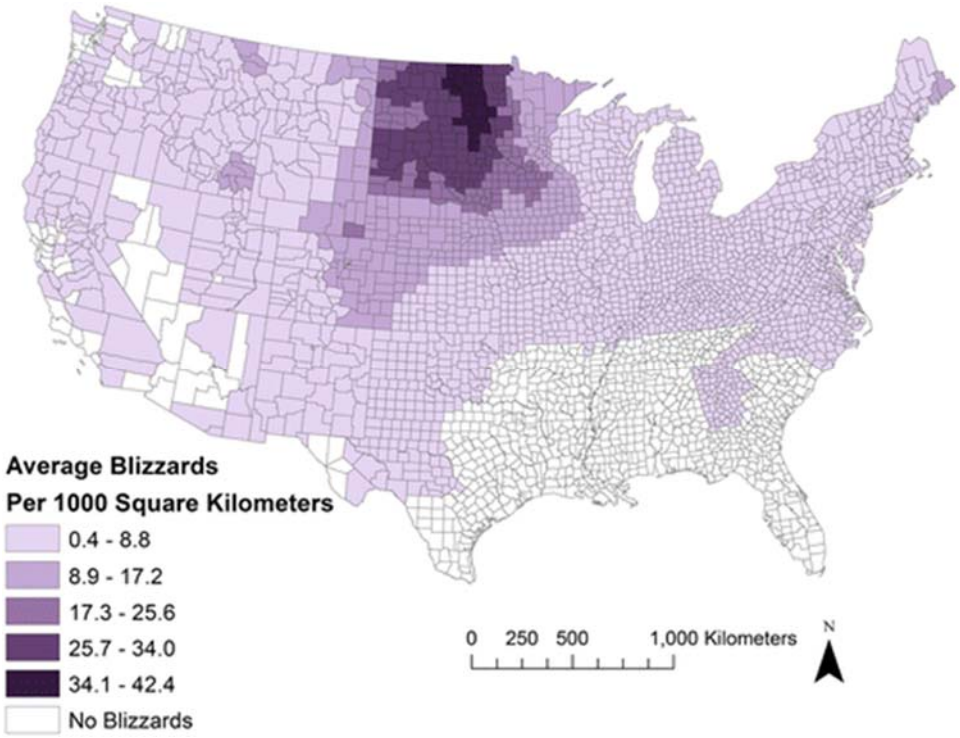
Severe winter weather includes blizzards, heavy snow, ice storms, and extreme cold. Important factors when evaluating the severity of winter storms include temperature, wind, wind chill, rain, sleet, snow, and blowing snow. The winter season can begin as early as September and last into May. The bulk of winter weather conditions occurs between mid-November until early April. Average annual snowfall in Cass County is around 42 inches and the average number of days with one inch or more snow depth is around 54 days per year. Typically winter has the windiest months whereby the winds shift to coming from the north and west, bringing in frigid arctic air.

Blizzard – Blizzards are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for a duration 3 hours or more. A blizzard, by definition, does not necessarily indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills.

Blizzard conditions can also exist without a major storm system. Strong surface winds can blow already fallen snow, which is known as a "ground blizzard." Visibility can be reduced to near zero even though the sun is shining and the tops of power poles and trees are easily seen. These conditions are extremely variable in duration and are usually accompanied by very cold temperatures and wind chill conditions, making them as dangerous as a conventional blizzard.

Based on historical data from 1959-2014, it was found that Cass County had the highest blizzard frequency at 111 identified blizzards, tied only with Traill County to the north. It is surmised that the flat open expanse of the Red River Valley contributes to the number of blizzards that form. The map below from Coleman and Schwartz (2017) illustrates how frequent blizzards are in Cass County compared to the nation as a whole.

Figure 4.6 Average number of blizzards per 1000 km2 for the 1959/60-2013/14 seasons.



Source: Coleman, Jill and Robert Schwartz. 2017. "An Updated Blizzard Climatology of the Contiguous United States (1959-2014): An Examination of Spatiotemporal Trends." Journal of Applied Meteorology and Climatology *56(1):173-187.*

Heavy Snow - Six inches of snow or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences.

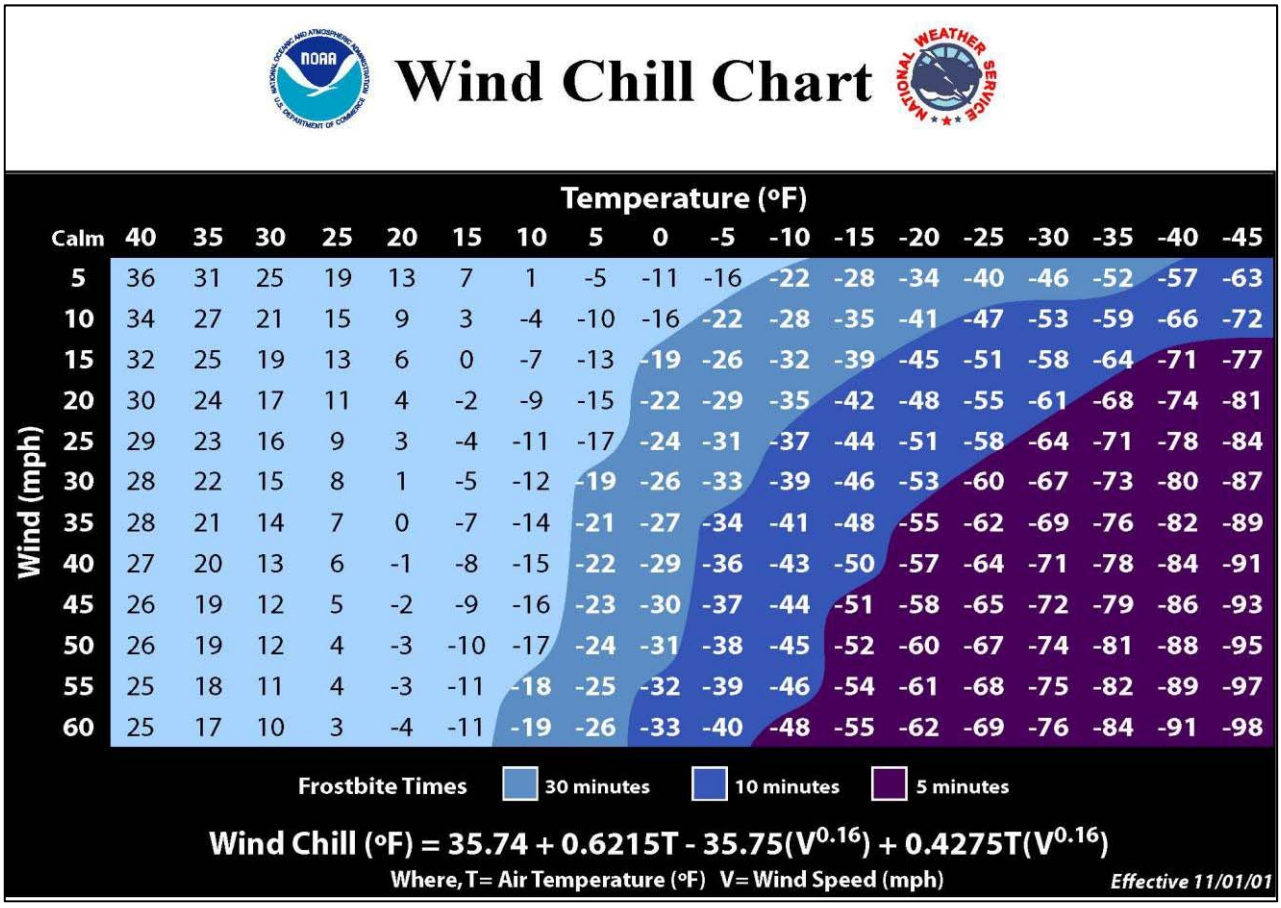
On rare occasions, the weight from excessive snow leads roofs to collapse. This is not normally a cause for concern given that most buildings are built to handle the snow load of a typical winter. Agricultural structures, grain bins are one example, aren't designed to the same standards as habitable buildings since it is the risk of injury to persons is lower.

Ice Storms – Ice storms develop when a layer of above-freezing moist air aloft collides with a below freezing pool of air at or near the earth's surface. As snow falls into the warm layer of air, it melts and then freezes on contact when hitting the ground, thus creating a slick layer of ice. Extended periods of freezing rain can lead to accumulations of ice on roadways and walkways making any form of travel difficult. Ice will also build up on trees, power lines and communication towers causing dysfunction or in some cases break degradation of the structures. Power lines, if not designed properly, are susceptible to the combination of freezing rain and the high wind that it often coincides with. The swaying of the power lines can cause them to break or touch each

other, resulting in a power outage.

Extreme Cold - Extended periods of cold temperatures frequently occur throughout the winter months in Cass County. When cold temperatures and wind combine, dangerous wind chills can develop. “Wind chill” is a measurement of how cold it feels when outside. Wind chill is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the ambient temperature. This can be quite dangerous if a person is exposed to the elements for any extended period of time. It may take only minutes before one’s skin is frostbitten, not to mention the onset of hypothermia. Figure 4.7 is the National Weather Service Wind Chill Chart.

Figure 4.7 National Weather Service Wind Chill Chart



Source: National Weather Service

Extreme cold can have a disproportionate impact on households with inadequate heating or are not weatherized appropriately. Drafty windows, insufficient insulation, and old furnaces can make it more of a challenge in heating a home within a budget that a household can afford. It is not unheard of for families to use space heaters or ovens as a heating source, even though these present a greater fire risk.

Unsheltered homeless are particularly vulnerable to extreme cold. Fortunately, over the past few years shelter capacity has increased whereby an emergency sheltering program initiated by local churches in 2011 was able to be discontinued.

LOCATION

Severe winter weather events can affect the entire planning area including all participating jurisdictions. Visibility in rural open areas can quickly deteriorate as the wind picks up. The built-up nature of cities tends to mitigate the loss of visibility, but neither they are immune to poor travel conditions. It is not uncommon for “no travel advisories” to be issued and state and federal highways to be closed to vehicular travel.

EXTENT

The impact of a severe blizzard with low visibility, heavy snow, and cold temperatures can bring not only the County but the entire region to a standstill. Utility and communication systems are often interrupted. Road systems are rendered impassable which causes school, workplace, and commercial shutdowns. This in turn magnifies the emergency and medical management needs of the community. Rural residents are especially hard hit if they are not adequately stocked with food and fuel. The livestock industry can be severely impacted. The inability to get feed and water to livestock can become critical quickly. Dehydration is a major cause of livestock casualties.

Strong winds and ice or snow accumulations can take down utility lines. A long-term utility outage becomes more significant during extended cold periods as sheltering and cold weather exposure becomes more challenging. Accessing those in rural areas following heavy snow events to deliver supplies or provide emergency services can be difficult. The need for such services would be compounded by any long-term utility outage. In Cass County, winter seasons with high snowfall can easily translate to flooding problems in the spring.

The lack of adherence to warnings and safety precautions are a significant factor when considering the effects of severe winter weather making education extremely important to combat loss of property, injury or even death.

Hypothermia has often been called “the killer of the unprepared”. It is also the number one killer of outdoor sports enthusiasts. Hypothermia is a condition where the body temperature or core temperature is lowered. The blood is cooled, reducing the oxygen carried to the brain and dulling the senses. The victim becomes fatigued, delirious, and loses dexterity of arms and legs. If the body’s core temperature continues to drop to about 85 degrees Fahrenheit, the victim eventually slips into unconsciousness. If treatment is not started immediately, the end result is arrest of the circulatory and respiratory systems and death.

PREVIOUS OCCURANCES

Every year during the winter months, county residents can expect to be exposed to a variety of winter weather. Cass County has been included in sixteen winter weather declared disasters and emergencies since 1989. These events are listed in Table 4.9. Not all winter storms receive a declaration by the Governor. Nonetheless, any winter storm can easily become disruptive and dangerous. In the winter of 2018-2019, the County saw eight separate named blizzards which is the third-highest total over the past forty years. Typically, the winter season sees two to three blizzard events. Travel became difficult and city and county budgets for snow removal were much higher compared to years past.

Table 4.9 Winter Weather Declared Disasters and Emergencies

Declaration	Location	Date	Other Information	Casualties	Damages
DR 1157	All counties in North Dakota	January 2-31, 1997	Public Assistance. For blizzards and severe winter storms.	8 deaths 91 injuries	$14,801,246* $317,000,000 estimated total
DR 1279	34 counties and 3 tribes in Central and Eastern North Dakota	March 1 – July 19, 1999	Public Assistance and Individual Assistance. For snow and ice. Also included impacts from severe storms, tornadoes, flooding, ground saturation, landslides, and mudslides	None	$124,391,622*~
State EO	North Dakota	2003	State Declared Winter Emergency	Unknown	Unknown
State EO 2005-09	North Dakota	10/6/2005	State declared snow emergency	Unknown	Unknown
State EO 2005-11	North Dakota	10/31/2005	State declared snow disaster	Unknown	Unknown
State EO 2005-12	North Dakota	11/29/2005	State declared snow emergency	Unknown	Unknown
DR 1621	Cass, Ransom, Richland, and Sargent Counties	November 27-30, 2005	Public Assistance for severe winter storms.	None	$2,728,807* $3,000,000 estimated total
State EO 2005-13	North Dakota	12/20/2005	State declared snow disaster	Unknown	Unknown

State EO 2009-02	North Dakota	1/22/2009	State declared winter storm emergency	Unknown	Unknown
State EO 2009-03	North Dakota	1/28/2009	State declare winter storm emergency	Unknown	Unknown
State EO 2009-04	North Dakota	2/20/2009	State declared winter storm emergency	Unknown	Unknown
State EO 2010-01	North Dakota	1/22/2010	State declared severe winter storm emergency	Unknown	Unknown
State EO 2010-03	North Dakota	1/27/2010	State declared winter storm emergency	Unknown	Unknown
State EO 2010-16	North Dakota	12/30/2010	State declared winter storm emergency	Unknown	Unknown
State EO 2011-04	North Dakota	3/11/2011	State declared winter storm emergency	Unknown	Unknown
State EO 2011-11	North Dakota	5/13/2011	State declared winter storm emergency	Unknown	Unknown

** Federal Share (includes Individual and Family Grant, Disaster Housing, Manufactured Housing, Crisis Counseling Immediate and Regular Programs, Disaster Unemployment Assistance, Hazard Mitigation Grant Program, Public Assistance, FEMA Mission Assignments, and SBA Home, Business, and Economic Injury Loans.;*
~ primarily includes flood impacts.

PROBABILITY OF FUTURE EVENTS

The likelihood of the county to experience severe winter weather in some form or another is nearly guaranteed. Under the most likely predicted climate change scenarios, winter precipitation is anticipated to increase 10-30% by century's end. This will translate into more severe winter storms.

RISK CLASS

B	Moderate to high risk condition, risk addressed by mitigation and contingency planning. All areas in Cass County are at the same risk of this hazard. Risk rating is unchanged since last plan.

Urban Fire

Fire is the result of three components: a heat source, a fuel source, and an oxygen source. When combined, these three sustaining factors will allow a fire to ignite and spread. Urban fires are considered those uncontrolled fires in a residence or building resulting from natural, human or technical causes. Within a structure, a small flame can quickly spread and become out of control and turn into a major fire within a short time. Thick black smoke will fill the structure within minutes. The heat from a fire can be 100 degrees Fahrenheit at floor level and rise to 600 degrees at eye level. In five minutes, a room can become so hot that everything in it ignites at once. This complete engulfment is called a flashover.

Urban fires and any structural collapses that result from the fire can lead to complete building losses in addition to other losses from the causative hazard (e.g. lightning, wildrye, human actions). In higher density areas, there is a greater risk of injuries, loss of life and property in addition to damage to critical infrastructure, all of which hampers a community's ability to function in the short term.

The municipal fire department is one of the oldest continuing institutions in the United States. Professional firefighters are well trained in the latest skills for preserving life and applying their abilities to limit property damages. They attempt to arrive at the fire as soon as possible, direct all people to safety, and suppress the fire as quickly as possible. The amount of lives and property saved from fire by fire departments tremendously exceeds losses which are reported in statistics.

Many rural fire protection districts across the state of North Dakota and even the country are facing the challenge of finding enough people to serve as a volunteer firefighter. The need to be on-call while at the same time balancing one's job and family duties makes it a difficult sell. The depopulation of many rural communities, not to mention the aging of the population, have decreased the pool of potential volunteers.

LOCATION

"Urban fires", for the purpose of this plan are those that happen in a built-up developed area and start due within a structure or on the premises. Therefore, these can occur in any of Cass County's towns. Older buildings that do not conform with the latest building codes are more vulnerable than newer ones. For example, multistory buildings built before the 1950s were often constructed with a framing method that didn't provide as much insulation or fire barriers between floors. Also, those structures that have been abandoned are particularly vulnerable to fire given that maintenance is not kept up and it can attract criminal activity such as arson. If a block or neighborhood has a preponderance of these buildings, extra attention should be paid to those locations.

Urban fires can occur anywhere but are generally most significant in downtown areas. To maintain continuity with the State of ND Multi-Hazard Mitigation Plan communities with 1,000 or more people will be focused on as they generally have a downtown area or other public venue that might be at increased risk of larger scale urban fires. These communities include Fargo, West Fargo, Horace, and Casselton as of the 2010 census.

One man-made source of urban fire is the derailment of trains carrying crude oil. On December 30, 2013, an oil train caught on fire after hitting a derailed grain train a mile outside of Casselton. Most of the community was evacuated as a precaution. If this accident were to occur in the city, the casualties would have been immense. This topic will be covered in more detail in the county's THIRA plan.

EXTENT

Property and the population are at risk from urban fires and structure collapses. Property losses are usually covered by insurance, but can be devastating to the building occupants, particularly for primary residences. These types of events often do not result in community-wide disasters, unless the structure is critically important to the economy. Fires and collapses that result in a significant loss of life or encompass the large part of a downtown or urban area would present the most significant challenges to local and county governments.

Depending on the time and location, a major structure fire could result in the loss of life either to firefighters or building occupants. The potential for this type of loss is difficult to determine due to advances in firefighter safety and the installation of sprinkler and alarm systems in many commercial and apartment structures. Those structures lacking smoke detectors are especially dangerous to the population. Should lives be lost, significant resources could be needed to manage the recovery.

Economic values could be lost if a business district were destroyed in an urban fire or structure collapse. For example, facilities of large employers or central community structures such as grain elevators could lead to significant community losses. Most historic buildings lack sprinkler systems and would lose much of their historical value in a fire or collapse.

Due to the housing density of Cass County being 38.49 per square mile in 2010 The State of ND Multi- Hazard Mitigation plan has given the County a vulnerability rating of high. A lack of County-wide building codes also has an effect on this determination.

Damage can vary greatly based on response time of responders. Cass County is served by twenty fire departments detailed below in Table 4.10.

Table 4.10 Cass County Fire Departments by City

City	Fire Department	City	Fire Department
Argusville	Argusville Fire Protection District	Harwood	Harwood Area Fire & Rescue
Arthur	Arthur Volunteer Fire Department	Hunter	Hunter Fire Protection District
Buffalo	Buffalo Fire Department	Kindred	Kindred Community & Rural Fire Protection
Casselton	Casselton Fire Department	Leonard	Leonard Fire Protection District
	Casselton Rural Fire Department	Mapleton	Mapleton Fire Department
Davenport	Davenport Rural Fire Protection	Page	Page Fire Department
Erie	Erie Rural Fire Department	Tower City	Tower City Rural Fire Protection District
Fargo	Fargo Fire Department	West Fargo	West Fargo Fire Department
Grandin	Grandin Fire Department		West Fargo Rural Fire Department

Source: North Dakota State Auditor's Office

PREVIOUS OCCURANCES

All jurisdictions experience fires every year. The majority of these are minor and occur at residences. Even though Fargo experiences numerous fires every year, in the past 25 years there have been only two that have extended beyond the property where the fire started. The potential for catastrophic loss is highest in those areas built before adoption of modern building and fire codes. The properties most at risk are those in close proximity to one another, those with inadequate fire separations or common basements, and large multi-family apartment buildings constructed without adequate fire protection before the adoption of the latest International Fire Code.

Notable fires in the planning region include the June 7, 1893 fire that destroyed the majority of Fargo including city hall, the business district, and homes of most of Fargo's then 6,000 residents. On Fargo's Broadway street alone, there have been six fire incidents which led to the complete destruction of the building since 1967. Most of these occurred in the 1960s and 1970s.

On October 11, 2010 nearly 150 residents were displaced after a massive fire destroyed an apartment building at Galleria Apartments on 42nd Street. Two firefighters had to be rescued when a third floor roof collapsed during a fight that lasted more than four hours. No casualties or serious injuries were reported.

On February 18, 2018 at the Magellan Midstream Partners tank farm in West Fargo, approximately 1,200 barrels of leaked diesel fuel caught fire. Area residents were told to shelter in place to avoid exposure to the smoke that was generated. Fortunately, with the design of the fuel tank and the type of fuel firefighters knew there wouldn't be a catastrophic failure of the tank or an explosion. Once equipment was set up, the fire was out in 10 minutes.

PROBABILITY OF FUTURE EVENTS

The probability of multiple urban fires in any given year is very high. There is also a high probability that at least one fire in any given year will require resources beyond the capability of the on-duty shift or first wave of

volunteer fire fighters in the rural communities. Generally, the more frequent events have a low impact such as a single vehicle or partial residence fire, while high impact events affecting a large number of people or property like an apartment building or office complex occur rarely.

RISK CLASS

D	Low risk condition with limited potential for impacts. Risk rating is unchanged since last plan.

Wildfire

A wildland fire are those uncontrolled fires occurring in undeveloped and vegetated areas. These are a natural process of the ecosystem's cycle. However, if left unwatched these can grow to a point that threaten property and lives.

It is estimated that up to 90% of wildfires are caused by humans, mostly by accident. Faulty electrical lines, negligently discarded cigarettes, campfires that were not completely extinguished, and sparks generated from farm equipment or trains are a few notable examples. Environmental conditions contribute to the incidence and severity of wildfire. Warm, dry, and windy conditions can easily spread the fire. Accumulation of fuel (i.e. vegetation) over time can also lead to larger and more intense fires.

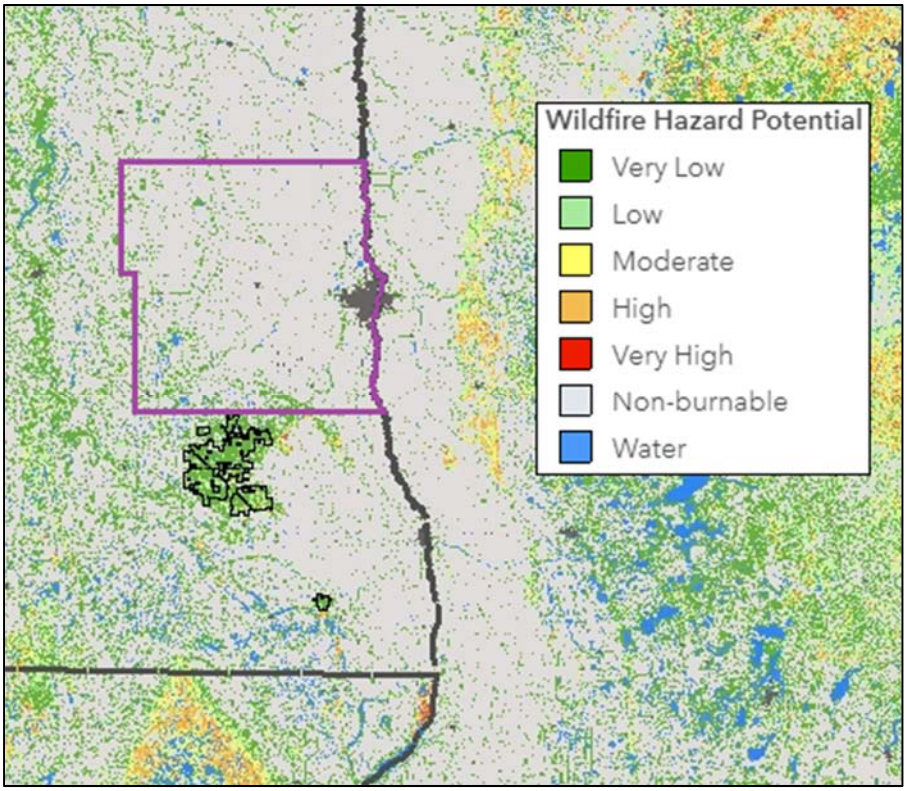
The peak fire hazard season usually begins in April after the snow melt when persistent spring winds dry out vegetation. Besides the potential for damage to crops and properties, the secondary effects of wildfires are the smoke that contains different compounds which can be harmful at high concentrations. Fine particulate matter can travel long distances and move deeply into the lungs during breathing. People more sensitive to this smoke are the elderly, young children, and those with reduced respiratory and heart function.

With the vegetative cover being burned off, erosion and soil runoff are more likely to occur. This will negatively affect surface water resources.

LOCATION

According to the US Forest Service's Fire Modeling Institute, Cass County has minimal risk of wildfire as seen in the following map:

Figure 4.8 Wildfire Hazard Potential Map (2018 Version)



The International Wildland-Urban Interface code describes vegetation consisting of herbaceous plants and round wood less than a quarter inch in diameter as being a lighter type of fuel. Grasslands would fall into this category. The majority of the grasslands in Cass County are agricultural acres temporarily enrolled in the Conservation Reserve Program. Grasslands and shrub lands should be managed in order to prevent the accumulation of vegetation that can serve as a fuel source.

Agriculture comprises the majority of Cass County's land cover. The flammability of planted acres depends upon the crop and its moisture content during the growing season. The dearth of forested acres means that the most potent of fuel is not present in large enough amounts to merit extra attention. Trees in rural areas are found mostly along the rivers and streams or are planted by farmers as a shelterbelt.

All in all, the risk of an uncontrolled wildfire in Cass County is very low.

EXTENT

Agricultural losses are typically the most significant measure of a wildland fire. Crop insurance can cover these losses, but depending on the acres burned, time of year and possibility of a fire spreading to outbuildings and equipment it could be devastating to owners. Crop cover, time of year and the terrain, including fire breaks such as streams or roads, can greatly impact the characteristics exhibited by a wildland fire.

The extent of damage caused by wildfire can be lessened through a quick and adequate response from firefighters. In the rural areas of Cass County, the fire districts typically cover a wide geographical area and are entirely staffed by volunteers. There is a delay in response resulting from the need for people to leave their homes or places of employment and travel to the fire station before putting on the requisite equipment and boarding the fire truck or tanker. A common issue found in many rural fire departments across North Dakota is the challenge in finding enough volunteers. Rural depopulation and the aging of residents has limited the pool of potential volunteers.

PREVIOUS OCCURANCES

Cass County experiences wildland fires nearly every year although there have been no wildland fires 1,000 acres or more in Cass County since 1989. According to the North Dakota Forest Service from 2009-2012 thirty wildland fires were reported in Cass County burning 269 acres. This is an average of less than nine acres per incident. A recent occurrence was on April 18, 2015 when two separate fires near Page spread from one acre to over a hundred. This was the result of an attempted controlled burn. The last time a red flag warning was in 2015.

PROBABILITY OF FUTURE EVENTS

The probability of a wildland fire occurring in Cass County in any given year can be high if conditions are dry enough. However, a fire of significant magnitude or one that would require additional resources beyond that of the first responding fire department is much less likely. Education is a key component of reducing all types of fires as most are caused by human error. Paying attention to key burn warnings can prevent unnecessary losses.

RISK CLASS

D	Low risk condition with minor impacts. Risk rating adjusted from a C in the previous plan. Although small wildland fires are likely every year the ground cover in Cass County and the rapid response time of emergency responders has only allowed for negligible damage.

SECTION V: GOALS AND OBJECTIVES

Goal 1: Encourage County and local planning related to hazard mitigation

- Incorporate a focus on mitigation throughout community planning efforts. These efforts include strategic, comprehensive, economic development, housing, and other types of plans.
- Utilize hazard mitigation plan data when seeking grant opportunities and writing applications.
- Assist townships and small cities with adopting and enforcing land use regulation which recognizes natural hazards and mitigates the effects thereof.
- Integrate mitigation data in business continuity, school district, transportation and park district planning.

Goal 2: Enhance the public's awareness of hazards

- Continue to support and enhance current tools such as education campaigns through local media and Code Red system.
- Provide training on mitigation-related topics to all of Cass County's communities.
- Continue to update and provide public access to online interactive flood stage maps.
- Increase the use of social media as a method to educate stakeholders.
- Continue public meetings during events and add post-disaster briefings to gather feedback on performance and future mitigation actions.

Goal 3: Reduce the impact future development has upon potential losses and vulnerabilities

- Require new roads be built no more than 6" below Base Flood Elevation (BFE) and that the top of the curb be at or above BFE.
- Encourage cities to require new structures be built at or above BFE.
- Encourage a stricter building code that requires new structures be built 2 ½ feet above BFE throughout the County.
- Conduct studies to better define risk exposure.
- Continue to work with FEMA in improving floodplain maps and ensure building ordinances recognize the mapped floodplains.
- Enforce protective ordinances.
- Educate small cities and townships on building codes and the benefits of implementing such codes.
- Encourage tornado preparedness in new construction including evacuation plans and safe room identification.
- Enforce current setback requirements as they relate to drains or rivers and encourage adoption of stricter setbacks where necessary.

Goal 4: Reduce impacts of flooding and geotechnical hazards to people and property

- Continue identifying forms of permanent flood protection for areas continually affected by flooding.
- Continue creating, enforcing, and updating as needed ordinances, planning, and zoning requirements.
- Assist cities in applying for and participating in the Community Rating System program.
- Continue acquiring properties in flood prone areas.
- Identify basin-wide areas available for water storing and retention.
- Support levee accreditations and dam emergency plans.
- Coordinate planning and strategies existing and being developed by other entities and agencies.
- Distribute Cass County mitigation plans and activities to other interested parties.

Goal 5: Mitigate the effects severe summer and winter weather has upon people and property

- Continue public education and awareness for severe weather.
- Continue enhancing and promoting warning systems.
- Encourage burying power lines or trimming trees to avoid downed power lines where possible.
- Increase public awareness of safety actions during severe weather.
- Examine potential shelter challenges in cases of prolonged electrical interruptions.

Goal 6: Mitigate the effects strong winds have upon people and property

- Promote the construction of safe rooms.
- Encourage wind engineering measures and construction techniques that protect against structural failure.
- Conduct outreach activities to increase awareness of tornado risk.
- Promote the use of weather warning systems.

Goal 7: Reduce impacts of drought and wildland fires on communities

- Develop a drought emergency plan
- Continue to monitor drought conditions and water supplies
- Support the Lake Agassiz Water Authority in their efforts to provide a high-quality water supply to the Red River Valley in times of drought
- Support local fire districts and include these entities in trainings and exercises
- Educate residents on water saving techniques
- Educate farmers on soil and water conservation practices
- Encourage farmers to utilize crop insurance

SECTION VI: MITIGATION STRATEGY

The prioritization of action items was driven by each city's leadership. They were instructed to consider the social, technical, administrative, political, legal, economic, and environmental factors that would determine the overall feasibility of alternative actions. Cities were encouraged to think through all of the hazards and potential projects that could improve the community's resiliency. In order to be as comprehensive as possible and not to circumscribe the range of actions, projects were listed even though it was readily apparent they were not feasible in the near-term. Those that were recognized as being realistic in the short-term and which would have an appreciable impact were designated as higher priorities. Flooding tended to be the hazard that had more of these higher prioritizations. This is not a surprise given the recent history of floods in Cass County.

A simple system was used to prioritize projects. Those deemed "high" address the most significant hazard(s) in a jurisdiction and therefore have the most potential for saving lives and property. It is surmised that these will score the best in the cost-benefit analysis used by FEMA for its grant programs. Projects that are in the "medium" category address the lesser probable hazards or protect fewer lives and properties. "Low" projects are those that may not have the best cost-benefit ratios or are those that deal with hazards that have a less probability of occurring or do not cause as much damage.

HAZARD PROFILE VARIABLE EXPLANATION

Each jurisdiction's hazard profile was compiled through an examination of factors known to either contribute to or reduce the risk exposure to the various natural hazards. The summary below provides an explanation on why and how those factors were evaluated.

Land Use and Growth Patterns

As a county that is growing in population, the areas in which new development is allowed to be built is a critically important set of policy decisions. Restricting building in flood-prone areas is an extremely cost-effective measure of prevention that would reduce the need for future infrastructure investments. In Cass County, building too close to streams and rivers is problematic in that riverbank erosion is not an uncommon occurrence.

The manner by which cities' footprints have expanded was looked at with the aim of determining whether adequate protections were put in place before development occurred, as well as the future plans for where development is prioritized.

If there were policy statements specific to appropriate locations, this was noted. Many of the smaller towns do not have explicit guidelines or plans for growth, since they do not experience the development pressures like the larger cities do.

Socio-Economic

The magnitude by which people are exposed to natural hazards and their ability to prepare for and respond to such events is mediated by their access to resources and their place in society. Extra attention was given to those segments of the population considered more vulnerable, where they predominately live, and what mitigation actions would fit their needs.

Households with incomes on the lower end of the spectrum are financially less capable of engaging in disaster preparedness or mitigation activities for themselves. Additionally, it is not an uncommon occurrence across the nation to find that lower-income households live the more vulnerable locations and occupy older buildings less able to withstand disasters. This is due mainly to the lower costs of living there which better fit the household's budget.

The elderly, defined hereafter as those 62 years or older, are more vulnerable due to a series of factors. First, the rate of physical impairments is higher among this segment of the population. This hinders their ability to quickly and safely evacuate by themselves during disasters. Relatedly, those who utilize a wheelchair may need a paratransit option provided for them in lieu of regular buses.

Nursing homes and related assisted living facilities typically contain those with very limited mobility and those with poor health. Evacuations of nursing homes are an extensive affair that can place undue stress upon residents. Measures to harden these facilities can ensure evacuations are less likely to be needed. This basic concept is applicable for other mobility-restricted groups such as jail inmates, children in daycares or schools, those staying at a homeless shelter, and those with complex health needs living in a group home facility.

Cass County has seen an increase in diversity over the years as immigrants have made it their home. This segment of the population can be considered more vulnerable due to an initial lack of familiarity with the hazards present in their new home as well as having a limited proficiency in English. Tailoring outreach regarding the natural hazards here to New Americans will aid in the process of acclimation.

Housing

Over the years, building codes have been amended and strengthen in response to disasters. In this plan, the age of the housing stock was used as a proxy measure to gauge how well it will withstand extreme weather events. This is not a perfect measurement, since it does not account for older houses which have been renovated and retrofitted to current standards. Nonetheless, it is a way to determine the overall condition of housing units and to pinpoint areas within cities that merit more attention.

While there may not be anything inherently more vulnerable about a multi-unit rental building vis a vis a single-unit house, the fact that the impetus for undertaking steps to mitigate the effects of disasters rests with the property owner and not the resident. Owners based elsewhere may not be as familiar with the hazards present in Cass County, thus necessitating the need to tailor outreach towards those companies. Also, renters tend to have higher rates of being cost-burdened, defined as having to spend more than a third of one's monthly income on housing costs, compared to those who own their home.

Mobile homes, also known as manufactured housing, are a vitally important source of affordable housing. However, these structures have notable shortcomings when it comes to its ability to withstand severe and damaging weather events. This is particularly the case when it comes to mobile home units constructed before the adoption of the more stringent wind design criteria, those set upon unreinforced piers, and those with inadequate anchoring. Additionally, a lack of a basement or sturdy interior room means residents cannot adequately secure shelter during tornados.

Emergency Services

Maintaining the operation of emergency response services – defined herein to include law enforcement, ambulance, and fire – is vital during disasters. For this plan, the facilities of these departments were looked at to find if there were any excessive exposure to the hazards which would impact their ability to deliver services. For example, if a fire hall was located within the mapped floodplain, this would indicate that mitigation measures should be explored and implemented. In the rural portions of the county, staffing is a common concern. The rural fire districts are typically volunteer-run and thus required a notable commitment of time from local residents.

Health Care

Health care providers, particularly their trauma units, play an important role in disaster response. Therefore, the capability of those facilities to maintain operations during major and disruptive events was looked at. Essentia Health and Sanford Health are the two major health care providers in Cass County. The Veteran's Administration hospital provides care but does not have a trauma center. Significant preparations have been made by these entities when it comes to disasters.

Those living in the outlying communities and rural areas are further away from the hospitals, all of which are located in Fargo. The time it takes for EMS services to arrive at a location and then travel to a hospital is higher for those areas. This increases the probability of an undesired outcome.

Critical Facilities and Infrastructure

Ideally publicly-owned and operated facilities and infrastructure will remain operational during disasters to the greatest extent possible. Those that are exposed to the hazards which would reduce or eliminate their functionality were closely examined for this plan. The condition of the infrastructure and its capacity to accommodate the increased demands associated with disasters was also taken into consideration.

An installed underground stormwater drainage system is found in the more developed communities, otherwise ditches and culverts are utilized. City leaders were asked if they had issues with their systems in instances of both riverine flooding and flash flooding. The adequacy of the water supply and distribution systems were assessed in order to determine a city's ability to withstand drought conditions.

In Cass County, electricity is provided by either Xcel Energy or by Cass County Electric Cooperative. Both entities were contacted for this plan. While numerous mitigation steps have been taken over the years – principally in response to flooding – additional mitigation measures underway include burying overhead powerlines, upgrading to more waterproof transformers, continuing an active tree pruning program.

Elements of the transportation network examined for this plan are municipal roads, highways, rail, and public transit. Special attention was paid to those areas where flooding would inundate roads and cut off access. The streets in small towns are often unpaved, which are more prone to being washed-out compared to paved streets.

According to the railroad companies who own and operate lines in Cass County – BNSF and Red River Valley and Western – flooding is the hazard that is of most concern given that bridges are exposed to high water levels and the debris that comes with. Hardening bridges and doing preventative debris clearance along rivers are viable actions that would reduce the risk greatly.

MATBUS is the public transit provider for Fargo and West Fargo. During emergencies the buses, including those that are handicap-accessible, can be utilized for evacuations. According to MATBUS staff, the central garage for where the fleet is stored and undergoes maintenance is well protected from flash flooding. When the Red River reaches a high stage, the buses can be moved towards higher ground.

Buildings spread throughout the county have been designated as potential emergency shelters and operation centers by the county emergency management department. These are often community centers, schools, and fire halls. It was noted whether these buildings were in good condition, were located outside of the floodplain, and had backup power generators. For those cities with designated shelters, city leaders were asked what can be done to better protect and harden said buildings. For those without identified shelters, they were asked what existing buildings could serve that purpose or if a shelter needs to be built.

Businesses and Employers

Destroyed manufacturing plants or offices, inaccessible logistical routes, and employees who must deal with the disruptions in their personal lives all contribute to an economic disruption that makes the recovery process much more challenging. In this plan, attention was paid to those economic sectors that are more vulnerable. Agriculture is a large component of Cass County's economy. Crops are damaged by hail, tornados, high wind, flooding, and drought. Agricultural producers would not be the only ones economically harmed. Businesses in rural towns that serve farmers are affected, not to mention the retail and restaurants that will see decreased patronage.

Cass County has a few large employers listed here in declining order: Sanford Health, North Dakota State University, Noridian Mutual Insurance Company, Essentia Health, US Bank, Microsoft, and Integrity Windows. When possible, these entities were contacted to find out if they experience any vulnerabilities. Not surprisingly, flooding was a top concern. There are few seemingly feasible and cost effective options to floodproof their facilities. Rather, city-wide flood protection measures are seen as more effective.

1. Cass County

Areas outside of incorporated cities face their own vulnerabilities to hazards and capacities to prepare and respond. The following list has projects for those areas as well as projects that are best done for across county as a whole.

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

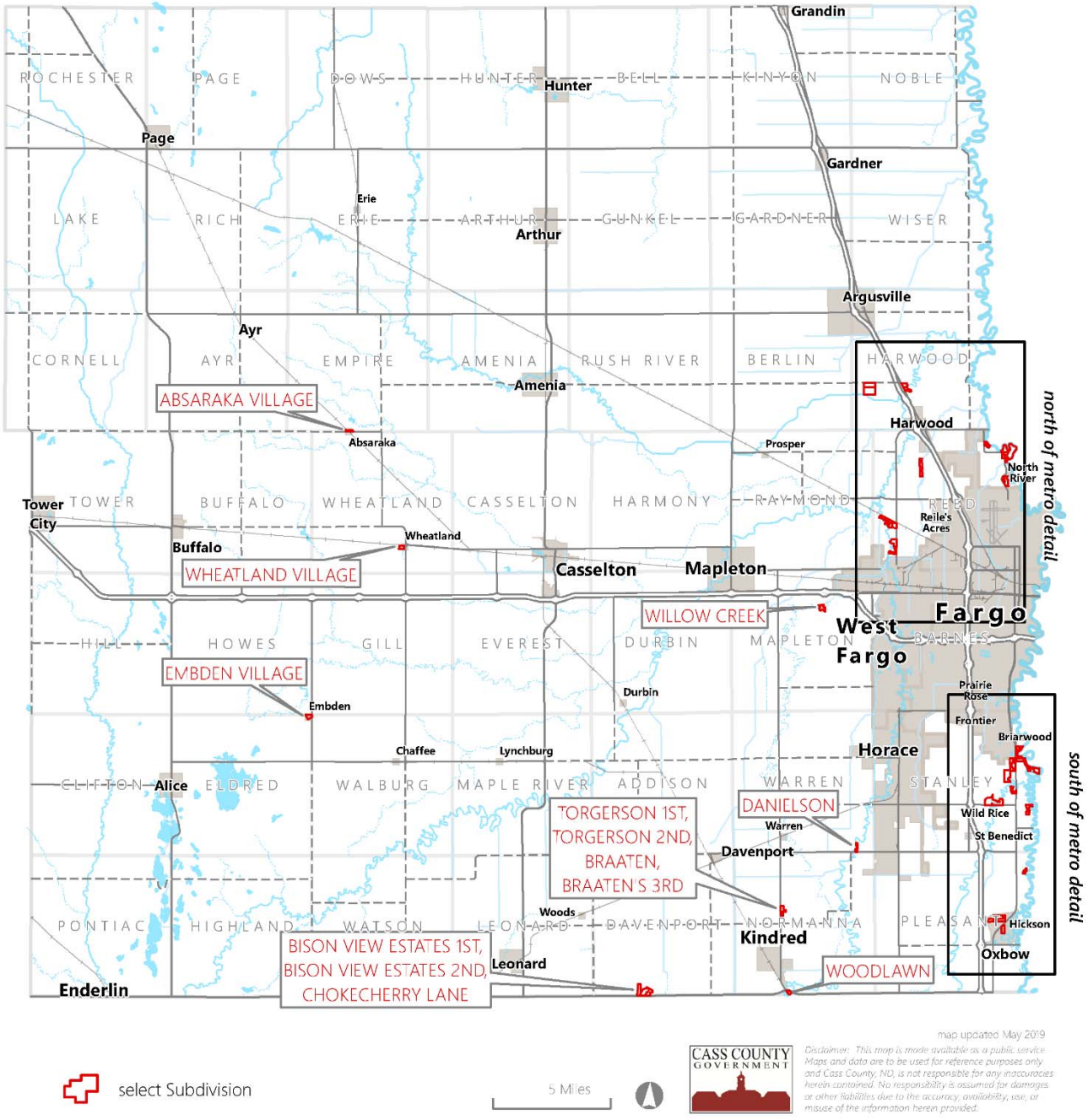
Most of unincorporated Cass County consists of farmland, although several residential subdivisions – some of which are Census Designated Places (CDP) - are found throughout. These subdivisions, their flooding vulnerabilities according to the current FEMA floodplain maps, the year they were platted, and whether they are within the extraterritorial of a city are listed below. Farmsteads and lone houses are not included in this table. Adjacent subdivisions that are clustered are listed together in the table.

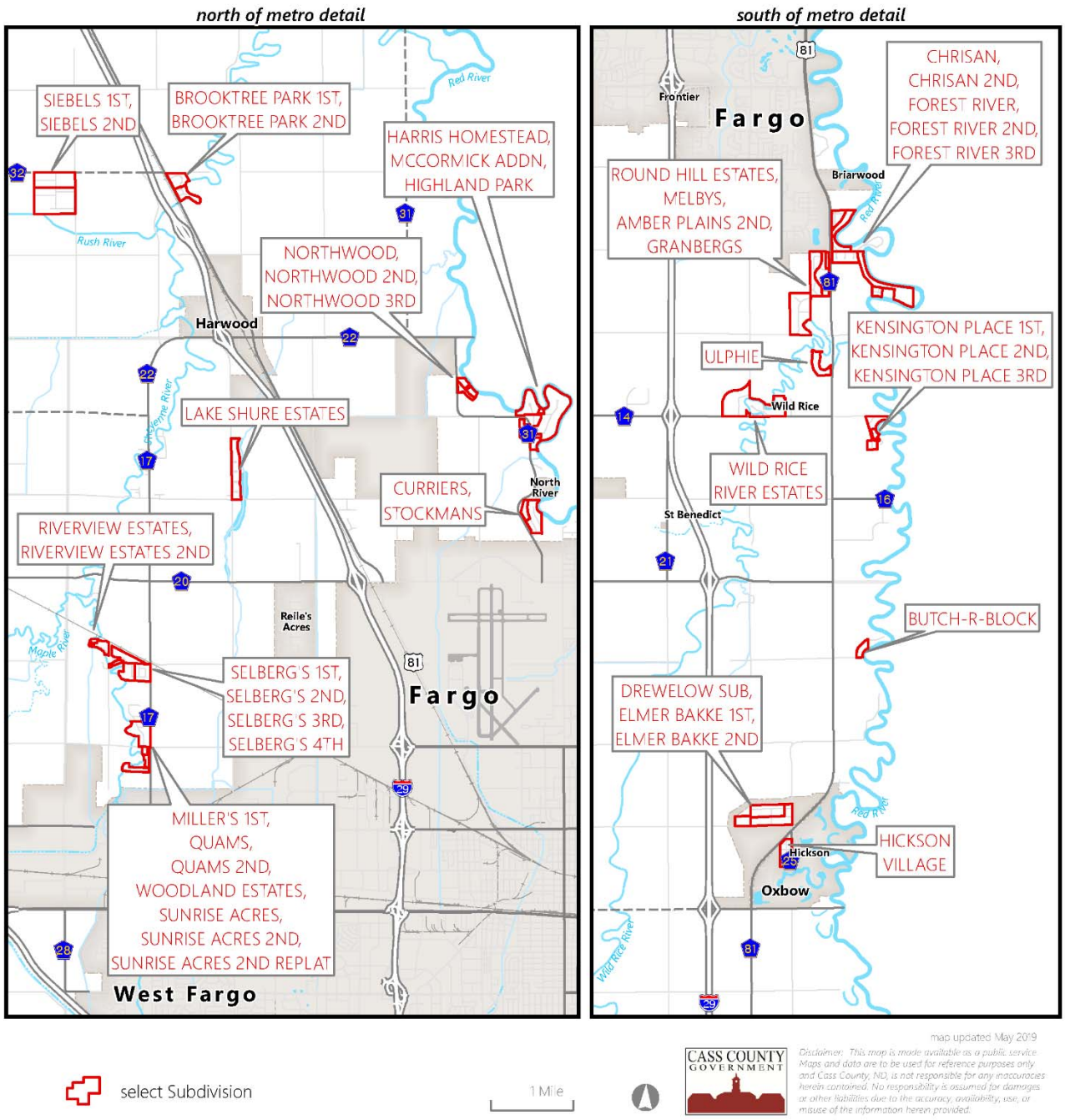
Table 5.1 Vulnerabilities of Rural Residential Subdivisions

Subdivision	Year Platted	Within ET Zone	Flooding Vulnerabilities
Millers 1st Quams 1st and 2nd Woodlawn Estates Sunrise Acres 1st and 2nd	1978 1961 and 1994 2006 1977 and 1992	✓	500-year = 36 homes 100-year = 6 homes Elevated above floodplain = 8 homes
Drewelow Elmber Bakke 1st and 2nd	1994 1975 and 1977	✓	500-year = 27 homes 100-year = 31 homes Elevated above floodplain = 0 homes
Danielson	2004		500-year = 0 homes 100-year = 5 homes Elevated above floodplain = 0 homes
Hickson	1883	✓	500-year = 15 homes 100-year = 1 home Elevated above floodplain = community center
Braaten 1st and 3rd Torgerson 1st and 2nd	1975 and 1996 2006 and 2008		Not located within mapped flood zone
Bison View Estates 1st and 2nd Choke Cherry Lane Woodlawn	2006 2007 1975		500-year = 0 homes 100-year = 25 homes Elevated above floodplain = 0 homes
Embden (CDP)			Not mapped but near dam and Buffalo Creek. Approximately 30 houses, several business, and public hall are in the community.
Butch-R-Block	1977		Within floodway = 1 home Elevated out of floodplain = 4 homes 4 homes have been removed
Siebels 1st and 2nd	1977		500-year = 8 homes

			100-year = 15 homes Elevated above floodplain = 0 homes
Riverview Estates 1st and 2nd Selbergs 1st-4th	1973 and 2017 1962-2009	✓	500-year = 18 homes 100-year = 12 homes Elevated above floodplain = 11 homes Within floodway = 3
Willow Creek	1975	✓	500-year = 0 homes 100-year = 10 homes
Wheatland (CDP)	1879-2004		Unmapped by FEMA
Melby's Amber Plains 2nd Granbergs	1962 1996 1975	✓	500-year = 55 homes 100-year = 20 homes
Chrisan 1st and 2nd	1960 and 1969	✓	500-year = 4 homes 100-year = 1 home 16 homes have been removed
Forest River 1st-3rd	1960-1974	✓	500-year = 22 homes 100-year = 6 homes 30 homes have been removed
Round Hill Estates	1975	✓	500-year = 17 homes
Ulphie	1983	✓	500-year = 14 homes 100-year = 1 home
Wild Rice River Estates	1993	✓	500-year = 3 homes Elevated above floodplain = 6 homes
Kensington Place 1st-3rd	1993-1996	✓	500-year = 8 homes 100-year = 0 homes Elevated above floodplain = 6 homes 5 homes have been removed
Absaraka (CDP)			Not in a mapped floodplain but near dam and Swan Creek. Approximately 12 homes and grain elevator are in the community.
Stockmans Curriers	1961 1978	✓	500-year = 20 homes 100-year = 2 homes
Highland Park Harris Homestead McCormick Addition	1989 1978 2000	✓	500-year = 92 homes 100-year = 5 homes Elevated above floodplain = 2 Removed structures = 2 homes
Northwood 1st – 3rd	1964-1977	✓	500-year = 4 homes 100-year = 10 homes Removed structures = 6 homes
Lake Shure Estates	1975		500-year = 11 homes 100-year = 14 homes Elevated above floodplain = 2 homes
Brooktree Park (CDP)	1962 – 1966		100-year = 26 homes

Figure 5.1 Location of Rural Subdivisions





As seen in the table and maps above, several rural residential subdivisions are exposed to a high risk of flooding as these were built near or adjacent to the river for its scenic beauty and amenities. Since these are outside of a municipality, the lead entity for hazard mitigation will be the county. The Cass County Planning Department is the office that leads the implementation of the subdivision ordinance, of which addresses development in areas of higher flood risk.

These rural areas may also be outside the audible range of warning sirens. Although it should be noted technology nowadays allows for prompt notification of incoming storms through one's cell phone. Maintaining road access is key for these subdivisions, in that they often do not have the same redundant road network which permits alternative routes to and from one's home. Finally, since they may not be connected to a city's storm drain system the potential for internal localized flooding is higher. Many of these homes are serviced by private water wells, which is the responsibility of the homeowner to maintain.

Socio-Economic

Data specific for residents living outside of incorporated jurisdictions are not available, aside from Census Designated Places. Therefore, only the four CDPs (i.e. Embden, Erie, Wheatland, and Brooktree Park) will be profiled here. The median age for these places is slightly above the County average, ranging from 35 to 45 years old. Income data and poverty rates are not available due to the small sample size. Additionally, the residents living there are principally of Caucasian origin.

Transportation

The Cass County Highway Department is responsible for the planning, design, construction, and maintenance of highways and bridges. The County's highway system consists of 634 miles of roadway covering more than 1,700 square miles as well as 541 bridges of which 240 span a distance of 20 feet in length or greater. Bridges are designed to the 5-year storm standard.

The county's road network does have vulnerabilities, primarily when it comes to flooding. Gravel roads may be washed out by heavy storms or by overland flooding. Additionally, several residential subdivisions can become blocked off by floodwaters. For example, Lake Shure Estates had this problem until a new elevated bridge structure was built. Roads close to riverbanks or streams are at risk of erosion.

Health Care

Health care facilities are found throughout the county within towns. Therefore, the vulnerabilities of those facilities are addressed in each city's section. Cass County and the City of Fargo jointly operate Fargo Cass Public Health, an entity that provides to all residents a range of services including clinical care; administer the Women, Infants and Children (WIC) nutrition program; enforcement of environmental health regulations, substance abuse prevention, response to public health emergencies, and operates a shelter and drop-in center for homeless individuals. Fargo Cass Public Health's building is located at the intersection of 25th St S and 13th Ave S in Fargo. The building is situated within the 500-year floodplain. The homeless shelter (Gladys Ray Shelter and Veteran's Drop-In Center) is too located within the 500-year floodplain.

While not a nonprofit per se but rather a governmental agency, Cass County Social Services administers child protective services, economic assistance programs, and services for adults. It is located inside the annex building attached to the Courthouse. This building is located within the 500-year floodplain.

Critical Facilities and Infrastructure

The Courthouse functions as the central administrative building for the county containing various departmental offices and the courtrooms themselves. It is an historic building that has undergone expansions and renovations over the years. It is located within the currently mapped 500-year floodplain. Other department offices are housed at the Highway Department building on Main Avenue in West Fargo. It is protected via the Sheyenne River Diversion.

The county jail is located within a primarily industrial area of Fargo. As a type of facility with a population that is extremely difficult to evacuate in emergencies, attention can be paid towards how to harden these facilities appropriately. The jail is located adjacent to a drain and is mostly within the 500-year floodplain.

In the state of North Dakota, water resource districts are the local entity that oversees field drainage, flood control structures and improvements, and manages water in rural areas. Cass County has four such organizations: Maple River, North Cass, Rush River, and Southeast Cass. The four coordinate on issues under the Cass County Joint Water Resource District. Wider river basin issues are addressed under the Red River Joint Water Resource District.

Several vulnerabilities that exacerbate flooding were identified by the water resource districts. The capacity of several drain channels has been found to be inadequate in handling the increasing amount of precipitation. Debris on rivers have built up over time causing flow to be hindered and backups to occur.

The Red River Regional Dispatch Center is the public safety and dispatch service for not only Cass County but also Clay County in Minnesota. It is located on NP Avenue in downtown Fargo and is within the 500-year floodplain.

Businesses and Employers

Outside the boundaries of local jurisdictions, the major economic activity is farming. According to the 2017 Census of Agriculture, 784 farms produced around $440 million of agricultural products. Agriculture is highly susceptible to drought, floods, and severe weather. Crop insurance can mitigate to a point the risk inherent in operating a farm.

Dam Failure	As mentioned, there are five dams deemed high hazard. If those were to fail, structures in cities and rural areas will be inundated. Most dams are in the low hazard class, meaning only crop or pastureland would be affected.
Drought	Drought can have a severe effect upon the agricultural sector by reducing yields significantly. Since Cass County historically has received enough moisture from snow melt and summer rains, only 32 farms in 2017 were irrigated. That means most farms will not be able to readily draw upon a secondary source of water in times of drought. The rural areas of the county are served either by Cass Rural Water Users District or by wells specific to the property. Representatives from the former indicated no major concern with the adequacy of the water supply. Drought is self-regulating to a certain extent given that most of the summer demand is through crop spraying. After years of crop failures, farmers will pull back their planting and therefore their water usage. The St. Benedict "A" well taps the West Fargo South Aquifer, the Phase 2 plant "E" well the Sheyenne Delta Aquifer, the Phase 3 plant "K" well south of Page the Page Aquifer, and approximately 30% is purchased from the City of Fargo.
Flooding	Recently the county has been in a wetter-than-normal climatic cycle. Overland flooding has resulted leading to delayed planting and reduced yields.
Geological Hazards	Roads near rivers and streams may be susceptible to erosion, creating the need for relocation of those roads. The planning department enforces a setback ordinance to prevent structures from being built too closely to rivers.
Severe Summer Weather	Hail, tornados, straight-line winds, and excessive rain can easily damage crops. Census data shows that rural areas tend to be of higher income compared with the metropolitan area proper. Concurrently, the poverty rates are lower. However, the housing stock is on the older side. These households will have the means to strengthen their homes against disaster, but the amount of work needed to do so may be higher. There are no mobile home parks in rural Cass County, although there may be individual mobile homes scattered throughout. Cass County leases and operates a park at Brewer Lake by Erie. Facilities include sites for campers, tents, restrooms with showers, a swimming area and boat ramp. There is no separate storm shelter built to FEMA standards at this park. Cass County is recognized as a StormReady community by the National Oceanic and Atmospheric Association.
Severe Winter Weather	High wind is common during winter, easily leading to white-out conditions that make driving dangerous. Census data shows that rural areas tend to be of higher income compared with the metropolitan area proper. Concurrently, the poverty rates are lower. However, the housing stock is on the older side. These households will have the means to strengthen their homes against disaster, but the amount of work needed to do so may be higher. There are no mobile home parks in

	rural Cass County, although there may be individual mobile homes scattered throughout. Cass County is recognized as a StormReady community by the National Oceanic and Atmospheric Association.
Urban Fire	Building fires are limited towards single structures in rural Cass County.
Wildfire	Grassfires are possible, particularly in times of drought when the ground vegetation is devoid of moisture. During droughts, burn bans are issued by the County. Wildfires affect namely farm fields and grasslands. Structures can be at risk if the wildfire spreads rapidly as the result of high winds and if responding firefighters are unable to adequately contain the growing blaze. Historically however, this has not been a significant concern recently. Prolonged and severe drought could exacerbate the conditions that contribute to wildfires.

PROGRESS SINCE LAST PLAN

Discrete items identified in the 2014 plan which have been completed are the following:

- Floodwater detention improvements at the Upper Maple River Dam
- Grade raising of 57th Street South along with upgrades to culverts
- Enhancing water management in Pontiac Township

Ongoing efforts that remain relevant since the previous plan are:

- The acquisition of floodprone properties have continued, albeit at a reduced number due to immense amount of work that had already occurred by the time the last plan was adopted. In total, since the 2009 flood the City of Fargo has bought out 222 homes for a total of $81.5 million. Cass County has spent $51.3 million to purchase 193 homes. The Diversion Authority have acquired 73 homes worth $55.3 million and 6 businesses for about $15.9 million throughout the county. More buyouts, separate from the diversion project, are in the works. On those properties, local jurisdictions have been able to build out the levee and floodwall protection system, not to mention provide space for habitat and recreational opportunities.
- For the Red River Valley Water Supply Project, the state has begun appropriation money towards the design and initial construction to the tune of $30 million for the 2017-2019 biennium. State funding is one component of this project with federal and local dollars involved as well.
- Encouraging homeowners to take protective measures that will prevent floodwater from entering their homes.
- Bridges are to be elevated and better protected against flooding when due for replacement.
- Pursuing permanent protection for a 100-year level flood from the Red River.

MITIGATION ACTIONS

Mitigation Action	**1] Assist cities and townships with the process of entering the Community Rating System program**
Hazards Addressed	Flooding
Responsible Agency	Individual cities and townships, Cass County Emergency Management department, and Cass County Planning department
Cost	To be determined
Description	Smaller communities may be interested in participating in the CRS for the mitigation and cost savings benefits, but they may not have the resources or knowledge on where to begin. The County can offer assistance or connect cities with entities that can. Ongoing administration CRS beyond that of the Class 9 or 8 level may or may not be beyond the capabilities of small jurisdictions. However, entering into the program at those levels will allow residents to take advantage of a small price discount on their flood insurance premiums. A cost-benefit analysis comparing the staff time necessary to enroll in the program with the cost saving s to property owners will help jurisdictions determine whether to participate or not.
Potential Funding Sources	Cass County
Timeline	Ongoing over the next five years
Priority	Medium

Mitigation Action	**2] Engage in public education efforts that will increase awareness of natural hazards and the steps people can take to mitigate their own risks.**
Hazards Addressed	All hazards
Responsible Agency	Cass County and each city
Cost	To be determined based on the communication methods
Description	There are many actions that are solely within the purview of property owners. The best role for government in those situations would be to share ideas and provide assistance, as appropriate, to as many people as possible as they carry out their own mitigation-related efforts. Examples of relevant topics include best practices for living adjacent to the river, the necessity of purchasing flood insurance, and the benefits of retrofitting structures adequately to withstand floods and storms. Method of outreach can include social media, in-person workshops, or mailing literature, to name a few examples.
Potential Funding Sources	County and city funding combined with any grant funding that will allow for more people to be reached.
Timeline	Ongoing over the next five years
Priority	Low

Mitigation Action	**3] Build permanent levy structures**
Hazards Addressed	Flooding
Responsible Agency	Cass County Government
Cost	$10.5 million

Description	The County will continue to build out the levee system.
Potential Funding Sources	FEMA (PDM), North Dakota (State Water Commission), and County (Flood Sales Tax)
Timeline	Ongoing over next five years
Priority	High

Mitigation Action	**4] Build ring dike around Sheldon Subdivision**
Hazards Addressed	Flooding
Responsible Agency	Cass County Joint Water Resource District
Cost	$650,000
Description	The Sheldon Subdivision, comprised of 14 homes, is located between West Fargo and Mapleton on County Road 10. It is at risk of overland flooding being located between the Maple River and a tributary of the Sheyenne River.
Potential Funding Sources	FEMA (PDM), North Dakota (State Water Commission), and County (Flood Sales Tax)
Timeline	Within 5 years
Priority	Medium

Mitigation Action	**5] Construct dry impoundments in Minnie Lake Township and Ellsbury Township (Barnes County)**
Hazards Addressed	Flooding
Responsible Agency	Cass County Joint Water Resource District
Cost	$25,000,000
Description	The first project will consist of an impoundment pond with an embankment approximately 2.3 miles long with a base varying between 20 and 185 feet wide, an 8 foot wide top, 3:1 side slopes. A dam will be embedded within the levee to release water as needed. An emergency spillway will consist of two concrete spillway drop structures. A levee will be constructed around two farmsteads. This project will reduce peak flows of a 100-year, 24-hour rain event by approximately 30% in areas downstream of impoundment. The second project will consist of a dry impoundment pond that will reduce peak flows of a 100-year, 24-hour rainfall event by approximately 26% in downstream areas. The embankment will be around 3.4 miles long with a base that varies between 20 and 175 feet wide, an 8 foot wide top, and 3:1 side slopes. The emergency spill way will consist of two concrete spillway drop structures. A levee approximately 1 mile northwest will be built to protect farmland from overland flooding.
Potential Funding Sources	FEMA (PDM), North Dakota (State Water Commission), and County (Flood Sales Tax)
Timeline	Within 5 years
Priority	Medium

Mitigation Action	**6] Increase greenway buffer zone**
Hazards Addressed	Flooding, foundation failures, riverbank slumping, erosion
Responsible Agency	Cass County
Cost	$4 million
Description	Ensuring that development remains an adequate distance from rivers and streams will remedy most of the problems associated with erosion as well as prevent building in the most flood prone areas. Over the years, properties

	that were bought out had structures removed or relocated and were turned into restored habitats and park facilities.
Potential Funding Sources	FEMA (PDM, FMA), County (Flood Sales Tax)
Timeline	Short term (1-5 years)
Priority	Low

Mitigation Action	**7] Increase protective measures for residences**
Hazards Addressed	Flooding, specifically sewer backup into homes
Responsible Agency	Cass County
Cost	To be determined based on outreach methods
Description	Homeowners can take preventative measures to stop stormwater and sewage from entering their basements. This can include plugging or capping all sewer openings (e.g. floor drains, toilets, sinks, showers, etc.). Homeowners need to be educated about the proper ways of preventing backups.
Potential Funding Sources	County
Timeline	Ongoing over the next five years
Priority	Medium

Mitigation Action	**8] Acquisition of flood-prone properties**
Hazards Addressed	Flooding
Responsible Agency	Cass County Government
Cost	$3 million
Description	Continuing acquiring identified flood-prone properties will remove high-risk structures as well, help restore the width of the natural floodplain, as well as provide space for habitat restoration and recreational amenities.
Potential Funding Sources	FEMA (PDM, FMA, HMGP), Cass County (Flood Sales Tax)
Timeline	Short Term (1-5 years)
Priority	Medium

Mitigation Action	**9] Create permanent access in and out of flood-prone areas**
Hazards Addressed	Flooding
Responsible Agency	Cass County Highway Department
Cost	$2 million
Description	Low-lying roads can easily become impassible during flood events. Access for first responders is hindered in these scenarios.
Potential Funding Sources	FEMA (PDM, FMA, HMGP) with local match including Cass County's flood sales tax.
Timeline	Short term (1-5 years)
Priority	High

Mitigation Action	**10] Road washout mitigation**
Hazards Addressed	Flooding
Responsible Agency	Cass County Highway Department
Cost	$2 million
Description	Roads that are submerged by floodwaters can have the roadbed eroded away by the movement of water. Roadbeds and banks can be reinforced to

	better prepare for flood events.
Potential Funding Sources	FEMA (PDM, FMA, HMGP) with local match including Cass County's flood sales tax.
Timeline	Short term (1-5 years)
Priority	High

Mitigation Action	**11] Retention projects that support the Red River Basin Commission (RRBC) goals for flood protection**
Hazards Addressed	Flooding
Responsible Agency	Cass County
Cost	$150 million
Description	The RRBC has identified the following projects in its *Long Term Flood Solutions for the Red River Basin* document from September 2011: • Complement current levee system with upstream retention. • In partnership with NRCS and water resource districts, implement demonstration projects to analyze the benefits of small distributed and culvert-sizing retention. • With cooperation of NRCS and RRRA, draw down wetlands in the autumn to enable spring storage. • Refurbish flood control dams to provide additional storage capacity. Reach out to property owners to gauge interest in storing water on their land.
Potential Funding Sources	FEMA (PDM, FMA, HMGP), Cass County (Flood Sales Tax)
Timeline	Long term (beyond 5 years)
Priority	Low

Mitigation Action	**12] Elevate bridge structures**
Hazards Addressed	Flooding
Responsible Agency	Cass County Government
Cost	$3 million
Description	Elevating bridges will ensure they remain open during floods for responders and emergency responders, as well as preventing the need for post-disaster reconstruction. This is an ongoing process as bridges are slated to be replaced.
Potential Funding Sources	FEMA (PDM, FMA, HMGP) with local match
Timeline	Long term (beyond 5 years)
Priority	Low

Mitigation Action	**13] Protection of bridge structures**
Hazards Addressed	Flooding
Responsible Agency	Cass County and Water Resource Districts
Cost	$600,000
Description	Bridges are vulnerable to damage caused by debris and ice carried by floodwaters. This can backup, thus exacerbating flooding. Water Resource Districts receive state funding for tree log clearance measures.
Potential Funding Sources	State through legislative appropriation
Timeline	Ongoing over the next five years

Priority	Medium

Mitigation Action	**14] Secure permanent and long-term alternate source of water**
Hazards Addressed	Drought
Responsible Agency	Lake Agassiz Water Authority (LAWA) and Garrison Diversion Conservancy District (GDCD)
Cost	$1.1 billion
Description	The selected option for constructing an alternate source of water is the Red River Valley Water Supply Project. This will entail bringing water from the Missouri River over to the Red River Valley via 165 miles of transmission lines. 20 cities and 15 rural water systems have signed on to the project, which would serve approximately 50% of the state's population in times of severe drought. It will be jointly owned by LAWA and GDCD and operated by the latter.
Potential Funding Sources	State Water Commission appropriations
Timeline	Anticipated construction timeline of 8 to 10 years
Priority	High

Mitigation Action	**15] Property acquisitions in landslide prone areas**
Hazards Addressed	Geologic hazard (landslide)
Responsible Agency	Cass County
Cost	$2 million
Description	Buying out properties along rivers and streams susceptible to erosion will reduce environmental disturbance and prevent future damage and injury.
Potential Funding Sources	FEMA (FMA and HMGP), Cass County (Flood Sales Tax)
Timeline	2-4 years
Priority	High

Mitigation Action	**16] Realign roads at risk from slumping**
Hazards Addressed	Geologic Hazard (landslide)
Responsible Agency	Cass County
Cost	$4 million
Description	The realignment of roads away from rivers and streambanks will prevent damage from happening and ensure they remain operational.
Potential Funding Sources	Local funds
Timeline	2-4 years
Priority	Medium

Mitigation Action	**17] Snag and clear rivers**
Hazards Addressed	Flooding
Responsible Agency	Water Resource Districts
Cost	$3,110,000
Description	Snagging and clearing rivers and their banks is a method to reduce the frequency and duration of flooding. It entails the removal of fallen trees and other organic debris in order to improve flow and prevent backup. Standing trees should remain, except those whose roots are exposed due to erosion and are at-risk of falling in.

Potential Funding Sources	State Water Commission, Cass County (flood sales tax)
Timeline	Ongoing over next 5 years
Priority	Medium

Mitigation Action	**18] Drain channel improvements throughout the county**
Hazards Addressed	Flooding
Responsible Agency	Water Resource Districts
Cost	$12,150,000
Description	Various drain channels can be improved to provide additional conveyance capacity and correct ongoing issues with slope stability and erosion. The projects per responsible water resource districts are as follows: *Maple River Water Resource District* • Drain 46 • MR-2 • MR-1 • Buffalo-Lynchburg (phase 2) *North Cass Water Resource District* • Drain 18 (NC-1) including outlet reach improvement and bridge upgrades • Drain 26 • Drain 31 (NC-1) *Rush River Water Resource District* • Drains 2 and 12 (Lower Rush and Rush Rivers) *Southeast Water Resource District* • Drain 40 • Drain 53
Potential Funding Sources	ND State Water Commission and Cass County Flood Sales Tax
Timeline	5 years
Priority	Medium

Mitigation Action	**19] Review model zoning ordinance offered to townships and adjust as needed to reflect best practices in the avoidance of development in risky areas.**
Hazards Addressed	Flooding
Responsible Agency	Cass County Planner
Cost	Staff time built within annual appropriation to planning department
Description	The exposure of people and structures to hazards can easily be prevented through proper land use planning and regulations. With flooding, development in the mapped floodplains can be prevented or at least held to a higher standard that incorporates measures such as floodproofing, building higher than the base flood elevation, prohibiting critical facilities from being sited in the 100 or 500 year flood plain, or allowing cluster pattern of development to permit flexibility in layout of subdivisions. Development can be limited in dam failure inundation zones.

	North Dakota law allows townships to enact and administer their own zoning ordinance, unless they decide to grant that authority to the county. Township officers are volunteer positions and they may lack expertise in land use planning. Assistance to townships by reviewing their ordinances and offering suggestions can go a long way towards strengthening the regulatory regime.
Potential Funding Sources	Staff time contributed by Cass County Planner
Timeline	Short term (1-2 years)
Priority	Medium

Mitigation Action	**20] Develop regulations preventing development from occurring in areas prone to soil stability problems, preventing land uses accelerating the inherent problem, and protecting the riverfront vegetation that helps stabilize soils.**
Hazards Addressed	Geological hazards
Responsible Agency	Cass County planner, townships, and cities
Cost	To be determined
Description	The county, each city, and each township should examine its subdivision and/or zoning ordinances to ensure they are stringent enough to prevent or limit development in areas at risk to erosion and stability problems. Examples of options include establishing setbacks, requiring soil studies for intensive uses, or requiring vegetated buffers.
Potential Funding Sources	Can be completed within budgeted staff time
Timeline	Short term (1-2 years)
Priority	Low

Mitigation Action	**21] Consider the cost and benefits of the County participating in the National Fire Protection Association's Firewise USA program.**
Hazards Addressed	Wildfire
Responsible Agency	Cass Fargo Emergency Management as lead agency with assistance from fire departments and the North Dakota Forest Service
Cost	Minimal expenditures and staff time
Description	This program is an effort to reduce the damage caused by wildfires through the completion of a dedicated risk assessment by the state's forestry service and local fire departments. A local committee will then prepare and implement a plan that relies heavily upon property owners voluntarily implementing risk reduction actions. These can include the choosing of appropriate landscaping methods, thinning overgrown vegetation, creating spatial barriers, and selecting ignition-resistance building materials. An annual review by the committee will ensure continued improvement and participation in the program.
Potential Funding Sources	Can be completed within budgeted staff time
Timeline	Short term (1-2 years)
Priority	Low

Mitigation Action	**22] Conduct repairs to the principal spillways at the Elm River and Maple River dams and upgrade spillway capacity at Swan Buffalo Detention Dam.**
Hazards Addressed	Dam failure

Responsible Agency	North Cass Water Resource District and Cass County Joint Water Resource District
Cost	To be determined
Description	The spillway outlet pipes at the first two dams have deteriorated and will need repairs in the future. The spillway capacity at the Swan Buffalo Detention Dam's spillway capacity met the standards at the time of construction. However, upgrading it to meet modern standards will ensure it can function during severe precipitation events that are more common nowadays.
Potential Funding Sources	North Dakota State Water Commission with local funding match
Timeline	3-5 years
Priority	Low

2. Alice

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Alice is a very small community consisting of single-family homes and a seed storage operation with several bins. New construction is not a common occurrence.

Socio-Economic

A little more than a quarter of the population (27.5%) is older than 62 years and the median age is 45.5 years, which is on higher end for Cass County communities. The median household income is $38,750, which is lower than the county as a whole. Best practices indicate those individuals should be given extra attention in all phases of emergency management. In mitigation, this may mean assistance to help retrofit their residences to withstand hazards.

Housing

The housing stock is chiefly detached single-family. It is estimated that approximately 80% of the houses are older than 1950, indicating they may not be up to the latest building codes and disaster safety features.

Emergency Services

Alice is home to the Alice Rural Fire District's two-stall fire station. The station is a standard steel structure. Around 25 people are signed up as volunteers. Ambulance services are covered by the Buffalo Area Quick Response Unit based out of Buffalo.

Health Care

Alice does not have a health care or nonprofit facilities. The nearest hospital is in Valley City.

Critical Facilities and Infrastructure

Alice is served by Cass Rural Water Users District. The city does not have an installed storm sewer system.

Businesses and Employers

The notable employer is the seed dealership. Alice is a farm community and is therefore susceptible to the impacts flooding and drought can have upon the farming economy.

Natural Hazards

Dam Failure	Alice has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said water supplies are adequate. Its businesses are in agriculture, which is highly vulnerable to drought.
Flooding	The City does not have a designated flood risk given that it remains unmapped. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations.

Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Alice faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town. In 2009, a storm bearing straight-line winds hit the town causing damage.
Severe Winter Weather	Alice faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The seed storage business presents the highest fire risk of any building in town.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

The population of Alice is very small, sitting at approximately 40 people. They do not have the personnel nor financial resources to execute significant mitigation projects by themselves. They turn to the County, State, and other agencies for assistance. Alice Rural Fire District has its fire hall in Alice.

The City does not have a contracted engineer who can act as project lead. There is no adopted building code nor zoning ordinance.

PROGRESS SINCE LAST PLAN

The only item in the last plan was the installation of warning sirens. This has not been accomplished since then and remains an action item for this plan.

MITIGATION PROJECTS

Mitigation Action	**1] Installation of warning sirens**
Hazards Addressed	Severe weather
Responsible Agency	City of Alice and Red River Regional Dispatch
Cost	$50,000
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-2 years depending on funding availability
Priority	Medium

Mitigation Action	**2] Install emergency generator at fire hall**
Hazards Addressed	All hazards
Responsible Agency	Alice Rural Fire District
Cost	To be determined
Description	The fire hall is in good shape and can serve as an emergency shelter or staging point for disaster response. A generator for backup power will allow it to remain operation in case a storm disrupts power.
Potential Funding Sources	FEMA (PDM and HMGP) with local match

Timeline	2-3 years depending on funding availability
Priority	Low

Mitigation Action	**3] Procure weather radios for residents and the fire hall**
Hazards Addressed	Severe summer weather
Responsible Agency	City of Alice
Cost	To be determined
Description	NOAA weather radios are a valuable tool to warn residents of an incoming severe storm or tornado. Procuring these and offering to residents will ensure everyone is made aware and seek appropriate shelter.
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	2-3 years depending on funding availability
Priority	Low

3. Amenia

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Amenia consists mostly of single-family houses and a few businesses including a grain elevator. New development is rare.

Socio-Economic

Amenia is a very small town, sitting at approximately 100 residents. This has remain roughly constant over the years. However, the median age has been increasing. In 2011 it was 34.8 years; in 2017, 55.5 years. The median household income is relatively high at $76,375 in 2017. The mean household income ($67,202), which is typically higher than the median, is actually lower than the median household income. This may be a statistical artifact resulting from the inevitable small sample size given the population.

Housing

The housing stock is chiefly detached single-family with most constructed before 1950 (estimated at 56%). There are no mobile homes readily apparent in the city.

Transportation

All of the streets are gravel except Reed Street/County Highway 32 and 3rd Ave NW/County Highway 18.

Emergency Services

Amenia is serviced by Casselton Rural Fire District, a department with 26 volunteer firefighters. EMS service is also based out of Casselton, an 11 minute drive from Amenia.

Health Care

The City has no health care facilities of its own, but rather the nearest hospitals are an approximately 40 minute drive to Fargo.

Critical Facilities and Infrastructure

The City of Amenia is connected to Cass Rural Water and has its own City sewer system. A single sewer lift station and pump house are the only critical infrastructure.

Businesses and Employers

Alongside one restaurant, the businesses are agricultural-based (grain elevator and seed company). Therefore, the town is susceptible to the impacts natural hazards may have upon the agricultural economy.

Natural Hazards

Dam Failure	Amenia has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said water supplies are adequate. Its businesses are in agriculture, which is highly vulnerable to drought.
Flooding	The City's flood risk comes from the Rush River to the north. The last updated FEMA floodplain map shows that the majority of town in in either the 100-year or 500-year floodplain. Inadequate drainage also presents a problem in that the system is unable to adequately handle severe precipitation events. There are no nursing homes, daycares, jails, schools, or other such concentrations of immobile populations.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Amenia faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Amenia faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The grain elevator presents the highest fire risk of any building in town.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

They have maintained a contract for outside engineering services. However, Amenia does not have resources to accomplish significant projects independently. The City has adopted the 2017 ND State Building Code and also has zoning regulations in place.

PROGRESS SINCE LAST PLAN

Warning sirens were identified in the previous plan. Since then, these have been installed and the city is now covered.

The levee project is closer now to getting started. A feasibility study examining options has been completed as of spring 2019. The next step would be to begin the design of the levee and putting together of detailed cost estimates. The rough cost estimate, as of this point in time, has risen to $2 million.

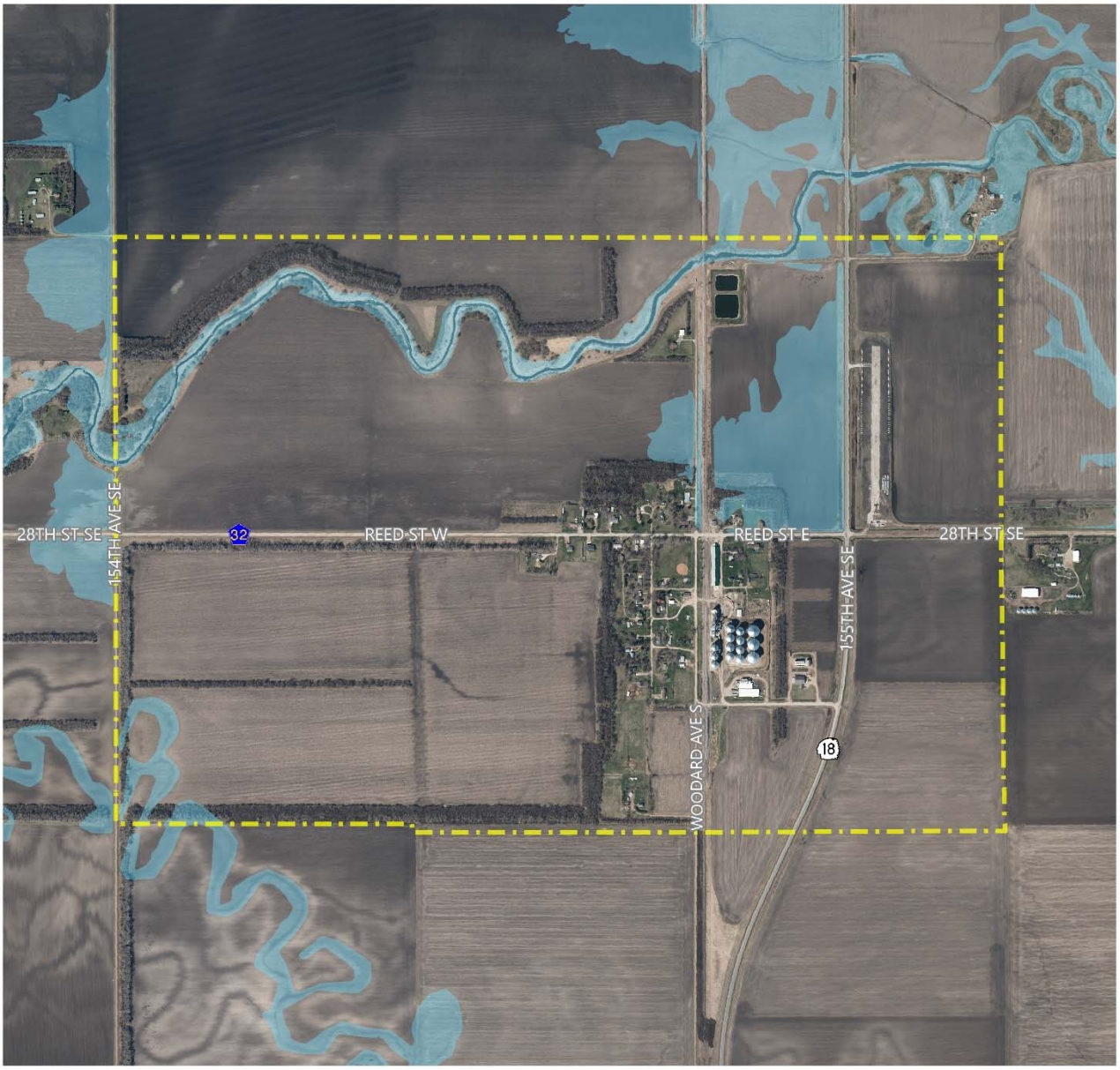
MITIGATION ACTIONS

Mitigation Action	**1] Build dike to protect against the Rush River**
Hazards Addressed	Flooding
Responsible Agency	City of Amenia and Cass County Joint Water Resource District
Cost	$2,000,000

Description	Amenia is affected from the north by overland flooding from the Rush River. Constructing a levee will protect the city and reduce the need to implement emergency measures.
Potential Funding Sources	FEMA (HMGP, PDM, and FMA) with local match, ND State Water Commission, Cass County flood sales tax
Timeline	5 years
Priority	High

Mitigation Action	**2] Installation of storm sewer and a storm sewer lift station**
Hazards Addressed	Overland Flooding
Responsible Agency	City of Amenia
Cost	$500,000
Description	Upgrading Amenia's internal drainage capacity will prevent localized flooding and damage to property.
Potential Funding Sources	ND State Water Commission, ND Department of Health (CWSRF loan), USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5 years
Priority	Medium

FLOODPLAIN MAP



4. Argusville

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Argusville is bifurcated between the original townsite east of Interstate 29 and the newer Leonards Way subdivision to the west. The new subdivision lead to substantial growth in the city's population, rising from 147 in the 2000 Census to 475 people in 2010. The city serves as a bedroom community to the metropolitan area, with the majority of the buildings being single-family housing.

Socio-Economic

Argusville is one of the higher-income communities in Cass County, with a median household income of $105,313. It is believed, however, that the eastern portion of town has those with lower-incomes. Census data shows that unemployment is nearly non-existent.

Argusville is a relatively young town with a median age of 31 years and approximately 45% of the population being 18 years or younger. Just 4% of the residents are older than 62.

Housing

Argusville saw significant housing development in the 2000s in the new western subdivision. The houses in the eastern part are generally older with many built either before the 1940s or in the 1970s. Argusville consists solely of single-family houses. The incidence of being cost-burdened is minimal, at least according to available Census data.

Transportation

Interstate 29 passes through with a convenient exit on 25th St SE. The roads in the western half are fully paved; in the eastern part most are gravel except the county highways. A BNSF rail line passes through the town, presenting a man-made hazard which is addressed in other County plans.

Emergency Services

Argusville is serviced by its own rural fire district. Around 25 people volunteer for the department. EMS service is provided by F-M Ambulance Service, which is an approximately 20 minute drive away.

Health Care

Argusville does not have any medical or social service facilities of its own. The nearest hospitals are in the metropolitan area.

Critical Facilities and Infrastructure

Important infrastructure to the community includes a building with the community center and fire department, two sanitary sewer lift stations, one storm sewer lift station and a pump house where the Cass Rural Water lines enter town. Recently culverts have been redone, thus improving internal drainage, but more sections of culverts remain to be addressed.

The community center and fire department are located within the protected portion of Argusville.

In the original part of town on the east side, the sanitary sewer and water distribution infrastructure was installed in the 1970s. The City is in the process of gradually replacing this infrastructure. Fortunately, the city has not been experiencing water main breaks. The sanitary sewer, however, does have portions that have been recently replaced or will need to be soon.

Businesses and Employers

Argusville can accurately be described as a "bedroom community" given that most residents commute to work in the metropolitan area. There are no significant employers within the town.

Natural Hazards

Dam Failure	Argusville has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said water supplies are adequate. CRWD has a drought response plan. There are no users in Argusville with a more pronounced exposure to the impacts of drought.
Flooding	Argusville has a history of fighting floods. Past experience has shown that the western Leonards Way subdivision is susceptible to overland flooding, a fact that is not shown in the currently in-effect floodplain maps. A few of the houses there are elevated enough to be out of harms way, but many are not. An earthen berm was built to protect those houses and reduce the amount of sandbagging, albeit not to FEMA standards. The older portion of Argusville east of the Interstate is protected by overland flooding via a levee, which was recertified in 2012. Roads have been washed out in the past, necessitating the need for repairs the cost of which may not always be reimbursed. There are no nursing homes, daycares, jails, schools, or other such concentrations of immobile populations.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Argusville faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Argusville faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The highest potential for fire is the abandoned and condemned old school building.

Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

The city staff size is small with only an auditor and a water superintendent employed, both on a part-time basis. Although they do not have a public works department, they do have a contract for outside engineering services. In addition to the city council, there is an active park district and planning and zoning committee. The City has adopted and enforces the 2017 ND State Building Code. Given the city's small population, there is a greater need for financial and technical assistance to carry out mitigation projects.

PROGRESS SINCE PREVIOUS PLAN

The 2014 version of this plan listed the installation of warning sirens and the levees around Richwood Estates and Leonard's Way as action steps. For the latter, the uncertainty surrounding the update of the floodplain maps halted progress, since it was unclear how extensive the floodplains will be. FEMA is closer now to issuing new floodplain maps. This will greatly aid the decision on how to proceed with the levees.

MITIGATION PROJECTS

Mitigation Action	**1] Installation of warning sirens**
Hazards Addressed	Severe weather
Responsible Agency	City of Argusville and Red River Regional Dispatch Center
Cost	To be determined
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-2 years depending on funding availability
Priority	Low

Mitigation Action	**2] Build storm shelter**
Hazards Addressed	Severe weather
Responsible Agency	City of Argusville with assistance of Moore Engineering
Cost	$80,000 for standalone; to be determined if co-located with new fire hall.
Description	Constructing a storm shelter according to FEMA's engineering standards will offer residents who may not have an adequate structure and those caught outside at the onset of a storm a place of refuge and safety. Currently, the fire department rents space in the Community Center from the city. A new separate fire hall would be ideal. Incorporating a storm shelter, that is readily available to the public, could lead to cost savings.
Potential Funding Sources	FEMA (HMGP and PDM), USDA Rural Development (Community Facilities Loan and Grant)
Timeline	1-2 years depending on funding availability for standalone; 3-5 years for co-located shelter

Priority	Medium

Mitigation Action	**3] Generator for the two lift stations' backup pumps**
Hazards Addressed	All hazards
Responsible Agency	City of Argusville with assistance of Moore Engineering
Cost	$150,000
Description	These will ensure the two lift stations (located in the west and east portions of the city) remain operational during power outages that are often the result of severe weather.
Potential Funding Sources	FEMA (HMGP and PDM)
Timeline	2-3 years
Priority	High

Mitigation Action	**4] Ensure community center/fire hall is able to withstand natural hazards**
Hazards Addressed	All hazards
Responsible Agency	City of Argusville and Argusville Fire Department
Cost	To be determined post inspection
Description	Given that the community center and fire hall need to remain operational in case of emergencies, it is recommended that a throughout examination by a professional is conducted in order to find out what alterations or hardening is needed.
Potential Funding Sources	Local funds
Timeline	1-2 years
Priority	Medium

Mitigation Action	**5] Assist households with vulnerable individuals in carrying out mitigation actions on their own properties**
Hazards Addressed	All hazards
Responsible Agency	City of Argusville
Cost	To be determined
Description	Argusville has areas of town with older style houses as well as modular homes where more vulnerable individuals (e.g. lower income, elderly) may live. Older homes tend not to comply with the latest building codes and have maintenance issues which increase their vulnerability to severe storms. The City can look for grant funding to help those households update their homes, remedy code deficiencies, and harden the structures thus providing protection.
Potential Funding Sources	USDA Rural Development (Housing Preservation Grant)
Timeline	2-3 years
Priority	Low

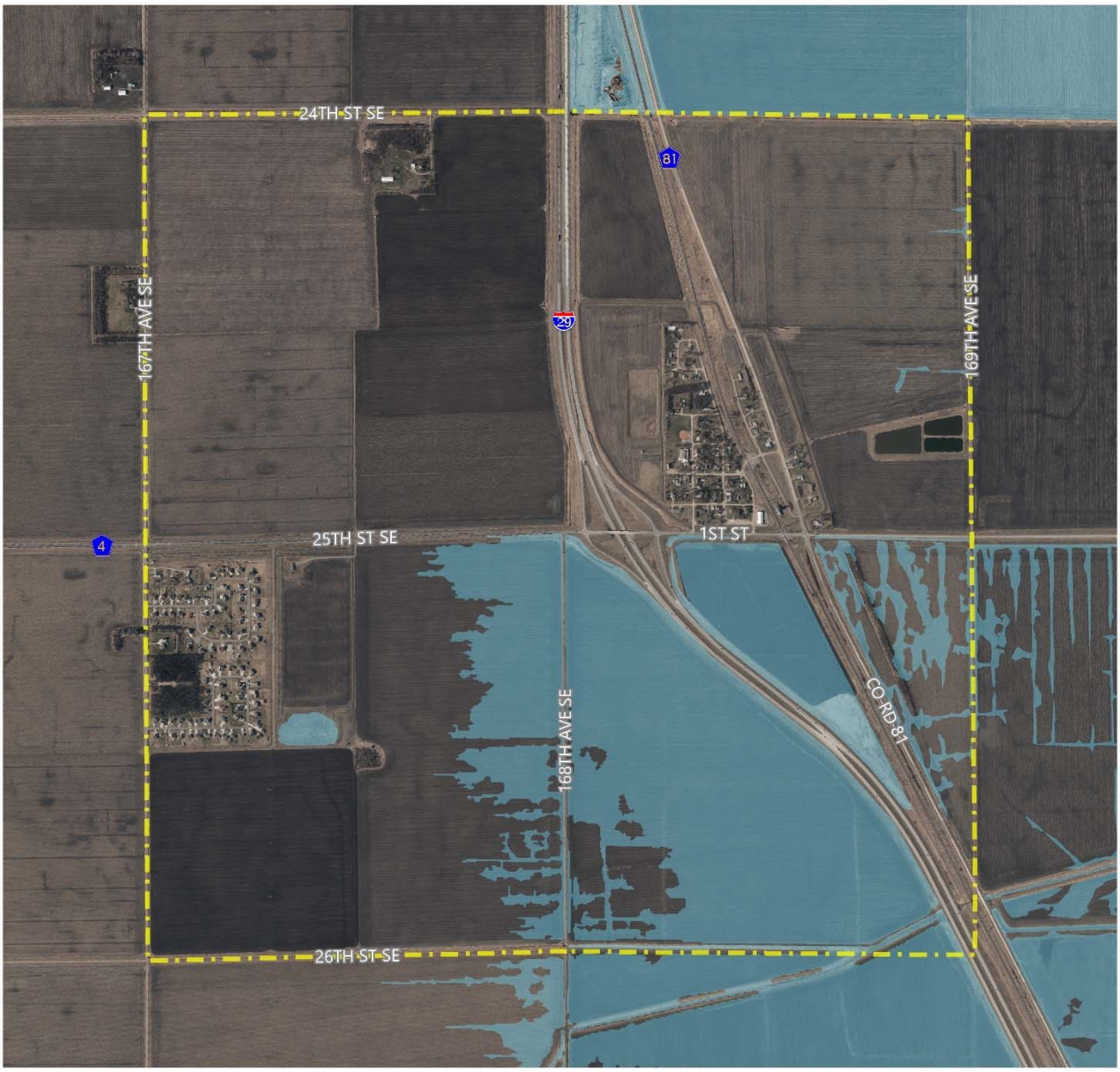
Mitigation Action	**6] Upgrade culverts that are not draining properly in storm events**
Hazards Addressed	Flooding and severe summer weather
Responsible Agency	City of Argusville with assistance of Moore Engineering
Cost	To be determined
Description	There are several culverts that are incapable of draining in an adequate time. Replacing these sections will increase the capacity and thus prevent water from backing up into lawns and buildings. The previous culvert project was

	about 10 to 12 years ago. These will be evaluated upon the completion of a currently underway sewer project.
Potential Funding Sources	FEMA (PDM, HMGP, and FMA) with local funding match, USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	2-3 years
Priority	Medium

Mitigation Action	**7] Raise and certify the levee around Richwood Estates/Leonards Way**
Hazards Addressed	Flooding
Responsible Agency	City of Argusville with assistance of Moore Engineering
Cost	$500,000
Description	The earthen berm for the west portion of the city will be examined as part of a certification process. Alterations to the levee may be necessary to obtain this certification. In the end, this will reduce the flood risk to housing development of approximately 85 homes.
Potential Funding Sources	ND State Water Commission, Cass County Flood Sales Tax Fund
Timeline	5 years
Priority	High

Mitigation Action	**8] Install backup generator for the water pump at the reservoir**
Hazards Addressed	All hazards
Responsible Agency	City of Argusville
Cost	To be determined
Description	If the power to the pump at the reservoir goes out, city residents will go without water. A backup generator would ensure continued operation during severe weather.
Potential Funding Sources	FEMA (PDM and HMGP)
Timeline	2-3 years
Priority	Medium

FLOODPLAIN MAP



100 Year Floodplain
Argusville City Limits

1,000 Feet

source: Western Cass Flood Insurance Study
imagery date April 2016 | map updated January 2019

CASS COUNTY GOVERNMENT

Disclaimer: This map is made available as a public service. Maps and data are to be used for reference purposes only and Cass County, ND, is not responsible for any inaccuracies herein contained. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, use, or misuse of the information herein provided.

5. Arthur

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Most of Arthur consists of single-family houses. Main Street is the commercial street with several ag-related businesses – most notably the grain elevator – as well as the city mall where the city council meetings occur. New construction does not occur frequently in Arthur; therefore, the city has not significantly expanded horizontally speaking.

Socio-Economic

In terms of socio-economic vulnerability, Arthur has an older than average population with a median age of 43.8 years. This can be partly explained by the presence of the Good Samaritan Society's assisted living and nursing home facility in the north of town.

The median household income is only slightly below that of the county's ($57,222 compared to $58,026).

Housing

77.3% of the housing units in Arthur were built before 1980. This may indicate those structures are not compliant with the latest building codes. There is one street with six mobile home units.

Transportation

The residential streets are primarily paced. Main Street and 21st St SE/County Highway 34 are paved. A rail line used to pass through Arthur but was closed. Currently, the cities of Arthur and Hunter are working towards turning it into a trail.

Emergency Services

The Arthur Volunteer Fire Department is collocated with the community center. There are around 15 volunteer firefighters. The Hunter Ambulance Service, whose facility is around a 10 minute drive on State Highway 18, covers the city of Arthur.

Health Care and Nonprofits

Arthur does not have health care facilities by itself. The nearest hospitals would be in Fargo.

Critical Facilities and Infrastructure

Arthur's critical infrastructure includes a pumping station that connects the city to Cass Rural Water's system, a water tower, and two sanitary sewer lift stations. The city has been going through the process of updating its infrastructure, some of which is aged and therefore is in need of replacement. The main lift station was installed in 1961 with new pumps in 2008, the north lift station around 1980, the water tower around 1961, and a large portion of the sanitary sewer mains (comprised mostly of vitrified clay pipe) installed in 1961 or earlier.

Businesses and Infrastructure

The two sizable employers are Arthur Companies' operations and BankNorth. Like other rural communities, the stores and restaurant can acutely feel the effects of downturn in the agricultural sector. Therefore, the businesses in Arthur can be indirectly affected by severe weather, flooding, and drought.

Natural Hazards

Dam Failure	Arthur has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said the water supply is adequate. Businesses will be economically affected in times of drought.
Flooding	Arthur's flood risk comes from overflow from the drainage ditch that runs along State Highway 18. The FEMA FIRM adopted in September 1993 shows that the coulee and drain that passes through town has a potential for flooding that will inundate several streets. As of the writing of this plan, the City is updating the storm sewer system that will increase its capacity which could take land out of the mapped floodplain. The nursing home houses an elderly population with limited mobility in instances where evacuation is required.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Arthur faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town. The most vulnerable population in Arthur would be the residents of the nursing home, who live in a well-maintained and safe facility.
Severe Winter Weather	Arthur faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The highest potential for fire is the grain elevator, since any uncontrolled dust can become engulfed.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Arthur is a small community of around 340 people. Therefore, financial resources are limited given the small tax base and the lack of economies of scale. Arthur employs only a few people who must cover a range of tasks, so the capacity to pursue mitigation action steps by themselves is limited. Contracted engineering services are in place to help identify and carry out improvement projects. The city is connected to Cass Rural Water and has its own sewer and storm sewer system.

PROGRESS SINCE PREVIOUS PLAN

The three mitigation action items listed below were in the 2014 version of the plan. These have not been completed in the meantime. Therefore, they will remain in this plan. The cost estimates were increased to

account for inflation.

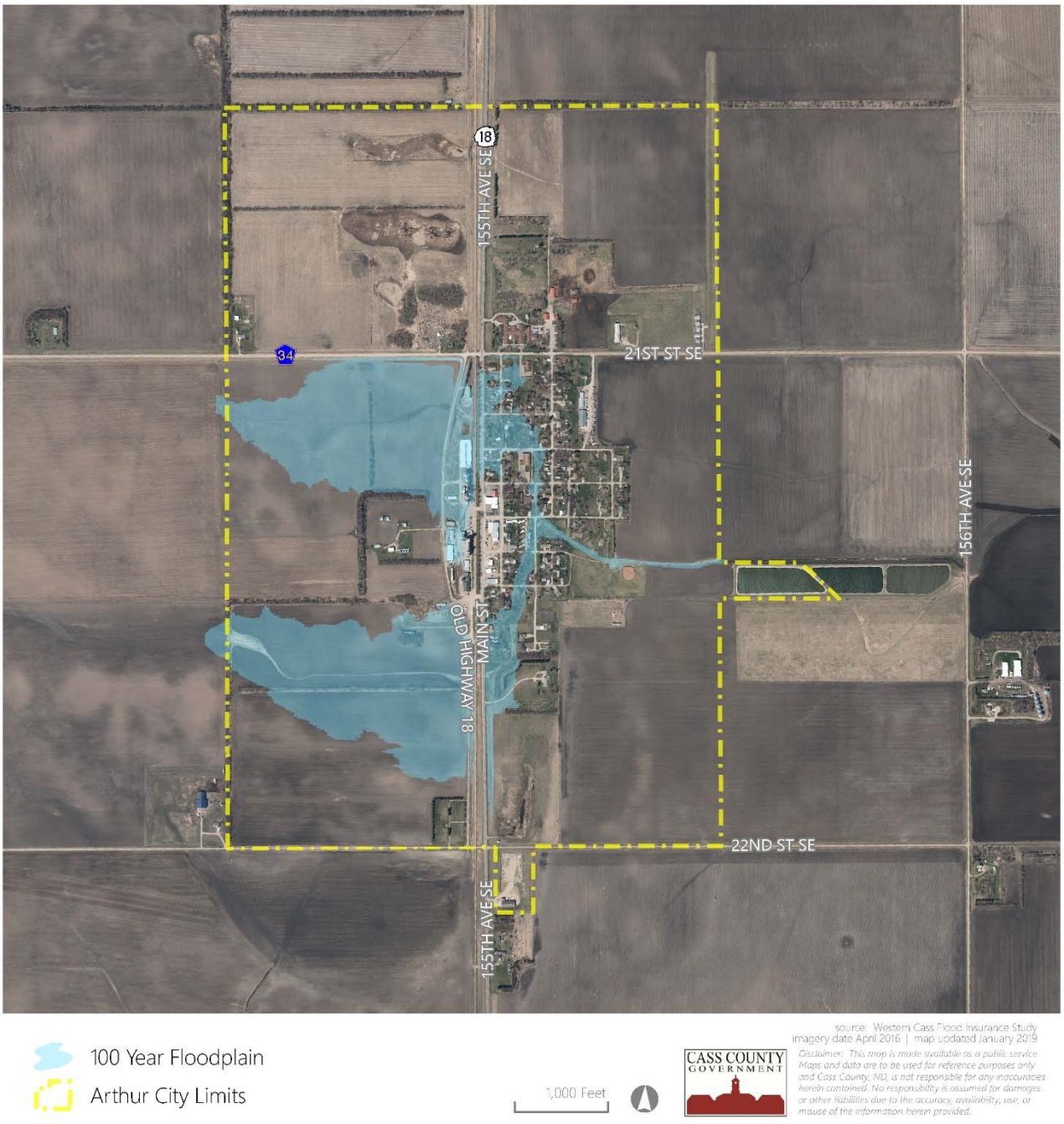
MITIGATION ACTIONS

Mitigation Action	1] Installation of warning sirens
Hazards Addressed	Severe weather
Responsible Agency	City of Arthur and Red River Dispatch Center
Cost	$50,000
Description	Advanced warning of oncoming storms will allow for timely action on the part of residents.
Potential Funding Sources	FEMA (HMGP and PDM), local match funds
Timeline	1-2 years depending on funding availability
Priority	Low

Mitigation Action	2] Create a new legal drain to move water north of City limits
Hazards Addressed	Flooding
Responsible Agency	City of Arthur
Cost	$1,000,000
Description	A new drain will reduce flood risk to the entire community, thus protecting public and private property
Potential Funding Sources	ND State Water Commission, Cass County Flood Sales Tax, local match funds, USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5-10 Years
Priority	Medium

Mitigation Action	3] Install a backup generator at lift stations
Hazards Addressed	Flooding
Responsible Agency	City of Arthur
Cost	$200,000
Description	Ensuring continued operation of lift stations reduces the chance for sewer backups and flooding to occur
Potential Funding Sources	ND State Water Commission, Cass County Flood Sales Tax, FEMA (HMGP and PDM), local matching funds
Timeline	1-2 years
Priority	High

FLOODPLAIN MAP



6. Ayr

UNIQUE VULNERABILITIES

Land use and Growth Patterns

Ayr is a very small town of around 20 people. Aside from the residences, it is home to one of Arthur Company's grain terminals. This terminal is served by a BNSF rail line. New buildings are a rare occurrence.

Socio-Economic

The availability of socio-economic data is restricted due to the small nature of the town. According to the 2010 Census the median age is 56.3 years, significantly older than the county average.

Housing

Data on the housing is limited due to the small sample size. An analysis through Google Earth would indicate that there are several mobile homes in addition to a few more stick-built houses. Several houses are in fair to poor condition and therefore may have issues withstanding severe weather.

Transportation

As mentioned, a rail line passes through town serving the grain terminal. Aside from Main Avenue which trucks utilize to access the grain terminal, all of the roads in town are gravel.

Emergency Services

Ayr is served by the Page Fire Department, which is an approximately 16-20 minute drive away. It is also served by the Page Ambulance Service.

Health Care and Nonprofits

Ayr does not have any such facilities in town. The nearest hospital is located in Valley City (CHI Mercy Health) around 45 minutes away.

Critical Facilities and Infrastructure

The City is hooked up to Cass Rural Water, but no sewer system is in place. Instead, residents have their own individual septic systems. The town doesn't have a central community facility from which to gather or to disseminate information.

Business and Employers

Arthur Company's grain terminal is the sole business in Ayr. Being in the agricultural sector, it is susceptible to the impacts drought, flooding, and severe weather can bring.

Dam Failure	Ayr has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said the water supply is adequate. The grain terminal will be economically affected in times of drought.
Flooding	The City of Ayr is not within a mapped floodplain but does experience issues with its internal drainage system. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Ayr faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Ayr faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The grain storage facility would be the one with the highest risk of fire that would cause damage to surrounding properties.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Ayr is the smallest incorporated community in Cass County with a population of 17 according to the 2010 Census. Due to their very small size, capacity is limited and the community must rely on state and local governments for assistance.

PROGRESS SINCE LAST PLAN

No progress has been made since the last plan update in 2014 that listed the two items below. City leaders indicated these remain relevant and therefore will be kept in.

MITIGATION ACTIONS

Mitigation Action	**1] Installation of warning sirens**
Hazards Addressed	Severe weather
Responsible Agency	City of Ayr and Red River Regional Dispatch Center
Cost	$25,000
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending on funding availability
Priority	Low

Mitigation Action	**2] Dredging ditches and replacing 4 culverts in town**
Hazards Addressed	Flooding (drainage issues)
Responsible Agency	City of Ayr
Cost	TBD

Description	Will reduce standing water and impacts to private property and city infrastructure. Streets have been improved with gravel recently and the it would also reduce the risk of have to redo it in a short time
Potential Funding Sources	FEMA (HMGP and PDM) with local match, Cass County flood sales tax, USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	1-5 years depending on funding availability
Priority	High

7. Briarwood

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Briarwood is located adjacent to the Red River to the east and Fargo to the west. Fargo's continued growth southward has limited the ability for Briarwood to annex more land away from the river, essentially locking in Briarwood's growth potential. The city has only single-family residences.

Socio-Economic

Briarwood is the city with the highest mean household income in the county, sitting at $330,225. Three quarters of the households make more than $75,000 annually. Residents are slightly older than the county average with a median age of 41.9.

Housing

The houses were built primarily in the 1970s through 1990s. A few individual homes have generators.

Since the 2009 flood, eight properties have been acquired and removed through a Hazard Mitigation Grant-funded project. This grant removed the homes most at-risk of flooding.

Transportation

Briarwood has one entrance on University Drive/US Highway 81. The road branches off into two cul-de-sacs with the eastern one mostly bought out and the western one containing most of the city's homes. These roads are paved.

Emergency Services

Briarwood is served by FM Ambulance Service, Horace Fire Department, and Cass County Sheriff's Department.

Health Care and Nonprofits

The nearest hospital (Essentia Health) is around 11 minutes away.

Critical Facilities and Infrastructure

Briarwood does not have an installed storm sewer system. City leaders did not indicate any pieces of infrastructure that merit attention in terms of mitigation.

Business and Employers

Briarwood does not have any stand-alone businesses. Residents often commute to work elsewhere in the metropolitan area.

Dam Failure	Briarwood has no risk from dam failure.
Drought	Briarwood obtains its water from Cass Rural Water Resource District. The City consists of 18 homes and does not have any land uses particularly vulnerable to drought.
Flooding	According to the current FEMA floodplain maps, Briarwood is significantly exposed to flooding from the Red River with the streets and open areas in the 100-year floodplain. Houses are elevated to the point where they are in the 500-year flood zone. The city experienced flooding in springs of 2009, 2010, and 2011. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Erosion has been occurring along the Red River as well as from overland flooding.
Severe Summer Weather	Briarwood faces the same severe summer weather risk as other jurisdictions. The houses are well-kept and able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Briarwood faces the same severe summer weather risk as other jurisdictions. The houses are well-kept and able to withstand severe weather.
Urban Fire	There are no land uses which present a higher than normal risk of building fire.
Wildfire	The risk of wildfire reaching the city is very low given that the city is within the developed metropolitan area. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

The City has an active Mayor and City Council. However, it does not have the staff and technical capacities on hand to accomplish significant projects independently.

PROGRESS SINCE LAST PLAN

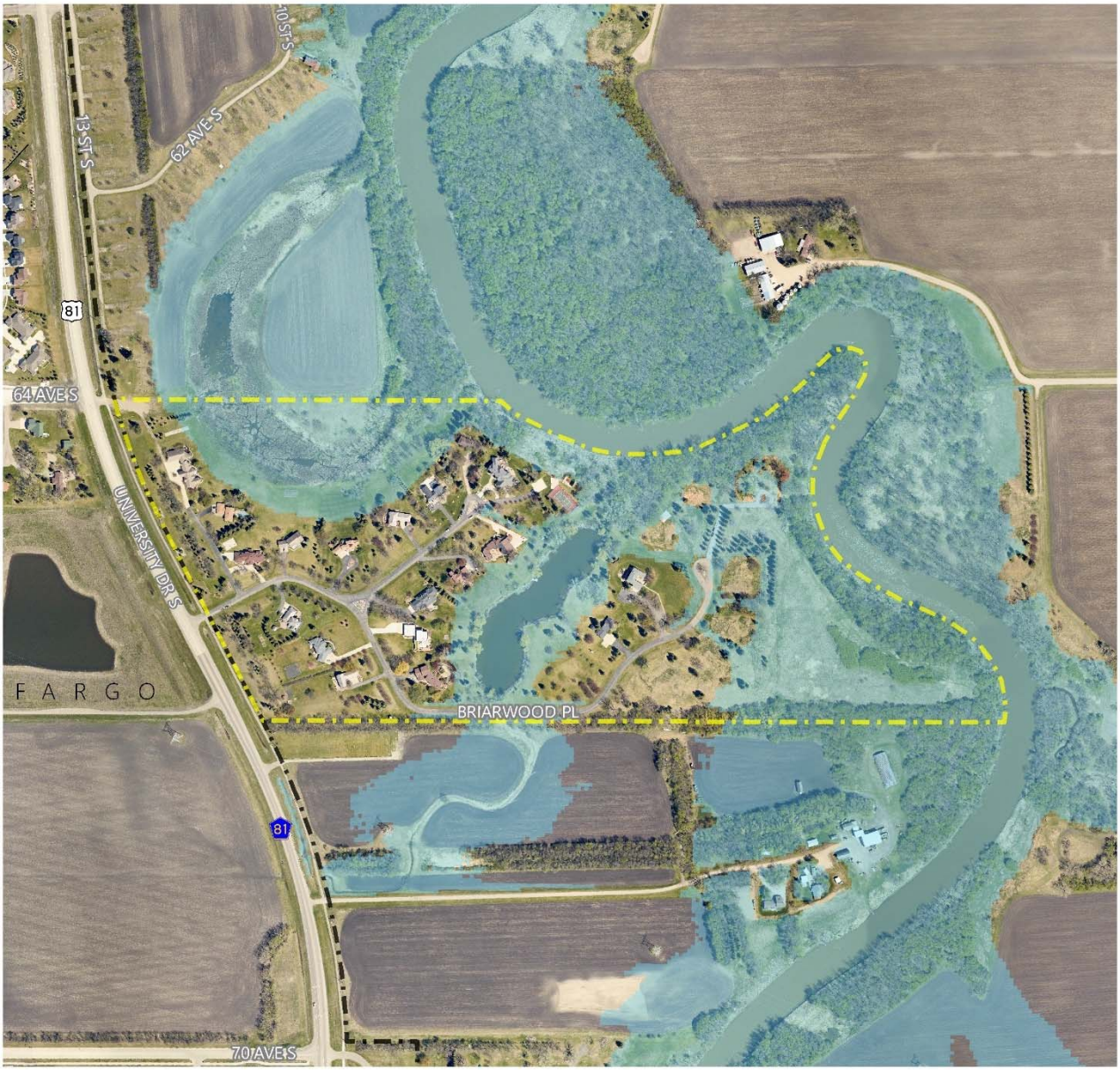
The previous plan only had the installation of a warning siren as an action item. Since that time, new sirens have provided adequate coverage. Additionally, many of the residents receive weather alerts via the Code Red system. Since it was not deemed relevant any longer, that action item was taken out for this update.

MITIGATION PROJECTS

Mitigation Action	**1] Address erosion caused by overland flooding**
Hazards Addressed	Geological hazards
Responsible Agency	City of Briarwood, Southeast Cass Water Resources District, Cass County (if cooperation needed), and City of Fargo (if cooperation needed)
Cost	To be determined

Description	New subdivisions near Briarwood have changed the drainage dynamics, resulting in flooding and subsequent erosion. The City will work with the relevant entities to find an amiable solution.
Potential Funding Sources	Dependent upon course of action taken
Timeline	1-2 years
Priority	High

FLOODPLAIN MAP



8. Buffalo

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Buffalo is a town of nearly 200 people. Public buildings and businesses are found mainly along Main Avenue and also County Highway 38. There are roughly 27 blocks of residential with religious land uses mixed within. New development that necessitates the extension of infrastructure does not occur often.

Socio-Economic

Buffalo has a higher median household income than the county as a whole ($68,472 versus $58,026). The poverty rate is undetermined due to the small sample size. In regard to age, the median is roughly in line with the County.

The Buffalo Development Corporation owns and operates an eight-unit affordable housing apartment along Main Street. This building is slated to undergo extensive rehabilitation in 2020.

Housing

Buffalo has an older housing stock with nearly 40% built before 1960 and 30% between 1960 and 1990. This may indicate those houses may be less able to withstand hazards given the likelihood they will not conform to the latest building codes.

Transportation

Buffalo is nearly 3 miles north of Interstate 94. A BNSF rail line passes through the town and serves a grain elevator there. Aside from the county highway and Main Street, all of the roads are gravel.

Emergency Services

Buffalo is served by the Cass County Sherriff's Department and the Buffalo Fire Department. There are 29 active volunteer firemen on the roster. The department also houses the Buffalo Area Quick Response Unit. Two firemen are EMT Basic trained and nine others BLS certified. Additional EMS service can be provided by Casselton Ambulance Service. It is around a 25 minute drive from Casselton to Buffalo.

Health Care

Buffalo does not have any health care or social services located within the city. The nearest hospital is in Valley City to the west.

Critical Facilities and Infrastructure

City leadership deems the community center, pump house, lift station, fire hall, and water tower as

all to be critical facilities. Several of these have action items related to their resiliency and continued operation during disasters.

Businesses and Employers

Aside from several service businesses located along Main Street, one other employer is the grain elevator and terminal. Being a rural community, Buffalo will feel the impact of an agricultural downturn resulting from severe weather, flooding, and drought.

Natural Hazards

Dam Failure	Buffalo has no risk from dam failure.
Drought	Briarwood obtains its water from Cass Rural Water who said its water supplies are adequate. As a rural community in an agricultural area, Buffalo's economy will be affected by drought if it were to occur.
Flooding	The City of Buffalo is not in a mapped floodplain and doesn't have an apparent risk from overland flooding. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Buffalo does not have any notable risk from geological hazards.
Severe Summer Weather	Buffalo faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Buffalo faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. In early 1997, the City went four days without power and water due to a large ice storm.
Urban Fire	The only land uses which would present a higher than normal risk of building fire is the grain elevator.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Buffalo has numerous boards and commissions, which are an indicator of an engaged citizenry. These are the Job Development Authority, the Historic Preservation Commission, Zoning Board, and Park Board.

Buffalo has an adopted zoning ordinance, albeit one that does not directly reference hazard mitigation directly. A separate ordinance deals with substandard, unsafe, dilapidated, and fire hazardous structures and the process for enforcement.

The city's staff consists of an auditor, a public works maintenance worker, and a custodian for the

community center. The city has a contract with an engineering firm who is able to apply for and lead the implementation of mitigation projects.

PROGRESS SINCE LAST PLAN

The city council conducted a thorough self-examination of its vulnerabilities. The two items from the previous plan (the backup generator for the lift station and the construction of a storm shelter) have not been undertaken, but nonetheless remain relevant today. The inclusion of new and higher priority items has pushed those two to the bottom of the action item list.

MITIGATION ACTIONS

Mitigation Action	**1] Upgrade lift station**
Hazards Addressed	Flooding
Responsible Agency	City of Buffalo
Cost	To be determined
Description	The current lift station, built in the 1960s, is unable to handle the in-flows and therefore need an exemption to pump into a nearby ditch to relieve pressure, lest it will backup into people's properties. A new lift station with greater capacity will prevent backups and internal flooding from occurring.
Potential Funding Sources	FEMA (PDM, FMA, HMGP) with local match (can include CDBG)
Timeline	1-2 years
Priority	#1 (Highest)

Mitigation Action	**2] Purchase tractor for city's PTO generator**
Hazards Addressed	Power outages due to severe weather
Responsible Agency	City of Buffalo
Cost	To be determined
Description	The city already owns a power take-off (PTO) generator, but does not have a tractor from which to connect it to or transport it around the city as needed.
Potential Funding Sources	FEMA (PDM, HMGP) with local match
Timeline	1-3 years
Priority	#2

Mitigation Action	**3] Installation of a backup generator at the lift station**
Hazards Addressed	Power outages due to severe weather
Responsible Agency	City of Buffalo
Cost	$100,000
Description	Reduces the risk of the lift station going down during any number of incidents.
Potential Funding Sources	FEMA (PDM, HMGP) with local match
Timeline	1-2 years depending on funding availability
Priority	#3

Mitigation Action	**4] Installation of backup generator at community center**
Hazards Addressed	Severe weather

Responsible Agency	City of Buffalo
Cost	To be determined
Description	The community center currently serves as shelter and space for organizing disaster response. Installing a backup generator would ensure power remains during a critical time.
Potential Funding Sources	FEMA (PDM, HMGP) with local match
Timeline	1-2 years depending on funding eligibility
Priority	#4

Mitigation Action	**5] Building a Storm Shelter**
Hazards Addressed	Severe summer weather
Responsible Agency	City of Buffalo
Cost	To be determined
Description	Provides a safe place for residents in times of a tornado or other severe weather. During power outages the community center has served as a make shift shelter but is not specially designed for this purpose.
Potential Funding Sources	FEMA (PDM, HMGP) with local match
Timeline	5-10 years
Priority	#5 (Lowest)

9. Casselton

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Casselton has seen healthy growth over the years, rising from 2,329 residents in 2010 to 2,773 residents in 2017. New development has expanded the city's footprint including new residential subdivisions in the southern part of town. An industrial area immediately north of Interstate 94 by the exit has sprung up. In the north of town, the school has greatly expanded over the years to accommodate the increase in student enrollment. A residential subdivision was built to the east of the school adjacent to the leveed drain.

Socio-Economic

Casselton's median household income is higher than the County average, sitting at $69,858 in 2017. The poverty rate is low with 3.3% of individuals being in that status. These two data points indicate that Casselton is a wealthier community, relatively speaking compared to others in Cass County.

The median age – 32.9 years of age - is in line with the County. A large share (32.7%) of the residents are below 18 years of age. Additionally, 39.6% are between 15 and 44 years of age. These data can lead to the reasonable conclusion that there are many younger families in Casselton.

Housing

As mentioned earlier, Casselton has seen increases in its housing stock. In 2010, there were 912 units; in 2017 it has increased to 1,062. Around 70% of the housing units are single-family detached. Almost 40% of the housing units were built before 1970. These older homes should receive special attention when it comes to hardening them to withstand severe weather.

Casselton has two mobile home parks: the one on the on 2nd Street south adjacent to the drain has spots for 8 homes; the one north of the railroad tracks west of downtown has spots for 16 homes. Neither has a dedicated shelter rated to withstand high winds and airborne debris.

The Housing Authority of Cass County has a low-rise apartment building for those with limited means. These structures do not have basements into which residents can seek shelter during tornados and high winds.

Transportation

Casselton has easy access to Interstate 94 and all of its city roads are paved, meaning that it has a better road network than many of the non-metropolitan communities.

In 2013, an oil-carrying train derailed a few miles outside of town. If it were to happen in Casselton, the results would have been catastrophic. This man-made hazard is addressed in the county's THIRA plan.

Emergency Services

The City is home to Casselton Ambulance Service, who cover an area of over 740 square miles of rural Cass County. It is also home to Casselton Rural Fire District, which has around 26 volunteer firefighters signed up.

Health Care

Other than Essentia Health's clinic, Casselton doesn't have any other health care facilities. The nearest hospital is the Sanford Medical Center 20-25 minutes away in Fargo.

Casselton is home to two non-profit organizations: Community of Care and the Cass County Rural Community Emergency Food Pantry. The former provides services for the elderly and the latter offers food assistance to families in need. Both serve an area greater than Casselton itself.

Critical Facilities and Infrastructure

The City is connected to Cass Rural Water but has their own sewer, storm sewer and city-run sanitation services. Critical infrastructure and facilities include a relatively new water treatment plant, nine sanitary sewer lift stations, four storm sewer lift stations, two water towers, and an Otter Tail Power Company substation and CenturyLink cell tower.

Business and Employers

A cluster of manufacturing businesses, all involved in the agricultural sector, sits adjacent to Interstate 94 on the south end of Casselton. These businesses will feel the ripple effect that droughts, floods, and severe weather can have upon producers. This industrial park does have a storm sewer system installed. To the west of town sits the Tharoldson Ethanol plant that can produce 150 million gallons per year. The plant does not use area groundwater resources given that it uses Fargo's wastewater in its operations.

Natural Hazards

Dam Failure	Casselton has no risk from dam failure.
Drought	Casselton obtains its water from Cass Rural Water who said the water supply is adequate. As a rural community in an agricultural area, Casselton's economy will be affected by drought if it were to occur.
Flooding	Flooding has been a concern in Casselton. The floodplain map adopted in 1989 as well as direct observation show that flooding occurs by the Casselton Reservoir and along the drain which circumvents most of the town. Further south in the city's extraterritorial zone the Wheatland Channel can flood potentially affecting access to Interstate 94 as well as some farmsteads and a winery. The successful completion of mitigation projects has improved the

	protection against flooding. Additionally, many property owners have applied for and received Letters of Map Revisions from FEMA. None of the eight licensed daycares nor the school are located within the mapped floodplain.
Geological Hazards	Casselton does not have any notable risk from geological hazards.
Severe Summer Weather	Casselton faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Casselton faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather.
Urban Fire	The only land uses which would present a higher than normal risk of building fire are the grain elevators.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

At a population of around 2,700, Casselton has greater capacity than most of the towns in Cass County. The City employs an auditor, assessor, and forester. It has adopted zoning ordinances, stormwater discharge ordinance, and water use restriction policy. Casselton has adopted the 2017 North Dakota State Building Code and enforces it through requiring of building permits for new buildings and significant renovations of existing buildings.

Casselton is a participating jurisdiction in FM Metro COG, the area's metropolitan planning organization. This allows for better transportation and development coordination with nearby cities.

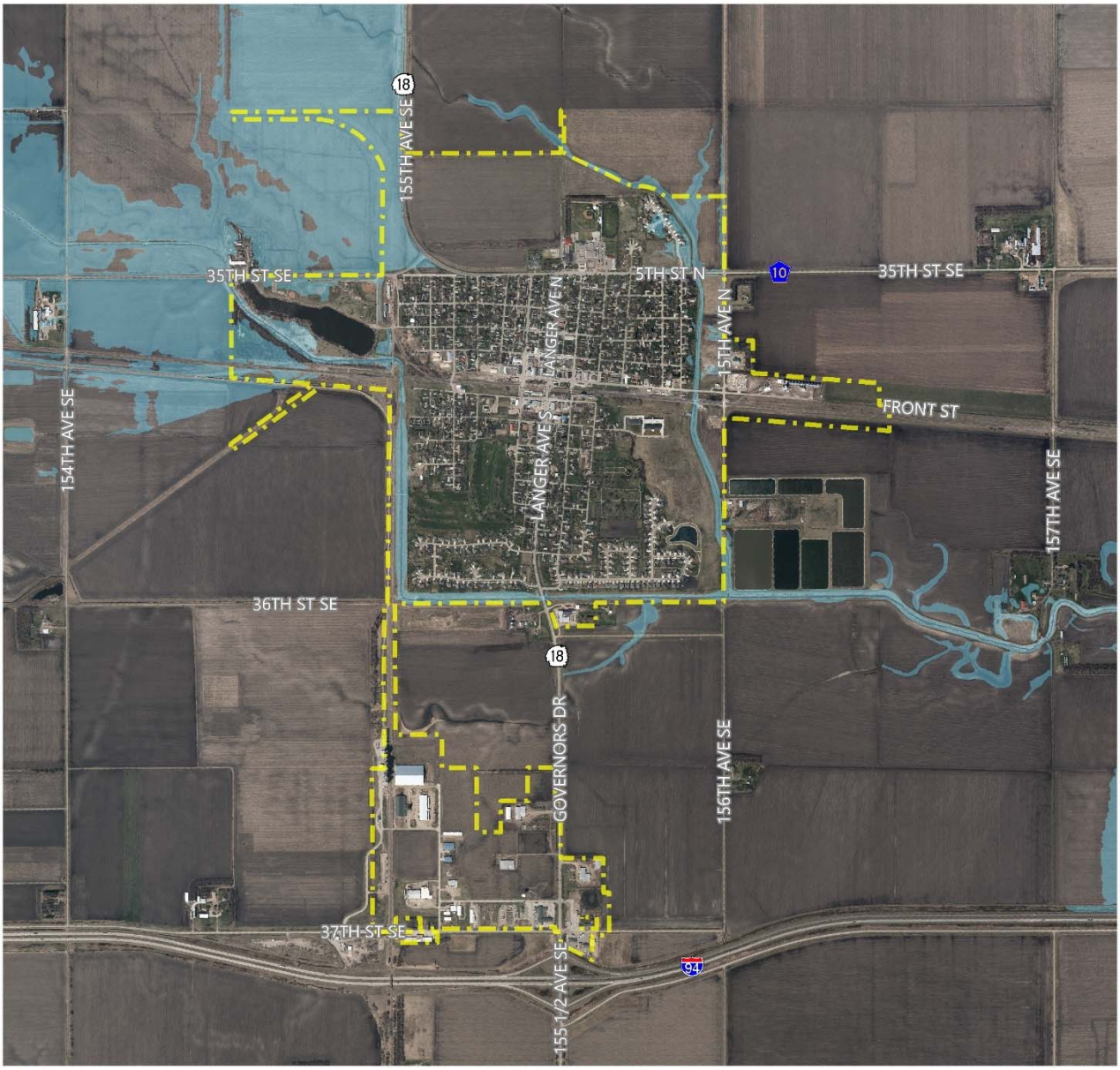
PROGRESS SINCE LAST PLAN

The only action step in the previous plan was the northside levee, which remains an action step in this plan as well. The issuance of new floodplain maps by FEMA will affect how this levee is to be designed and built. Progress will remain halted until updated floodplain data is released.

MITIGATION ACTIONS

Mitigation Action	**1] Raising levee on north side of town**
Hazards Addressed	Flooding
Responsible Agency	City of Casselton with assistance from engineering firm
Cost	$1.6 million
Description	The city will consider raising the levee on the north side of town depending on FEMA's update of the floodplain map.
Potential Funding Sources	FEMA (PDM, HMGP, and FMA) with local match
Timeline	5 years
Priority	High, although contingent upon new floodplain data

FLOODPLAIN MAP



10. Davenport

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Davenport is a primarily residential community a little more than eight miles southwest of Horace. The City has seen moderate growth over the years rising from 230 residents in 2010 to 274 in 2017. Most employed residents commute towards Fargo.

Socio-Economic

The median household income for 2017 is $66,250, which is higher than the county's average. 7.5% of individuals fall below the poverty line. The median age of 36.6 years is not significantly higher than the county's. Additionally, around 33.2% of the population is under 18 years of age, indicating that there are numerous younger families in Davenport, a fact that many rural communities do not share.

Housing

The majority (approximately 80%) of houses are single-family detached, although there are a few multi-family apartment buildings. According to Census data, many homes were built between the 1960s and 80s. A significant share were built before 1950. This may indicate the houses may not conform to current building codes and therefore will need special attention when it comes to house-specific mitigation actions that can be taken.

Transportation

Davenport's sits at the intersection of two rail lines owned and operated by Red River Valley and Western. These lines serve a grain elevator located at the west end of Davenport. The city's roads are paved.

Emergency Services

The city is served by the Davenport Rural Fire Protection District, whose fire hall is co-located with the community center. The district has around 20 volunteer firefighters. It is also served by the Kindred Area Ambulance Service, which is based around 12 minutes away.

Health Care

Davenport does not have any health care facilities of its own. The nearest emergency hospital is located in Fargo.

Critical Facilities and Infrastructure

Davenport does have a sanitary sewer system with a lagoon to the east of town. It does not have a storm water sewer system instead, instead relying on ditches. As mentioned earlier, the community center and fire hall are located under the same building. The building is in good condition, although a backup power generator would

be useful for its continued operation as a fire hall and potential emergency shelter during power outages. The city uses the old school for its council meetings.

Businesses and Employers

The city does not have many businesses. In addition to a restaurant, the other notable employer would be the grain elevator. The City is a little more than half-hour from the metropolitan area, showing that commuting is feasible for most residents.

Natural Hazards

Dam Failure	Davenport has no risk from dam failure.
Drought	Davenport obtains its water from Cass Rural Water who said its water supply is adequate. As a rural community in an agricultural area, it's economy will be affected by drought if it were to occur.
Flooding	The preliminary floodplain map for Davenport shows the majority of the City will be in the 100-year or 500-year floodplain. Many homes would be affected by flooding and road access cut off. The City is looking at options for permanent flood protection which would negate the need for property owners to purchase flood insurance. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Davenport does not have any notable risk from geological hazards.
Severe Summer Weather	Davenport faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Davenport faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather.
Urban Fire	The only land uses which would present a higher than normal risk of building fire are the grain elevator and the 30,000 gallon propane storage tank. The City indicated it had no concerns about those facilities, as long as proper safety procedures are followed.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

The City of Davenport has a population of 275 people, which means obtaining economies of scale and spreading project costs across the tax base is hindered. Due to limited financial and technical resources, the City will turn to on the state and county for larger scale projects.

Davenport is not a participant in the National Flood Insurance Program but may decide to do so after the approval of FEMA's new floodplain maps. This will entail designating a floodplain administrator and adopting regulations that meet NFIP minimums.

PROGRESS SINCE LAST PLAN

The two items in the 2014 version of the mitigation plan was the installation of a warning siren and improvements that would aid the city's drainage. These have not been accomplished since then and will remain items for this new version of the plan.

MITIGATION ACTIONS

Mitigation Action	**1] Installation of warning sirens**
Hazards Addressed	Severe weather
Responsible Agency	City of Davenport and Red River Regional Dispatch Center
Cost	$50,000
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life. In the meantime, residents will be encouraged to sign up to Code Red to receive alerts via their cell phones.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending on funding availability
Priority	Low

Mitigation Action	**2] Improvements to city's drainage system**
Hazards Addressed	Flooding
Responsible Agency	City of Davenport and State Water Commission
Cost	To be determined
Description	The city does not have a storm sewer system, so the drainage system is inadequate causing localized flooding issues.
Potential Funding Sources	FEMA (PDM and HMGP) with local match, Cass County flood sales tax, State Water Commission, ND Department of Health (CWSRF), USDA Rural Development (Water and Waste Disposal Loan and Grant Program), USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5-15 years
Priority	Medium

Mitigation Action	**3] Install permanent flood protection**
Hazards Addressed	Flooding
Responsible Agency	City of Davenport and State Water Commission
Cost	$3,800,000 to 5,000,000
Description	The city is at risk at of local overland flooding and overland flooding caused by breakout flows from the Sheyenne River. A levee system will reduce the flood risk for the city and reduce or eliminate the need for emergency measures.
Potential Funding Sources	FEMA (HMGP, PDM, and FMA) with local match, Cass County flood sales tax, State Water Commission
Timeline	1-3 years depending on funding availability
Priority	High

Mitigation Action	**4] Install permanent backup generator for the community center**
Hazards Addressed	All hazards

Responsible Agency	City of Davenport
Cost	To be determined
Description	Davenport's community center and city hall was a former school. It has adequate space in the gym to function as an emergency shelter. A backup generator would allow for the center to function in that role even if power remains out for an extended period of time.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	3-5 years
Priority	Medium

FLOODPLAIN MAP

11. Enderlin

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Enderlin was founded alongside the Maple River. A small business district of a few blocks is located between Railway Street and Center Street. Besides the rail line that passes through the city are a grain elevator and an agriculture processing plant owned by Archer Daniels Midland. The town's population has fortunately been itching upwards, rising from 886 in 2010 to 963 in 2017.

Socio-Economic

Enderlin's median age of 47.1 is notably higher than the county's. In terms of median household income, Enderlin is roughly in line with the county sitting at $52,500. At 10%, Enderlin's poverty rate is also in line with the county as a whole.

Housing

The majority of the housing stock, of around 73%, is detached single-family structures. Census data shows that a bit over half of the houses were built before 1950, indicating that many may not be up to the latest building codes or can have maintenance issues, both of which lead to a reduced ability to withstand severe weather.

Transportation

Enderlin is home to a crew-change and yard office for the Canadian Pacific Railway. The rail has crossings at ground level, except for an overpass for Highway 46. Issues of parked trains blocking city streets for extended periods of time have come up. The city's roads are paved.

Emergency Services

Enderlin has a building for the Enderlin Rural Fire Protection District, an entity which has around 20 volunteer firefighters. The eastern half of the fire hall building is located in a high-risk floodplain. EMS is provided by First Medic Ambulance of Ransom County, based 20-30 minutes away in Lisbon.

Health Care

Aside from a Sanford Health clinic, Enderlin does not have any other health care facilities. The nearest hospital is CHI Lisbon Health, a 25-bed Critical Access Hospital with a 24-hour Emergency Level V Trauma Center, in Lisbon.

Critical Facilities and Infrastructure

Enderlin's critical infrastructure includes a school, city hall, fire hall, five water supply wells, five sanitary lift

stations, two water towers, five lagoon cells. A new water well is forthcoming. Of those only the fire hall is located in Cass County. Building permanent flood protection throughout the city will protect the fire hall as well as other properties.

Business and Employers

As alluded to earlier, the ADM processing plant and CP rail yard are significant employers. In the downtown district, one will find restaurants, bars, a butcher shop, banks, a motel, among others. As a rural community with numerous ag-related businesses, Enderlin's economy is susceptible to downturns in the commodities markets resulting from macroeconomic considerations in addition to natural disasters.

Natural Hazards

Dam Failure	Enderlin has no risk from dam failure.
Drought	Enderlin obtains its water via five wells that tap into the Enderlin Aquifer. One of the wells is not producing due to age, therefore a new well is being dug. As a rural community in an agricultural area, it's economy will be affected by drought if it were to occur.
Flooding	The Maple River runs along the eastern boundary of the city and is the main source of flooding. For the small portion of the city which lies in Cass County, the fire hall is located within the mapped floodplain. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate located within the Cass County portion of Enderlin. There are such uses within the Ransom County portion of Enderlin however.
Geological Hazards	The City did not state there were erosion concerns for the hill that extend from the northwest to the southeast of the town.
Severe Summer Weather	Enderlin faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Enderlin faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather.
Urban Fire	The only land uses which would present a higher than normal risk of building fire are the grain elevator and the ADM processing plant. The City indicated it had no concerns about those facilities, as long as proper safety procedures are followed.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town or the trees that line the Maple River.

JURISDICTIONAL CAPACITY

The City of Enderlin has a full time auditor, public works staff and contracted engineering services to assist with the identification and execution of public projects. The City, like others of its size, does rely on state and county resources and assistance for large scale improvements.

PROGRESS SINCE LAST PLAN

The sole item from the 2014 plan was the installation of new storm water pumps, which has been completed. Enderlin lies mostly in Ransom County, who had completed its own multi-hazard mitigation plan in 2015. The following items were listed within that plan. The City indicated these remain relevant and thus are inserted.

MITIGATION PROJECTS

The majority of Enderlin is south of Highway 46 in Ransom County with only a small portion extending into Cass County. Therefore, the Ransom County Multi-Hazard Mitigation Plan addressed most of the city's exposure to natural hazards and the actions that can be taken to mitigate it.

Mitigation Action	**1] Flood mitigation workshop to educate public**
Hazards Addressed	Flooding
Responsible Agency	City of Enderlin in conjunction with FEMA and county emergency management staff
Cost	Up to $500 for materials and staff time per workshop
Description	The majority of Enderlin is located within thee 0.2% floodplain (X Zone). Encouraging homeowners and business owners to consider purchasing flood insurance is worthwhile, particularly as the city is continuing to find a permanent flood protection solution. The workshop can cover examples of higher building standards, elevation certificates, and activities the city is doing that would enhance its CRS rating.
Potential Funding Sources	Allocate cost staff time and materials out of city budget
Timeline	Ongoing activity over planning period. Ideally conduct workshop every year or two years.
Priority	Medium

Mitigation Action	**2] Enroll in the Community Rating System**
Hazards Addressed	Flooding
Responsible Agency	City of Enderlin
Cost	To be determined
Description	Obtaining one of the lower-level classifications in CRS would entail enacting readily achievable action steps that will reduce the impacts of flooding as well as lead to savings for property owners on flood insurance.
Potential Funding Sources	City of Enderlin
Timeline	1-2 years and ongoing maintenance of CRS status
Priority	Medium

Mitigation Action	**3] Permanent levees along Maple River**
Hazards Addressed	Flooding
Responsible Agency	City of Enderlin
Cost	To be determined by engineering professional
Description	Constructing a levee will protect most of the city. Within the part of Enderlin in Cass County, the levee will protect the rural fire district's building.
Potential Funding Sources	FEMA (HMGP and PDM)
Timeline	5-15 years
Priority	High

12. Fargo

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

As the largest city in North Dakota, Fargo has a diverse economy and population that presents a unique set of vulnerabilities. Over the past few decades, Fargo has been experiencing a high rate of growth both in terms of population and jobs. The city has spread outward mainly to the south, due to being constricted by West Fargo to the west and Minnesota to the east.

Lateral growth in the north part of the city has been minor due to the airport and lagoons. Historical satellite imagery from the mid-1980s shows that there were only a few subdivisions south of Interstate 94. Currently, the farthest subdivision is now 5 miles south of the Interstate.

While Fargo's comprehensive plan prioritizes infill development, new greenfield development is anticipated to occur mainly in the southern reaches of the city.

Socio-Economic

Socio-economic variations can present a range of vulnerabilities across Fargo's neighborhoods. In terms of racial and ethnic makeup, the downtown core and the neighborhoods surrounding West Acres Mall (e.g. Willow Park, Village West, and West Acres neighborhoods) are more diverse. The latter has become home to New Americans over the past few decades.

Of the over 10,000 residents who speak a language other than English, 38.4% speak English less than "very well". The most common foreign languages spoken include Kurdish, Arabic, Nepali, Somali, Creole, and Bosnian. The communication of emergency management information needs to take into account the variety of languages spoken in the community.

Lower-income neighborhoods are found downtown and adjacent to downtown, the areas around West Acres Mall, and around NDSU. The latter is the result of the presence of college students. Poverty rates correlate to those income levels.

As the urban hub for the region, Fargo has numerous income-restricted housing developments found throughout the city. The Fargo Housing and Redevelopment Authority is the lead agency providing affordable rental units through the administering of the Housing Choice Vouchers program as well as the direct operation of apartment complexes. The hazard of flooding is ever present in Fargo and thus presents a risk for many of these complexes. Continued buildout of the city's flood wall and levee system over time has given a sizable

measure of safety.

One subsidized housing building to make note of is the Lashkowitz High Rise located in downtown Fargo near the Red River. Aside from flooding, the tower had issues with access for emergency personnel as well as sustained some fire damage in the winter of 2018. The building will be demolished given that it cannot be fixed. A new building with affordable housing units will be built adjacent to the property.

Housing

Rental housing units are a higher share of the housing stock in downtown, area around NDSU, and around West Acres Mall. In Fargo, approximately 55% of residential units are renter-occupied. This is a much higher proportion compared to most cities in the region.

Fargo also has five mobile home parks, three of which are north of Main Avenue. While a valuable source of affordable housing, manufactured housing does not fare as well in severe storms. For example, the lack of a basement or an interior room without windows means residents have less protection during tornados and high-wind storms. None of the five mobile home parks have dedicated storm shelters available to the residents.

The City has added a local amendment to the International Building Code whereby all new and substantially improved manufactured housing units must either be elevated or anchored according to specifications in order to prevent being carried away by floodwaters. Additionally, tie-downs are required for all new and substantially improved mobile homes. Units that were grandfathered in the new ordinances are at a higher risk to storms and floods.

The older houses are found in the core neighborhoods and in north Fargo. The City administers several housing rehabilitation programs for low-to-moderate income households. These fix code deficiencies and therefore improve the condition of houses to withstand natural hazards. Widespread development to the south has meant those houses are built to more recent building codes.

Among renters, a sizable share (36% in 2017) are deemed cost burdened in that 35% or more of their monthly income goes towards housing costs. The areas with the highest concentrations of cost-burdened renters are around NDSU and in the four neighborhoods south of Interstate 94 and near the Red River: Brunsdale, Southpointe, Lincoln, and River Drive. The cost-burden rate is much lower for those who own their homes. Among those with mortgages it is approximately 11%; among those with no mortgages it is 6%. The Village West neighborhood has the highest share of cost-burdened homeowners. This can be explained in part to the sizable mobile home park within that neighborhoods.

Transportation

Fargo and the metropolitan area as a whole is a commercial center for the region. It sits at the cross roads of Interstates 94 and 29, contains an international airport, and BNSF rail lines that carry up to 100 trains daily. Hazardous materials such as oil and anhydrous ammonia travel on those rails. Risks related to transportation incidents and other man-made hazards are discussed in the county's THIRA plan. According to BNSF, the bridges and approaches are designed to withstand the 100-year flood level. Jams resulting from ice and debris can present issues.

Health Care and Nonprofits

As the regional hub, Fargo has multiple medical facilities and elderly care facilities. In 2018, the new Sanford Medical Center was verified as a Level 1 Adult Trauma Center. Essentia Health's hospital in Fargo has a Level 2 rating.

Sanford Health's emergency management staff said that flooding is not a concern for their facilities, except for the Broadway location that is closest to the river. All of their hospitals have sufficient generator capacity while the clinics will just close in the event of a power outage. The new facilities have been built to modern standards, therefore they were hardened against severe storms.

The Veterans Administration hospital is located in north Fargo adjacent to the Red River. It is protected via a floodwall. The hospital had problems in 2016 and 2017 with power outages caused by old infrastructure and untrimmed trees. For each brownout a fuse in one elevator blows out which over time cost hundreds of thousands of dollars to replace. Xcel Energy has fixed this issue in north Fargo neighborhoods.

Because of the proximity to health care and as the hub for the region, the Fargo metro has numerous nursing homes and other similar assisted living facilities for older adults. In emergencies with advanced notice, it takes time and is detrimental to the residents' health to evacuate. Since the 2009 flood, local senior care facilities have upgraded their evacuation plans and procedures. Since flooding is the top concern, the mitigation actions Fargo has or will undertake have greatly reduced the risk and therefore likelihood of needing to evacuate.

A network of nonprofit agencies provides shelter and assistance to those individuals and families experiencing homelessness. However, unsheltered people are particularly vulnerable to the often harsh winters found in Cass County. Fortunately, shelter capacity has increased over the years allowing safe accommodations for people during the coldest months of the year.

Emergency Services

In 2017, Sanford Health opened a 284-bed, 1-million square foot hospital that offers a range of services. It is the only Level I Adult Trauma Center between Minneapolis and Seattle and between Denver and Omaha. Sanford Health's emergency management staff said that all of their locations are either already protected, the flood risk is undefined, or properties will be protected by the Diversion if it comes to pass. Their new facilities are built according to modern standards, therefore there was little concern about withstanding the effects of severe weather.

Essentia Health also has a Level II Trauma Center hospital on 32nd Avenue South. EMS is provided by FM Ambulance Services. 911 calls are answered and processed at the Red River Regional Dispatch Center.

Critical Facilities and Infrastructure

The City of Fargo has been able to invest significantly into its infrastructure to not only accommodate the growth it has experienced, but also to be better prepared for natural disasters and flooding in particular.

Fargo's wastewater treatment plant serves not only its own residents but also the residents of Frontier, Prairie Rose, Briarwood, Oxbow, Reile's Acres, North River, Harwood, Horace, and various rural residential subdivisions. 67 lift stations pump wastewater into the collection system that culminates at the treatment plant in far north Fargo. Over time and as the budget allows, Fargo has been installing backup power generators at its lift stations. Several generator projects are listed in the mitigation action list. Given that the wastewater treatment plant is adjacent to the Red River, it is at risk of flooding. If it were to be inundated, the consequences would be dire for public health and safety. The time necessary to get the plant back online would mean significant pollution of the Red River and lead to widespread property damage. As of writing, Fargo is pursuing a FEMA grant for the construction of a permanent levee.

Fargo's 75 storm sewer lift stations are a crucial component of the city's flood protection efforts, in that it protects the interior of the city by pumping rainfall and snowmelt into the river when the gravity flow no longer works when the Red River is high. Along 2nd Street and Main Avenue near the Veterans Memorial Bridge the oldest storm sewer lift station in the city is being replaced, along with the installation of a removable floodwall that ties into said bridge and the levee near the Lashkowitz High Rise.

The City obtains its drinking water from both the Red and Sheyenne rivers. Recently, an expansion to the water treatment plan has been completed which added membrane treatment technology. This will allow for the removal of sulfate and bromide, a capability that wasn't present before. Additional projects related to hazard mitigation include installing backup power generators and raising the intake pumphouse above base flood elevation.

Businesses and Employers

Fargo is home to several large employers whose impact is felt throughout the county and region. It is not uncommon for people living in the rural, small communities to commute to Fargo for work. As 2017, the largest employers in Fargo were in descending order were Sanford Health, North Dakota State University, Fargo Public Schools, Noridian Mutual Insurance Company, and Essentia Health. The Fargo metropolitan area has become a regional hub for health care, education, technology, and manufacturing sectors. This leads to a more resilient economy overall that can better withstand disruptions and downturns. In terms of natural hazards, flooding and drought are the two that arguably can have the greatest impact upon Fargo's businesses. The economic impact of severe floods are found in the need to divert resources towards flood preparations and also in the disruptions in the supply chain in case transportation routes are cut off by floodwaters. For drought, the impacts to the agricultural sector can nonetheless have a significant impact, even with Fargo's relatively more diverse economy.

Natural Hazards

Dam Failure	Fargo has several low-head dams on the Red River. Failure of these will lead to only minor impacts.
Drought	Fargo obtains its water via the Red River, which is vulnerable to drought. If needed, a secondary intake on the Sheyenne River can be used. The most significant effort aimed at drought mitigation is the project to divert water eastward from the Missouri River. The city has adopted a four-phase drought response plan which elevates the restrictions depending upon the severity of the drought.
Flooding	Fargo has a significant flood risk, as evidenced in the past decade with record or near-record flood stages. In the 2009 flood, the City was close to issuing an evacuation order as the river levels continued to rise. At the time, officials estimated up to 100,000 people were in the evacuation zone. Fortunately, that order did not need to be issued. The experience did emphasize to elected leaders and the public at large the imperative of implementing permanent flood protection measures. Climatic changes, including the present wetter-than-normal cycle, will only aggravate this risk. To prepare against flooding of that magnitude, numerous measures are being pursued. The most notable of these is the Fargo-Moorhead Diversion. This $2.75 billion project will consist of an upstream embankment that will hold back water and direct it westward to a 30 mile long channel, approximately 1,500 feet wide, that will route water around the metropolitan area. Coupled with in-town protection such as floodwalls, levees, and retention, this project will ultimately reduce a 100-year flood event from the current 42.4 feet to 37 feet river level. Other efforts include active enforcement of robust floodplain ordinances including water course setbacks, issuance of floodplain development permits, and building floodproofing codes. Fargo is a participant in CRS at a Class 5 level. Also, FEMA has granted an exemption to Fargo that allows new homes in the 100-year floodplain to have a basement. This was originally approved in 1975 but was recently given an extension.

	Over the last decade, Fargo has bought out 235 homes to the tune of $84.5 million. The city intends to buy at least 28 more homes to allow for the construction of floodwalls and levees.
Geological Hazards	Riverbank slumping has been a concern for many years. Homes built too closely to the river were at risk of compromised structural integrity. Fargo's flood buyout program has removed the vast majority of those buildings which were at risk. Restrictive covenants now ensure that land remains undeveloped in perpetuity.
Severe Summer and Winter Weather	Fargo can face extreme weather throughout the year from weeks of temperatures below zero and whiteout blizzards in the winter to drenching downpours and suddenly forming tornados in the summer. One's ability to engage in steps to reduce the extent of damage possible to one's property, not to mention keep themselves safe during the events, can be constrained by the aforementioned socio-economic factors. Lower-income households do not typically have the wherewithal in their budget to retrofit their houses, if they own their house that is. Those households are more often than not renters, so the onus to undertake mitigation retrofits rests with the property owner and management company. One example is for developers to consider communal safe rooms where residents are better protected compared to the bathrooms of their units. The Fargo Park District indicated that not all of its parks have structures which can serve as storm shelters. Those with buildings have safety areas identified and staff are trained where those are located. At Lindenwood Park, the informational center is capable of serving as a storm shelter for park patrons. Fargo is recognized as a StormReady community by the National Oceanic and Atmospheric Association.
Urban Fire	The Fargo Fire Department updated its Standard of Response Coverage in 2016. This contained a risk assessment of the fire hazards in the city, specifically looking at what areas of the city pose the maximum fire risk, the properties that would be a critical or economic loss, and the greatest non-fire risks. The high risk properties include hospitals, nursing homes, schools, apartment buildings greater than four units, commercial buildings greater than one story or greater than 6,500 square feet, public assemblies, manufacturing, and businesses that store or use reportable amounts of hazardous materials. Denser areas of the city pose a greater fire risk. Downtown Fargo has undergone a revitalization that has meant many buildings have been remodeled and updated according to most current fire codes. In the same vein, the older apartments typically found in the core and northern neighborhoods represent a higher fire risk given they were not built to the stricter codes. At the time, the Standard of Response Coverage found that 30 hydrants in single-family residential areas did not meet the requirement of 1,000 gallons

	per minute standard and 227 hydrants in multi-family/commercial areas did not meet the 3,500 gallons per minute standard. Most of these were found in the older portions of the city, but the Fire Department does not feel these areas are large or isolated enough that they couldn't be reached by water tanker trucks in a timely manner. In November 2018, the City of Fargo was upgraded by the Insurance Services Office from an ISO Class 2 to a rating of ISO Class 1. This has placed Fargo in the top half-percent of all communities nationwide for the fire suppression delivery system. The Fargo Fire Department was judged on emergency communications, water supply, and department operations. It is one of 72 departments that have achieved an ISO Class 1 designation in addition to being Internationally Accredited.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town. The forested areas along the Red River can also be an ignition source for wildfires.

JURISDICTIONAL CAPACITY

The City of Fargo has significantly more resources than many of the smaller communities in the County. A large staff including specialties in engineering, GIS, public works, planning, zoning, accounting and legal. An inspections department enforces codes adopted by the City of Fargo (i.e. 2015 International Codes with local amendments), as well as some of the city's ordinances.

The City has an active ongoing planning program which engages the public in an inclusive manner. These efforts provide a roadmap for elected officials and other community leaders as policy is enacted and implemented. Plans that have been done include a comprehensive plan, a plan specific to the downtown core, a housing study, and action plans for the annual allocation of CDBG and HOME funds. The planning department will soon be in the process of working with the leaders of the core neighborhoods in updating plans specific to those areas.

A substantial budget, comparatively speaking, places Fargo in a better position to accomplish top ranking projects. A local two percent sales tax provides a funding stream for replacing, upgrading, or expanding infrastructure. An infrastructure sales tax of 1% is authorized until 2028; a flood control sales tax is authorized until 2084. Larger scale projects still require assistance from federal and state resources.

PROGRESS SINCE LAST PLAN

Fargo has continued making progress towards building a resilient city that is better equipped to respond to disasters. Since flooding remains the prominent concern, the projects mentioned in

previous plan which have been completed or are no longer relevant include:

- The relocation of lift stations #13, 18, and 19
- The completion of the 2nd Street floodwall by the new city hall
- Headworks improvements at the water treatment plant to more effectively manage flows
- Installation of west side overflow interconnects to allow sewage to be pumped to lagoons during heavy rain events
- Relocation of storm sewer lift station and installation of permanent generator at lift station #65
- Convert portable lift station to permanent with generator at lift station #64
- Installation of emergency generators at lift stations #26, 46, and 2
- Flow shedding project for sanitary sewer relief.

As previously mentioned, the City is one entity among multiple working to make progress on the FM Diversion and Red River Water Supply Project.

MITIGATION ACTIONS

Mitigation Action	**1] Install failsafe traffic signals, street lighting and message boards along designated emergency routes**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$5 million
Description	This updated equipment will ensure traffic can still flow along key evacuation routes during hazard-caused power outages.
Potential Funding Sources	Infrastructure sales tax
Timeline	10-50 years
Priority	Low

Mitigation Action	**2] Remove structures from slough and cutbank areas along Red River**
Hazards Addressed	Flooding (riverine and flash)
Responsible Agency	City of Fargo
Cost	$15-20 million
Description	Continuing with property acquisition along rivers and streams will remove structures at-risk of erosion.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 years
Priority	Low

Mitigation Action	**3] Execute Fargo's Revised Comprehensive Flood Mitigation Plan**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$80 million

Description	Completely implementing Fargo's comprehensive flood control plan will save nearly a billion dollars in structural losses as well as removes threats to life and property by reducing reliance on emergency flood protection measures. This plan identifies buyouts and levees in areas hardest to provide emergency protection for. It also seeks to avoid loss of housing because of construction of freeboard purely for the purpose of obtaining certification in areas that have not experienced flooding in the past.
Potential Funding Sources	Flood control sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**4] Bury electrical power and communication lines**
Hazards Addressed	Wind, Thunderstorms, Winter storms
Responsible Agency	Private utility companies
Cost	$50 million
Description	Coordinate with electric and telecommunications companies in identifying appropriate areas where lines can be buried.
Potential Funding Sources	Private companies' capital workplans
Timeline	10-25 years
Priority	Low

Mitigation Action	**5] Elevate, floodproof, or fill basements of residential structures in the Special Flood Hazard Area**
Hazards Addressed	Flood
Responsible Agency	Private
Cost	$150 million
Description	Structures that can not be feasibly acquired and moved can be retrofitted instead according to FEMA standards that ultimately lead to a reduced flood insurance premiums for the property owners.
Potential Funding Sources	Flood control sales tax
Timeline	15-30 years
Priority	Low

Mitigation Action	**6] Floodplain storage areas in select locations citywide (250 acre footprint or larger)**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$20 million for three ponds for total of $60 million
Description	Floodwalls and levees alone cannot control flooding, unless combined with a water retention strategy.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**7] Storm water retention ponds in select locations citywide**
Hazards Addressed	Flooding (localized)
Responsible Agency	City of Fargo

Cost	$5 million
Description	This will provide relief to the City's storm sewer system during heavy rainfall events, thus minimizing damage to properties as well as maintaining traffic flow for emergency personnel.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**8] Install relief storm sewer in select locations citywide**
Hazards Addressed	Flooding (localized)
Responsible Agency	City of Fargo
Cost	$10 million
Description	In areas where the existing storm sewer is undersized, a relief storm sewer can provide extra capacity for peak flows during extreme precipitation events.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**9] Install permanent generator at STS LS #8 (Drain 10: 32nd Street south of Main Avenue)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will ensure pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**10] Install permanent generator at STS LS #9 (Drain 40: 45th Street at Main Avenue)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if

	water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 Years
Priority	Medium

Mitigation Action	**11] Install permanent generator at STS LS #16 (Drain 10 south of 2nd Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 Years
Priority	Medium

Mitigation Action	**12] Install permanent generator at STS LS #21 (Drain 3: West of 18th Street and north of 12th Avenue North)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 Years
Priority	Medium

Mitigation Action	**13] Install permanent generator at STS LS #33 (East of Dakota Drive on 19th Avenue North)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The

	potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 Years
Priority	Medium

Mitigation Action	**14] Install permanent generator at STS LS #50 (45th Street South of 3rd Avenue North)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 Years
Priority	Medium

Mitigation Action	**15] Raise gatewell and install permanent generator at STS LS #1 (2nd Street South at Main Avenue)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise gatewell: $100,000 Permanent generator: $150,000
Description	This will maintain traffic for civilian, city and emergency personnel and also from river flooding. This lift station pumps water from the underpass on 2nd Street north of Main Avenue. If this lift station lost power the underpass would be impassable to citizens, city maintenance workers and emergency vehicles during rain events. The top of the gatewell elevation is below the flood of record and needs to be ringed with sandbags during high flood events to keep river water from expelling out of the lift station.
Potential Funding Sources	Infrastructure and/or flood control sales taxes
Timeline	1-10 years
Priority	High

Mitigation Action	**16] Install permanent generator at STS LS #3 (25th Street at Main Avenue)**
Hazards Addressed	Flooding, Thunderstorms
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintaining traffic for civilian, city and emergency personnel. This lift station pumps water from the underpass on 25th Street north of Main Avenue. If this

	lift station lost power the underpass would be impassable to citizens, city maintenance workers and emergency vehicles during rain events.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	Medium

Mitigation Action	**17] Install permanent generator at STS LS #6 (45th Street at 19th Avenue North)**
Hazards Addressed	Flooding, Thunderstorms
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water in Cass County Drain 40 that collects water from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. Lift station has free flow gates but if water downstream of the lift station is at a higher elevation the pumps are needed.
Potential Funding Sources	Infrastructure sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**18] Install permanent generator at STS LS #11 Trollwood (east lift)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**19] Install permanent generator at STS LS #14 (West of 25th Street at 26th Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift

	station was to become inoperable. This lift station is critical to pump storm water out of Bluemont Lakes in the event of heavy rainfall/large runoff.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**20] Relocate lift station and install permanent generator at STS LS #15 (East of 9th Street at 26th Avenue South - Country Club)**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	Relocate lift station: $2 million Install permanent generator: $150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The location of the lift station makes it susceptible to river flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**21] Install permanent generator at STS LS #16 (Cass County Drain 10 south of 2nd Avenue South)**
Hazards Addressed	Flooding, Thunderstorms
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 years
Priority	Medium

Mitigation Action	**22] Install permanent generator at STS LS #17 (University Drive at Main Avenue)**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water from the underpass on University Drive north of Main Avenue. If this lift station lost power the underpass would be impassable to citizens, city maintenance workers and emergency vehicles during rain events.

Potential Funding Sources	Infrastructure sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**23] Install permanent generator at STS LS #20 (Island Park)**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$150,000
Description	This will maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**24] Upgrade to duplex pumping station for redundancy and install permanent generator at STS LS #24 (Wastewater treatment plant)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$2 million
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. This lift station also pumps runoff from around the wastewater treatment plant. The potential for property damage, wastewater plant flooding along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax, flood sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	**25] Install permanent generator at STS LS #26 (Ridgewood Addition)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax
Timeline	10-20 years
Priority	Low

Mitigation Action	26] Relocate lift station at STS LS #30 (Milwaukee bike trail south of 40th Avenue)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$200,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	1-3 years
Priority	High

Mitigation Action	27] Install permanent generator at STS LS #34 (West of Elm Street on Forest Avenue)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	28] Install permanent generator at STS LS #35 (Cass County Drain 10 south of 6th Avenue South)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	High

Mitigation Action	29] Relocate lift station and install permanent generator at STS LS #39 (VA Hospital)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo

Cost	Relocate lift station: $2 million Install permanent generator: $150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. Location of the lift station makes it susceptible to river flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax
Timeline	5-15 years
Priority	Low

Mitigation Action	**30] Relocate lift station and install permanent generator at STS LS #40 (East of Eagle Street on 32nd Avenue North)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Relocate lift station: $2 million Install permanent generator: $150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. Location of the lift station makes it susceptible to river flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	10-20 years
Priority	Low

Mitigation Action	**31] Raise gatewell at STS LS #41 (10th Street North – 3700 Block)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$10,000
Description	Minimize river flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the gatewell is close to the flood of record. If water was to expel out of the gatewell it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	10-20 Years
Priority	Low

Mitigation Action	**32] Relocate lift station and install permanent generator at STS LS #42 (5th Street South at 21st Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Relocate lift station: $2 million Install permanent generator: $150,000

Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. Location of the lift station makes it susceptible to river flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**33] Relocate lift station and install permanent generator at STS LS #43 (West side of University Drive at Rose Coulee)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Relocate lift station: $2 million Install permanent generator: $150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. Location of the lift station makes it susceptible to river flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**34] Elevate lift station cover slab, pump and control panel at STS LS #47 (38th Street south of Cass County Drain 27)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Contain river water in the lift station structure and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-15 years
Priority	Medium

Mitigation Action	**35] Raise gatewell at STS LS #48 (38th Street north of Cass County Drain 27)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$50,000
Description	Contain river water in gatewell and maintain pumping to minimize flooding damages to commercial properties along with maintaining traffic for civilian,

	city and emergency personnel. The top of the gatewell elevation is below the flood of record elevation. If water was to expel out of the gatewell it would lead to flooding commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**36] Raise gatewell and install permanent generator at STS LS #49 (45th Street north of Cass County Drain 27)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise gatewell: $50,000 Install permanent generator: $150,000
Description	Contain river water in gatewell and maintain pumping to minimize flooding damages to commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the gatewell elevation is below the flood of record elevation. If water was to expel out of the gatewell it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax
Timeline	5-15 years
Priority	Medium

Mitigation Action	**37] Raise lift station at STS LS #52 (East of Broadway at Kandi Lane)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$100,000
Description	Contain river water in gatewell side of the lift station while maintaining pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable. The top cover of the lift station is above the 2009 highwater elevation however, the risk of flood water expelling out of the gatewell on a larger flood event is possible.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	10-20 years
Priority	Low

Mitigation Action	**38] Install permanent generator at STS LS #53 (Drain 10 at 40th Avenue North- CC20)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$200,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water in Cass County Drain 10 that collects water from both residential and commercial properties. The

	potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	10-20 years
Priority	Low

Mitigation Action	**39] Raise gatewell and install permanent generator at STS LS #54 (36th Street north of 40th Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Install permanent generator: $150,000
Description	This lift station pumps water from the underpass on 40th Avenue South at I29. If this lift station lost power the underpass would be impassable to citizens, city maintenance workers and emergency vehicles during rain events.
Potential Funding Sources	Infrastructure sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**40] Raise gatewell and install permanent generator at STS LS #55 42nd (Street north of Cass County Drain 27)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$50,000
Description	Contain river water in the gatewell and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the gatewell elevation is below the flood of record elevation. If water was to expel out of the gatewell it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**41] Raise lift station and install permanent generator at STS LS #56 (42nd Street south of Cass County Drain 27)**
Hazards Addressed	Flooding, Thunderstorms
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years

Priority	Medium

Mitigation Action	**42] Raise lift station and install permanent generator at STS LS #57 (Trollwood - west lift)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**43] Raise lift station at STS LS #58 (University Drive at 64th Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	1-10 years
Priority	High

Mitigation Action	**44] Install permanent generator at STS LS #59 (36th Street at 9th Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water primarily from commercial areas and from the 9th Avenue South underpass at Interstate 29. If this lift station lost power the underpass would be impassable to citizens, city maintenance workers and emergency vehicles during rain events.
Potential Funding Sources	Infrastructure sales tax, flood sales tax
Timeline	5-15 years
Priority	Medium

Mitigation Action	45] Raise lift station and install permanent generator at STS LS #61 (East side of 5th Street at 18th Avenue South)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	46] Raise lift station and install permanent generator at STS LS #67 (Osgood lift station - east side Cass County Drain 27)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	47] Raise lift station and install permanent generator at STS LS #68 (Osgood lift station - west side Cass County Drain 27)
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax
Timeline	5-15 years
Priority	Medium

Mitigation Action	48] Raise lift station and install permanent generator at STS LS #70 (45th Street south of Cass County Drain 27)

Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**49] Raise lift station and install permanent generator STS LS #71 (Cass County Drain 53 at 52nd Avenue South)**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	Raise lift station: $150,000 Install permanent generator: $150,000
Description	Contain river water in gatewell side of lift station and maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. The top of the lift station is lower than emergency levees installed in 2009. If water was to expel out of the gatewell side of the lift station it would lead to flooding residential and commercial property along with street flooding.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**50] Install permanent generator at STS LS #75 (2nd Street North at 15th Avenue)**
Hazards Addressed	Flooding, Thunderstorm
Responsible Agency	City of Fargo
Cost	$150,000
Description	Maintain pumping to minimize flooding damages to residential and commercial properties along with maintaining traffic for civilian, city and emergency personnel. This lift station pumps water that collects in the storm sewer system from both residential and commercial properties. The potential for property damage along with street flooding is present if this lift station was to become inoperable.
Potential Funding Sources	Infrastructure sales tax, flood sales tax.
Timeline	5-15 years
Priority	Medium

Mitigation Action	**51] Emergency generator for lift station #58**
Hazards Addressed	Thunderstorms, heavy rainfall intensity
Responsible Agency	City of Fargo

Cost	$1 million
Description	Power supply to Lift Station #58 in event of grid power loss, allowing the city to continue sewer operations thus minimizing flooding, overflows, and sewer backup damages to properties.
Potential Funding Sources	Infrastructure Sales Tax
Timeline	1-10 years
Priority	High

Mitigation Action	**52] Emergency generators for wastewater treatment plant**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$2 million
Description	The installation of four backup power generators will ensure the water treatment plant continues operation during disasters.
Potential Funding Sources	FEMA (HMGP or PDM) with local match including infrastructure sales tax
Timeline	1-5 years
Priority	High

Mitigation Action	**53] Effluent force main improvements**
Hazards Addressed	Thunderstorms, Flooding
Responsible Agency	City of Fargo
Cost	$4 million
Description	Modify existing force main to more efficiently manage flows, which potentially minimizes flooding, overflows and sewer backup damages to commercial and residential properties.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	Low

Mitigation Action	**54] Storm Lift Station Upgrade - Wastewater Treatment Plant**
Hazards Addressed	Thunderstorms, heavy rainfall intensity, flooding
Responsible Agency	City of Fargo
Cost	$500,000
Description	Install a new pump and retrofit the existing pump station to allow the Storm Lift Station to operate correctly during high flow and high water events at the Wastewater Treatment Plant preventing surcharging of the storm sewer system.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-10 years
Priority	Low

Mitigation Action	**55] Emergency standby generator at Sheyenne River Pump Station**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$1 million
Description	Power supply to the Sheyenne River Pumping Station in event of grid power loss allowing the City to continue to provide raw water to the treatment

	plant to be treated for fire protection and to serve users
Potential Funding Sources	Infrastructure sales tax
Timeline	1 year (2019)
Priority	High

Mitigation Action	**56] Relocation of the Sheyenne River Pump Station**
Hazards Addressed	Flooding
Responsible Agency	City of Fargo
Cost	$15 million
Description	New location to remove loss of service due to flood event
Potential Funding Sources	Infrastructure sales tax
Timeline	1-3 years
Priority	High

Mitigation Action	**57] Emergency standby generator at Red River Pump Station**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$1 million
Description	Power supply to Red River Pumping Station in event of grid power loss allowing the City to continue to provide raw water to the treatment plant to be treated for fire protection and to serve users
Potential Funding Sources	Infrastructure sales tax
Timeline	1-5 years
Priority	Low

Mitigation Action	**58] Emergency Standby Generator at High Service Pump Station**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$1 million
Description	Power supply to High Service Station in event of grid power loss allowing the City to continue to provide potable water for fire protection and to serve users and maintain pressure within the distribution system to prevent contamination
Potential Funding Sources	Infrastructure sales tax
Timeline	5-10 years
Priority	High

Mitigation Action	**59] Electric Actuated Valve for Water Source**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$350,000
Description	The City of Fargo utilizes two surface water sources. The two sources come together in the yard of the Water Treatment Plant and currently a manual valve needs to be adjusted to switch water sources, this actuated valve would provide a near instantaneous transfer allowing the City to maintain their treatment process in the event of the loss of a raw water station

Potential Funding Sources	Infrastructure sales tax
Timeline	5-10 years
Priority	Low

Mitigation Action	**60] Expand dry chemical storage capacity**
Hazards Addressed	All hazards
Responsible Agency	City of Fargo
Cost	$500,000
Description	The City of Fargo currently has 7 days capacity for dry chemical storage at water treatment plant. This requires additional chemical deliveries weekly to provide for water treatment. This project would allow for 30 days' worth of storage.
Potential Funding Sources	Infrastructure sales tax
Timeline	1-3 years
Priority	Low

Mitigation Action	**61] Permanent floodwalls at High Service Pump Station**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$500,000
Description	Floodwalls around the High Service Pump Station to protect against a flood allowing the High Service Station to stay in service allowing the City to continue to provide potable water for fire protection. serve users and maintain pressure within the distribution system to prevent contamination
Potential Funding Sources	Infrastructure sales tax
Timeline	5-10 years
Priority	High

Mitigation Action	**62] Red River Pump Station flood prevention and flood wall construction**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$5,810,750
Description	Reconstructing the intake pump house at the water treatment plant will raise all pumps, controls, and electrical components above base flood elevation flood wall height. Also, install a flood wall to tie into the existing flood wall north of the pump stations as well as tying to Phase III of the Belmont Flood protection project on the south. This will protect the Red River Pump Station intake and the Water Treatment plant.
Potential Funding Sources	FEMA Pre-Disaster Mitigation (75%), Water Utility (25%)
Timeline	1-2 years
Priority	High

Mitigation Action	**63] Permanent levee for Wastewater Treatment Plant**
Hazards Addressed	Flood
Responsible Agency	City of Fargo
Cost	$4,900,000
Description	The construction of permanent, long-term flood protection consisting of

	levees, sheet piles, and road raises will protect the wastewater treatment plant up to a 500-year flood without the need for a temporary enclosure.
Potential Funding Sources	Flood Mitigation Assistance (FMA)
Timeline	Begin construction 2020
Priority	High

Mitigation Action	**64] Relocation of Red River Intake Screens**
Hazards Addressed	Drought
Responsible Agency	City of Fargo
Cost	$1.5 million
Description	Relocating the intake screens from the side channel to the deeper center channel of the River would allow prolonged use of the Red River during drought periods.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-10 years
Priority	Low

Mitigation Action	**65] Emergency Water Supply Line Improvements**
Hazards Addressed	Drought
Responsible Agency	City of Fargo
Cost	$12 million
Description	Provide water source Sheyenne River to the Water Treatment Plant for treatment in the event of the Red River being too low.
Potential Funding Sources	Infrastructure sales tax
Timeline	5-10 years
Priority	High

Mitigation Action	**66] Encourage rooftop retention on buildings and parking garages in downtown Fargo**
Hazards Addressed	Severe weather (heavy precipitation events)
Responsible Agency	City of Fargo, private developers
Cost	Dependent on building
Description	Mitigates stormwater quantity and quality as well as storage of water for fire suppression if stored on high elevation. It is estimated in downtown Fargo there are enough flat roofs to have approximately 875,000 cubic feet of capacity.
Potential Funding Sources	Building owners
Timeline	Ongoing
Priority	Low

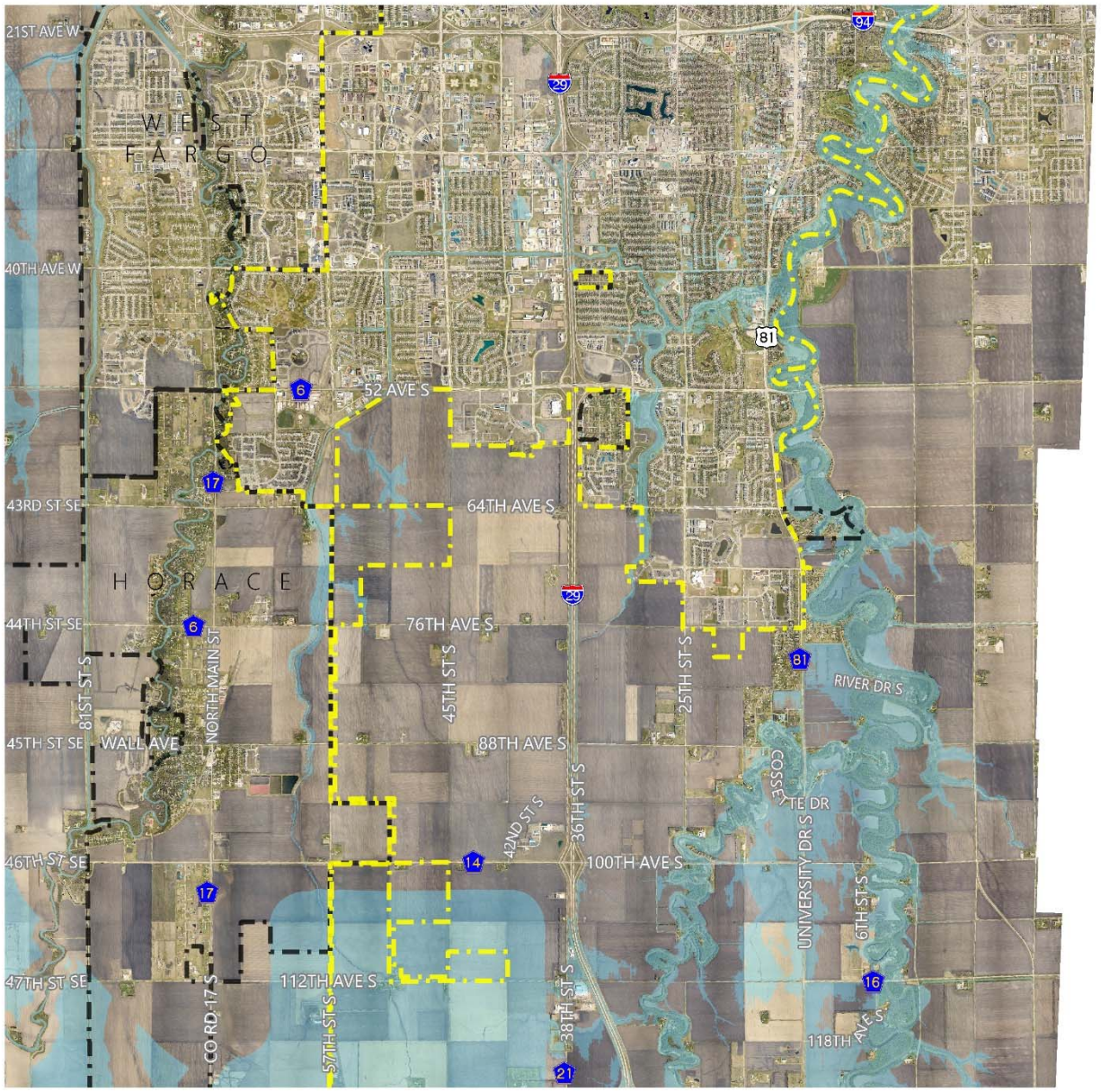
Mitigation Action	**67] Retain rainwater on street through green infrastructure methods**
Hazards Addressed	Thunderstorms, heavy rainfall
Responsible Agency	City of Fargo, private developers
Cost	To be determined according to location and method
Description	The installation of storage capacity underground (i.e. under sidewalks and roads where space is available) can provide rainwater retention in an area where large-scale detention/retention basins are infeasible such as the more densely built downtown.

Potential Funding Sources	Incorporate within normal road construction budget and funding sources, North Dakota Department of Health (CWSRF)
Timeline	Ongoing
Priority	Low

Mitigation Action	**68] Increase tree canopy coverage downtown to reduce urban heat island effect**
Hazards Addressed	Excessive heat
Responsible Agency	City of Fargo Forestry Department, private property owners
Cost	To be determined
Description	Having adequate shade can reduce temperatures in the downtown core, thus alleviating somewhat the urban heat island effect. Air conditioning costs are reduced and the aesthetic value of street trees will increase property values.
Potential Funding Sources	Incorporate within Forestry Department budget paired with grants from National Fish and Wildlife Foundation, ND Forest Service, and other funders.
Timeline	Ongoing
Priority	Low

Mitigation Action	**69] Support the establishment of a day center for homeless individuals**
Hazards Addressed	Extreme cold and heat
Responsible Agency	Social service agencies with support from City of Fargo
Cost	To be determined
Description	Most of the homeless shelters in the area are only open in the evenings and overnights. A center whereby people can visit during the day will not only provide a space to access services but will also be a place to warm up or cool down during extreme temperatures.
Potential Funding Sources	Foundation grants, City of Fargo's CDBG allocation and social service funding
Timeline	To be determined, but within five years
Priority	Low

FLOODPLAIN MAP



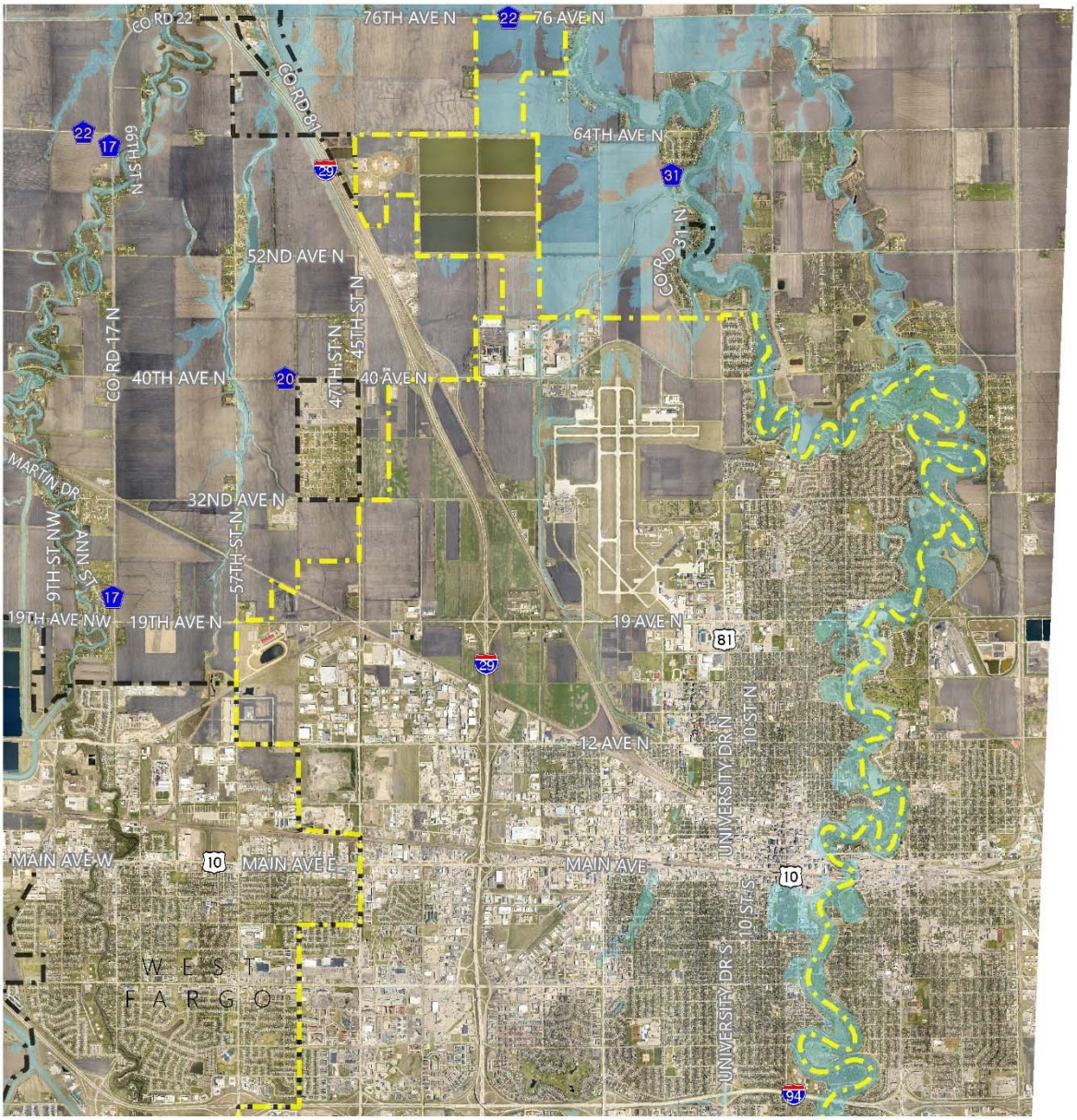
source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

100 Year Floodplain

Fargo City Limits

1 Mile

CASS COUNTY GOVERNMENT



source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

100 Year Floodplain

Fargo City Limits

1 Mile

CASS COUNTY GOVERNMENT

13. Frontier

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Frontier is a small but fully built-out community of 214 that is landlocked by Fargo on all sides. Therefore, growth is effectively stunted. Six businesses line 36th Street South adjacent to Interstate 29. The remainder of the city are single-family homes.

Socio-Economic

Frontier is a wealthier community with a median household income of $123,750 and no registered levels of poverty. Its median age of 46.9 years is higher than that of the county.

Housing

As stated earlier, all of the housing stock is single-family, owner-occupied detached homes. 54% of the homes were built in the 1970s, with the remainder built between 1980 and 2000. While the houses are older, the higher income level of the community would show that the households will have more resources towards implementing mitigation projects.

Transportation

Frontier has quick access to Interstate 29 with an onramp on Fargo's 52nd Avenue. All of the city's roads are paved.

Emergency Services

Frontier is served by FM Ambulance and the Cass County Sheriff's Department.

Health Care and Nonprofits

The nearest hospital is Essentia Health's hospital on 32nd Avenue South. Frontier does not have any health care or social service operators in town.

Critical Facilities and Infrastructure

Frontier has its own sewer system but is connected to Fargo's who ultimately treats the wastewater. It does not have a stormwater system installed. Water is provided by Cass Rural Water, although a few properties still have a private well.

Businesses and Employers

Most residents commute elsewhere for work. However, there are several businesses on the west end of town including a farm equipment supplier, auto body shop, fireworks retailer, and an automobile dealership.

Natural Hazards

Dam Failure	Frontier has no risk from dam failure.
Drought	Frontier obtains its water from Cass Rural Water District who said its water supply is adequate. There are no water users within Frontier that are particularly susceptible to the effects of drought.
Flooding	Per the existing floodplain maps, the northeast quadrant of the city is in the area for 1% annual chance for flooding with the remainder of the city in the 0.2% annual chance flood hazard area. Fortunately, many homes are elevated above the 100-year flood mark along with the roads in the community. In 2012, Frontier became a participant in NFIP thus allowing property owners to purchase flood insurance. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Frontier has no risks from geological hazards.
Severe Summer Weather	Frontier faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather. There is no public storm shelter in town.
Severe Winter Weather	Frontier faces the same severe summer weather risk as other jurisdictions. The older houses may be less able to withstand severe weather.
Urban Fire	The only land uses which would present a higher than normal risk of building fire would be the fireworks retailer.
Wildfire	The risk of wildfire reaching the city is very low, given that it is within the developed metropolitan area. These are typically contained before putting any structures in danger.

JURISDICTIONAL CAPACITY

Frontier has a small population and limited staff capacity. Therefore, they may turn to county and state resources for financial and technical assistance. There is a community center from which for people to gather and disseminate information.

Frontier has an adopted zoning ordinance that includes a section, applied to the entirety of the city, that addresses flood damage prevention. This section requires development permits that show construction is not in risky areas nor would aggravate flooding issues. Other provisions include structures needing to be anchored, flood-resistant building materials to be used, utility equipment being elevated, and elevating the first floor of buildings on earthen fill.

PROGRESS SINCE LAST PLAN

The warning sirens and permanent flood protection items were in the 2014 plan, neither of which were completed. The solution for flooding will invariably be one regional in nature which can include the proposed diversion project.

MITIGATION ACTIONS

Mitigation Action	**1] Installation of warning sirens**
Hazards Addressed	Severe weather
Responsible Agency	City of Frontier and Red River Dispatch Center
Cost	$50,000
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending on funding availability
Priority	Low

Mitigation Action	**2] Upgrade storm sewer system**
Hazards Addressed	Flooding
Responsible Agency	City of Frontier
Cost	To be determined
Description	The storm sewer system was installed in the early 1990s. It will need to be upgraded in order to handle storm water adequately.
Potential Funding Sources	(ND Department of Health) Clean Water State Revolving Fund
Timeline	3-5 years depending on funding availability
Priority	Medium

Mitigation Action	**3] Create permanent flood protection around the City**
Hazards Addressed	Flooding
Responsible Agency	City of Frontier and Cass County
Cost	To be determined
Description	This would reduce damages to public and private property and allow a more resilient community to without the frequent emergency flood preparations that have recently plagued the area.
Potential Funding Sources	Federal, state, and county
Timeline	5-10 years
Priority	High

FLOODPLAIN MAP

source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

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14. Gardner

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

The majority of Gardner consists of single-family houses. Other uses are a grain elevator, warehouse, parkland, and civic and religious buildings. The City is amidst farmland and has Interstate 29 on its western side. Several new homes have recently been built or are currently under construction on 4th, 5th, and 6th Streets.

Socio-Economic

Census data indicates that Gardner's median age is slightly under that of the county as a whole: 31.0 years compared to 32.2. This can be explained by the increase in the number of young families. The median income is $33,750; although it should be noted that among those who are not retired mean earnings are $52,347 per household. Even though younger families have been moving into town, approximately 17% of Gardner is 62 years or older.

Housing

Around 56% of the houses in Gardner are older than 1950, meaning that many houses may not be able to withstand severe weather like a newer house can. As previously noted, numerous new houses have been built in the past few years. There are a few mobile home units in the city.

Transportation

Gardner is adjacent to and has an exit on Interstate 29. A BNSF rail line passes through the city and services Hunter Grain Co.'s elevator. The city's streets are unpaved.

Emergency Services

It is home to a fire hall of the Gardner Fire District, of which consists of 24 volunteer firefighters. The fire hall can serve as an emergency shelter if the need arises. It is a steel structure with room for two small-sized fire trucks.

Health Care and Nonprofits

Gardner has no health care or social services within the city. The nearest hospitals are in the Fargo metropolitan area.

Critical Facilities and Infrastructure

Gardner's critical infrastructure includes a fire station, a water pump station where the community connects to Cass Rural Water, sanitary lift station, and lagoon ponds. The city does not have an underground storm water system installed; rather, it utilizes ditches and culverts. There is a slight, but sufficient, slope across the city that has led to improperly graded culverts. The result has been areas of town which have issues with water drainage.

Businesses and Employers

The two notable employers in Grandin are Hunter Grain Company and Winfield United. Both are in the agricultural sector and therefore susceptible to the impacts of severe weather and fluctuations in the commodities market. Most residents commute for work, presumably to Fargo-Moorhead, given the mean commuting time is 28.3 minutes according to Census data. Maintaining access to Interstate 29 is vitally important to ensure residents can get to and from work.

Natural Hazards

Dam Failure	Gardner has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who said its water supply is adequate. Its two businesses are in agriculture, which is highly vulnerable to drought.
Flooding	Gardner has not been mapped by FEMA, however the city can be affected by overland flooding from poor water drainage near Interstate 29. Portions of town have inadequate drainage leading to the potential of localized flooding. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Gardner faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Gardner faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The grain elevator presents the highest fire risk of any building in town.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

As a town of around 70 to 100 people, Gardner has limited financial and technical resources upon which to draw from. Assistance from the State and County is necessary for carrying out mitigation projects. They do have a contract with an engineering firm who can assist with various improvement projects.

PROGRESS SINCE LAST PLAN

The two items from the 2014 plan remain uncompleted but are still relevant for Gardner. Therefore, they remain for this plan update albeit with important updates.

MITIGATION ACTIONS

Mitigation Action	**1] Installation of generators at the water station and sanitary sewer lift station**
Hazards Addressed	Severe Weather that may impact power
Responsible Agency	City of Gardner
Cost	$100,000
Description	The water intake station and sanitary sewer lift station are critical to homes and business in town having basic services. Back-up generators would reduce the threat of discontinued service in the event of a power outage Not directly related to hazard mitigation, Gardner needs a larger lift station to accommodate recent and projected growth. The estimated cost of this will be around $250,000. Additional pond capacity is also needed.
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-5 years
Priority	High

Mitigation Action	**2] Drainage improvement project**
Hazards Addressed	Flooding
Responsible Agency	City of Gardner with assistance of City Engineer
Cost	$2 million
Description	The installation of storm sewer and a storm sewer lift station would reduce flooding issues in town and the associated damages to private property and public infrastructure. Currently, the culverts are improperly graded and therefore unable to adequately remove water.
Potential Funding Sources	State Water Commission, Cass Flood Sales Tax, ND Health Dept. HMGP, USDA Rural Development, USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5-15 years
Priority	Medium

15. Grandin

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Grandin consists primarily of single-family homes along with a few businesses, including a grain elevator. The population has remained around 190 people since the 2010 Census, showing that growth is minimal or nonexistent.

Socio-Economic

Grandin's socio-economic makeup shows that the median household income is higher than the county's, sitting at $65,625 while the poverty rate is near zero. In terms of age, the median is roughly in line with the county's being at 37.1 years. It is estimated that only 9.2% of residents are over 62 years of age.

Housing

As far as the condition of the housing stock goes, many homes were built before 1970 (approximately 60.3% according to Census data). This may entail the structures do not meet the stricter safety standards and are thus more vulnerable to severe weather.

Transportation

Grandin is adjacent to Interstate 29. Many of Grandin's residents may commute to the Fargo metropolitan area for work, therefore it is imperative to maintain access to the onramp to Interstate 29. A BNSF rail line passes through town which services the grain elevator located there.

Emergency Services

Grandin is in the service area of the Hunter Ambulance Service, which is located nearly 20 minutes away. The Grandin Rural Fire Protection District has its fire hall in town and is a volunteer-based fire department.

Health Care and Nonprofits

Grandin does not have any health care or nonprofit operations of its own. The nearest hospital would be in Sanford Health's in Hillsboro that is nearly 20 minutes away.

Critical Facilities and Infrastructure

The city's critical infrastructure includes a fire station, water pump station where the community connects to Cass Rural Water, and a sanitary lift station.

Businesses and Employers

Most residents who work commute elsewhere. Besides the aforementioned grain elevator, the other businesses are a bar and a bank.

Natural Hazards

Dam Failure	Grandin has no risk from dam failure.
Drought	The city is serviced by Cass Rural Water District who indicated their water supplies are sufficient. Its businesses are in agriculture, which is highly vulnerable to drought.
Flooding	Grandin has not been mapped by FEMA. Nonetheless, the city can have problems with overland flooding from the Elm River to the north as well as insufficient internal drainage. The City functions as a small agricultural service center that would be affected by flood damage to nearby farm fields. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Grandin faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town. The fire hall does have a backup power generator which enhances its role as an emergency shelter.
Severe Winter Weather	Grandin faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	There are several abandoned houses in town that present a fire risk. The grain elevator is the other use which has a higher than normal fire risk. In fact, one had caught fire and was destroyed in the past.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Grandin has limited financial and technical resources as a town of around 175 to 200 people. Assistance from the State and County is necessary for funding and carrying out large scale projects. The City does contract for engineering services to assist with identifying and carrying out improvement projects.

PROGRESS SINCE LAST PLAN

The 2014 plan listed a warning siren as an action item. Elected officials have indicated that the siren at the fire hall has good coverage and therefore is adequate. This item has been removed from this version of the plan.

MITIGATION ACTIONS

Mitigation Action	**1] Replace ditch system with storm sewer**
Hazards Addressed	Flooding (localized)
Responsible Agency	City of Grandin with assistance of city's contracted engineer
Cost	$2 million

Description	The installation of storm sewer and a storm sewer lift station would reduce overland flooding issues in town and associated damages to private property and public infrastructure.
Potential Funding Sources	ND Department of Health (Clean Water State Revolving Fund), USDA Rural Development (Water and Waste Disposal Loan and Grant Program), State Water Commission, Cass County Flood Sales Tax, USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5-15 years
Priority	Medium

Mitigation Action	**2] Address abandoned buildings**
Hazards Addressed	Urban fire
Responsible Agency	City of Grandin
Cost	To be determined
Description	The city has around three abandoned buildings in town which present a threat to health and safety as well as a higher fire risk. Acquiring those properties and demolishing the buildings will address blighted conditions.
Potential Funding Sources	CDBG
Timeline	3-5 years
Priority	Medium

16. Harwood

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

The City of Harwood has seen strong population growth since 2000, increasing from a shy over 600 people to nearly 800 by 2017. Growth has occurred mostly on the western side of Interstate 29, although new residences have been built on the east nearer to the Sheyenne River.

Socio-Economic

Harwood is a higher income community with a median household income of $93,750 in 2017. Accordingly, the poverty rate is extremely low (1.1%). In regard to median age, at 38.1 years is not too much greater than the county's. 14.7% of residents are 62 years or older while a notable share of 25.7% are under 18 years old.

Housing

A significant share of the housing was built during the 1970s (41%) with many others built in the decades after. Nearly all of the housing stock are single-family detached units.

Transportation

Interstate 29 bisects the town. Given its proximity to Fargo, it is safe to presume that many residents use I-29 to commute to jobs there. All of the roads in Harwood are paved.

Emergency Services

Harwood is served by FM Ambulance Service for EMS needs. Harwood Area Fire and Rescue is an all-volunteer department, consisting of 25 active volunteers, whose fire hall has been built to withstand high winds and tornado events. Additionally, the building is easily cleanable if flooded.

Health Care and Nonprofits

The nearest hospital with an emergency department would be Sanford Health's on Veterans Boulevard or Essentia Health's on 32nd Avenue South, both in Fargo.

Critical Facilities

Harwood's critical infrastructure includes its city hall, community center, and an elementary school. The city obtains its water from the West Fargo Aquifer. It has a water treatment and storage plant and two 200' deep wells. The water plant has a detection, aeration, and iron manganese removal filtration system.

Storm water is managed via ditches instead of an installed underground system.

Businesses and Employers

Harwood is primarily a bedroom community with a few home-based and service businesses. CHS Dakota Plains has a location in Harwood.

Natural Hazards

Dam Failure	Harwood has no risk from dam failure.
Drought	The city obtains its own water via a series of wells, which have found to be adequate. An adopted drought management plan guides how the city will respond to drought conditions.
Flooding	Flooding is a pertinent issue for the City as they have seen overland flooding originating from the Sheyenne River. The floodplain map currently in effect has almost the entirety of Harwood in a Special Flood Hazard Area. The Plan B design of the FM Diversion runs north of Harwood and would take the city mostly out of the floodplain. Harwood has a school and one licensed in-home daycare, both of which are located within the mapped floodplain.
Geological Hazards	There are no significant geological hazards affecting the town.
Severe Summer Weather	Harwood faces the same severe summer weather risk as other jurisdictions. The older homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Harwood faces the same severe summer weather risk as other jurisdictions. The older homes may experience higher heat loss compared to newer homes.
Urban Fire	The grain elevator presents the highest fire risk of any building in town.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town. The forested areas along the Sheyenne River can also be an ignition source for wildfires.

JURISDICTIONAL CAPACITY

The City of Harwood has an active City Council, mayor, auditor and public works superintendent in town and is contracted with an engineering firm. The City will need to turn to state and county resources for undertaking larger scale mitigation projects. Harwood has adopted and enforces the ND State Building Code, zoning ordinances, and a flood damage prevention ordinance.

PROGRESS SINCE LAST PLAN

The principle issue identified during the last planning process, that also remains the most important now, is flooding. Permanent flood protection was listed as an action step. The exact details on how this is to be done, if at all, remained undetermined as the Fargo-Moorhead Diversion was in the planning and approval processes. As of this writing, the Diversion is further along but construction has not begun in earnest. Therefore, the City remains in a holding pattern regarding if it needs to implement flood protection measures on its own or not.

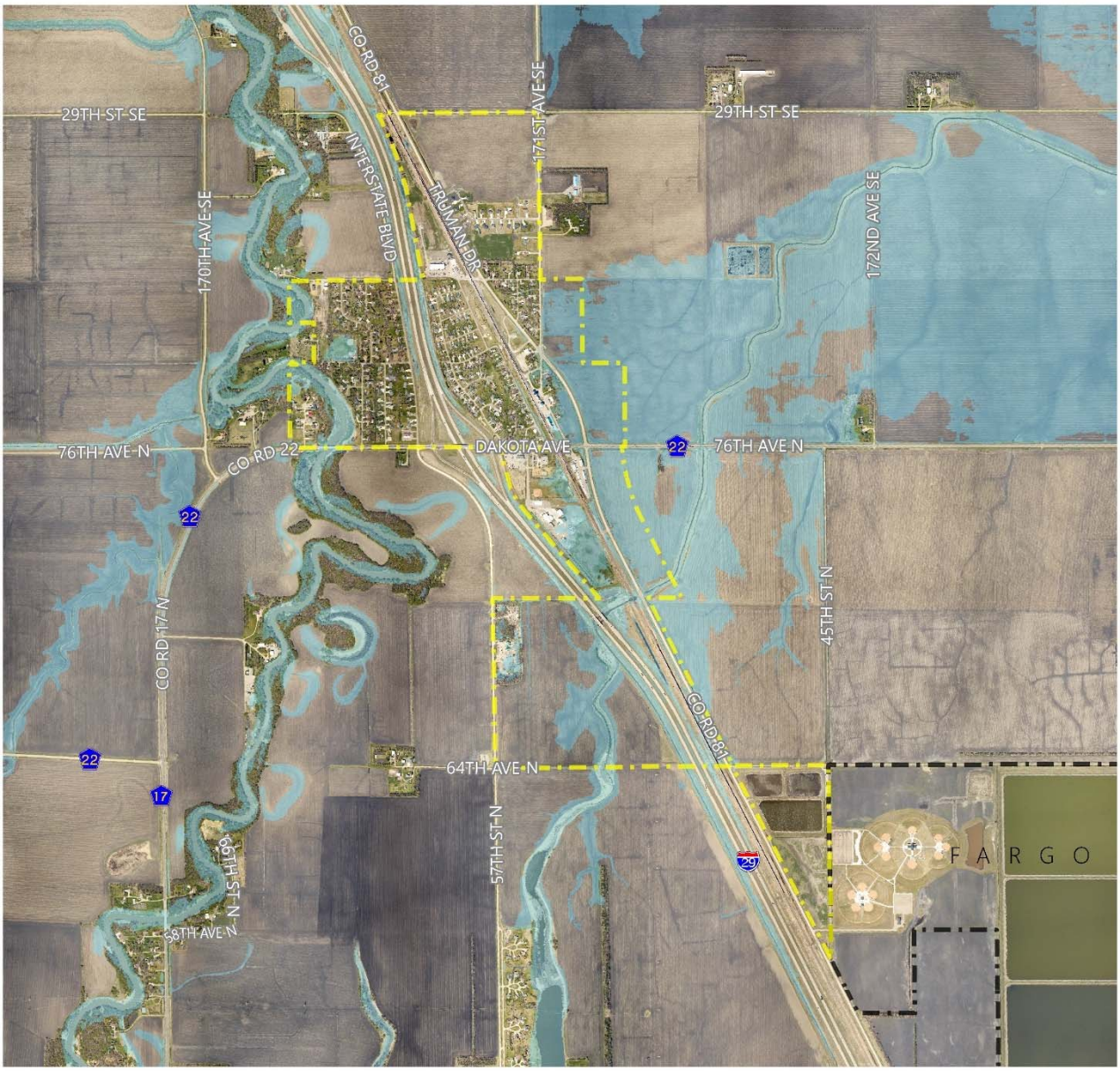
MITIGATION ACTIONS

Mitigation Action	1] Increase permanent flood protection throughout Harwood
Hazards Addressed	Flooding
Responsible Agency	City of Harwood
Cost	To be determined
Description	The City is waiting to see whether or not the FM Diversion will begin construction before examining what flood protection measures would be appropriate.
Potential Funding Sources	FEMA (PDM, HMGP, or FMA) with local match, ND State Water Commission, Cass County flood control sales tax
Timeline	5 years
Priority	High

Mitigation Action	2] Install backup power generators at lift station
Hazards Addressed	All hazards
Responsible Agency	City of Harwood
Cost	$200,000
Description	A back-up generator at the lift station would reduce the threat of discontinued service in the event of a power outage.
Potential Funding Sources	FEMA (PDM or HMGP) with local match
Timeline	5 years
Priority	High

Mitigation Action	3] Install backup power generator at fire hall
Hazards Addressed	All hazards
Responsible Agency	Harwood Fire Department
Cost	$50,000
Description	The fire hall is a critical facility in that it houses the department's trucks and equipment. It also serves as a staging area for disaster response efforts. Ensuring it remains powered is vitally important.
Potential Funding Sources	FEMA (PDM or HMGP) with local match
Timeline	5 years
Priority	Medium

FLOODPLAIN MAP



source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping imagery date May 2017 | map updated January 2019

100 Year Floodplain

Harwood City Limits

1,000 Feet

CASS COUNTY GOVERNMENT

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17. Horace

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Horace has been growing at a brisk pace, increasing 184% from 2000 to 2017. New subdivisions were platted adjacent or near the Sheyenne River to accommodate new residents who desired the aesthetic amenity presented by the river. In response to ever increasing enrollment, the West Fargo Public School District will build a new high school within the city limits of Horace at Sheyenne Street and 76th Ave S. This new school will be able to accommodate 1,000 students upon opening, with room for future expansion. Additionally, the Horace Elementary will be undergoing an expansion to accommodate new students.

The city is undertaking an update to its long-term comprehensive and transportation plan with a horizon looking towards 2045. This document, once completed by the end of 2019, will guide the city's zoning and subdivision ordinances, capital improvements plan, and annual budget as it deals with continued growth.

Socio-Economic

Horace is among the wealthiest cities in the county with a median household income of $110,870. Not surprisingly, poverty registers at an extremely low rate (1.8%). A sizable share of people, 43.1%, have a four-year post-secondary degree or higher.

Housing

For the most part, the condition of the housing stock is good. The mobile homes located at Sheyenne Trailer Court and Willow Court (approximately 38 spots in total) may require more attention when it comes to hazard mitigation. Horace does require manufactured homes to be elevated, anchored, or tied down to resist the flow of floodwater. Also, mobile homes tend to present a higher fire risk. There is no public storm shelter in the mobile home park.

Transportation

County Highway 17 bisects Horace. Most of the city's roads are paved.

Emergency Services

Horace is in the boundary FM Ambulance Service. The Horace Rural Fire Protection District covers the city and an area east towards the Red River. A new modern fire hall was built in 2016.

Health Care and Nonprofits

The nearest hospitals would be the Sanford Medical Center and Essentia Health, both in Fargo.

Critical Facilities and Infrastructure

Critical infrastructure in the City of Horace includes city hall, community center, and an elementary school. The city's water utility covers most users, but some portions of the city are connected to Cass Rural Water instead.

Horace is in the process of installing a sanitary sewer line that will connect to Fargo's regional sanitary system. Once completed, the process of decommissioning the lagoons can begin.

Businesses and Employers

Horace has a few businesses along County Highway 17. Most residents, it can be presumed, commute for work since it is close to Fargo.

Natural Hazards

Dam Failure	Horace has no risk from dam failure.
Drought	Horace sources its own water while some properties are served by Cass Rural Water District. There are no land uses in Horace that are extra vulnerable to the effects of drought.
Flooding	Flooding has been a challenge for the City of Horace. While the Sheyenne Diversion has eliminated flood risk from the river, the land along County Drain 27 has a lower elevation than adjacent areas. Any future development in this area must requires a minimum of 50 feet set back to ensure properties are beyond the drain's right-of-way. Newly developed areas will also require retention ponds to be installed when built out. The Adelman, Ironwood, and Chestnut neighborhoods can potentially experience flash flooding conditions, given they have drainage issues currently. The Horace Elementary School is located just outside of the area protected by the Sheyenne River Diversion. There are seven licensed daycare operations in town; three are not protected by the Sheyenne River Diversion. There are no other properties where vulnerable populations live or congregate.
Geological Hazards	There have been minimal problems associated with riverbank slumping. The setback requirement of at least 150 feet from any drain or watercourse, if not more based upon the recommendations of the City Engineer, for structures has prevented conditions whereby the normal riverine erosion would present a concern.
Severe Summer Weather	Horace faces the same severe summer weather risk as other jurisdictions. The mobile homes may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Horace faces the same severe summer weather risk as other jurisdictions. The mobile homes may experience higher heat loss compared to newer homes.
Urban Fire	One facility that may present a higher than typical risk of fire are the liquified petroleum gas storage tanks located on the southern end of Main Street at

	the intersection with Liberty Lane. Nearby land uses are several homes, industrial businesses, and farm fields.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. The forested areas along the Sheyenne River can also be an ignition source for wildfires.

JURISDICTIONAL CAPACITY

Horace has an active city council, planning and zoning committee, park board, and public works department. The city contracts with a firm for engineering services. It is home to the Horace Rural Fire Protection District's fire hall, a modern facility that was recently built in 2016.

The city has the capacity to engage in long-range and capital improvement planning. The city's ordinances contain provisions for storm water management as well an overlay zoning district for the floodplain that delineates appropriate uses therein. The ND State Building Code, with local modifications, is enforced.

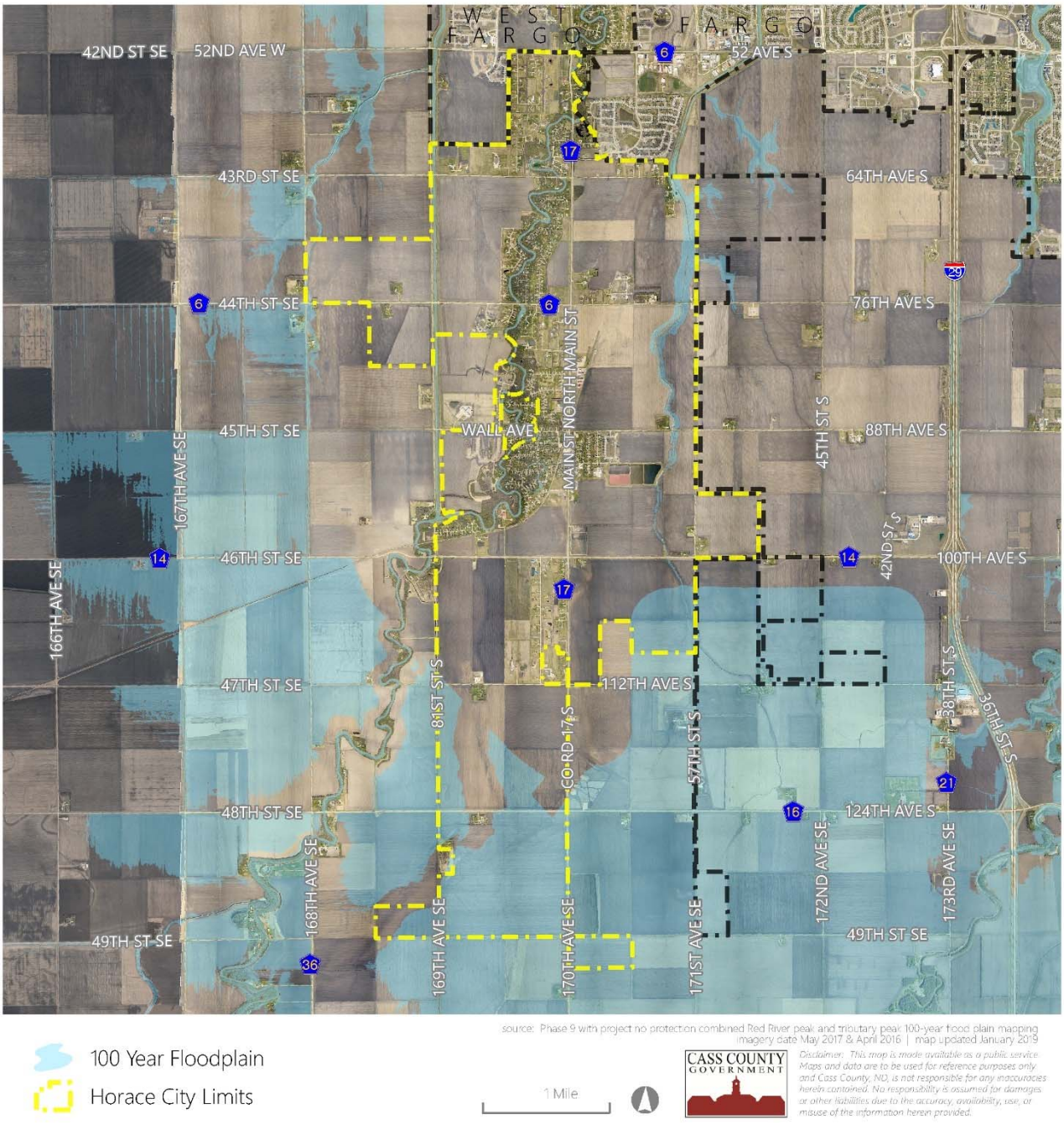
PROGRESS SINCE LAST PLAN

The only action item from the previous plan was to enhance the existing storm sewer and lift station capacity. This item remains for this plan as it has not been accomplished yet.

MITIGATION ACTIONS

Mitigation Action	**1] Enhance existing storm sewer and lift station capacity**
Hazards Addressed	Flooding
Responsible Agency	City of Horace
Cost	To be determined
Description	Increasing the capacity of the city's storm sewer system and installing new lift stations as needed, particularly as the city continues to grow and build out, will be necessary to deal with severe precipitation events.
Potential Funding Sources	Special assessments levied against properties, Cass County Flood Sales Tax
Timeline	1-5 years
Priority	High

FLOODPLAIN MAP



source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 & April 2016 | map updated January 2019

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18. Hunter

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Hunter is a small rural community in north central Cass County of a little over 300 people, a tally that has remained roughly the same over the years. Several buildings are located along Main Street/County Highway 18 including a grain elevator, café, retail, and agricultural-related services. The remainder of town is residential.

Socio-Economic

Hunter's median household income of $64,821 is high for the county. However, the poverty rate is roughly the same compared to the county at 12.4%. The median age of 40.3 is higher than the county average, but in line with other rural towns.

Housing

It is estimated that 56% of the houses were built before 1960, potentially indicating that many may not be up to the latest building codes. The vast majority of the housing stock is single-family detached.

Transportation

County Highway 18 passes through the middle of town. Most of the town's roads are paved, but there are some unpaved gravel roads that can be more prone to being washed out.

Emergency Services

For EMS coverage, Hunter is served by Hunter Ambulance Service right in town. The all-volunteer Hunter Fire Protection District is also located in town.

Health Care and Nonprofits

The nearest hospital is located 25 to 30 minutes away in Hillsboro.

Critical Facilities

Critical infrastructure includes a pump house that connects the city to Cass Rural Water and a sanitary sewer lift station.

Businesses and Employers

With most of the businesses in Hunter being small, there is no one notable employer. As a small rural community, the effects of downturns in the agricultural sector will be felt by some of those local businesses.

Dam Failure	A high-hazard dam is located on the west side of town. Were to fail or be overtopped, buildings may be inundated. This dam does not meet current safety standards for spillway capacity but did meet the conditions in effect at the time of construction. There have not been any problems in the past related to the spillway capacity.
Drought	Hunter receives its water from the Cass Rural Water District who indicated its water supplies are sufficient in normal times. As a rural community, its businesses will feel the ripple effect of farmers' reduced income during drought. The grain elevator, in particular, is vulnerable.
Flooding	The City of Hunter has exposure to flooding risk via the south branch of the Elm River. The potential exists for flood waters to inundate the Main Street bridge and a few properties along the south edge of town. Internal drainage issues have arisen as a result of heavy rain. There are no nursing homes, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate. Hunter has two licensed in-home daycares.
Geological Hazards	The city has no areas that are prone to erosion or other geological failures.
Severe Summer Weather	Hunter faces the same severe summer weather risk as other jurisdictions. The older housing stock may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Hunter faces the same severe summer weather risk as other jurisdictions. The older housing stock may experience higher heat loss compared to newer homes.
Urban Fire	The one facility that may present a higher than typical risk of fire is the grain elevator. There are several older houses in town that the City has encouraged the owners of to fix up. Older houses typically do not meet modern fire codes. On April 26, 2018, an early morning fire destroyed the municipally-owned bar.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town. The forested areas by the dam reservoir and along the stream can also be an ignition source.

JURISDICTIONAL CAPACITY

The City of Hunter has an active City Council, mayor, auditor and a maintenance provider in town and a contract with outside engineering services to assist the community in identifying and carrying out improvement projects. Hunter follows the latest ND State Building Code. The City will have to rely on state and county resources for larger scale projects.

PROGRESS SINCE LAST PLAN

The two action items listed below were in the 2014 version of the plan. These have yet to be completed and therefore remain action items for this update.

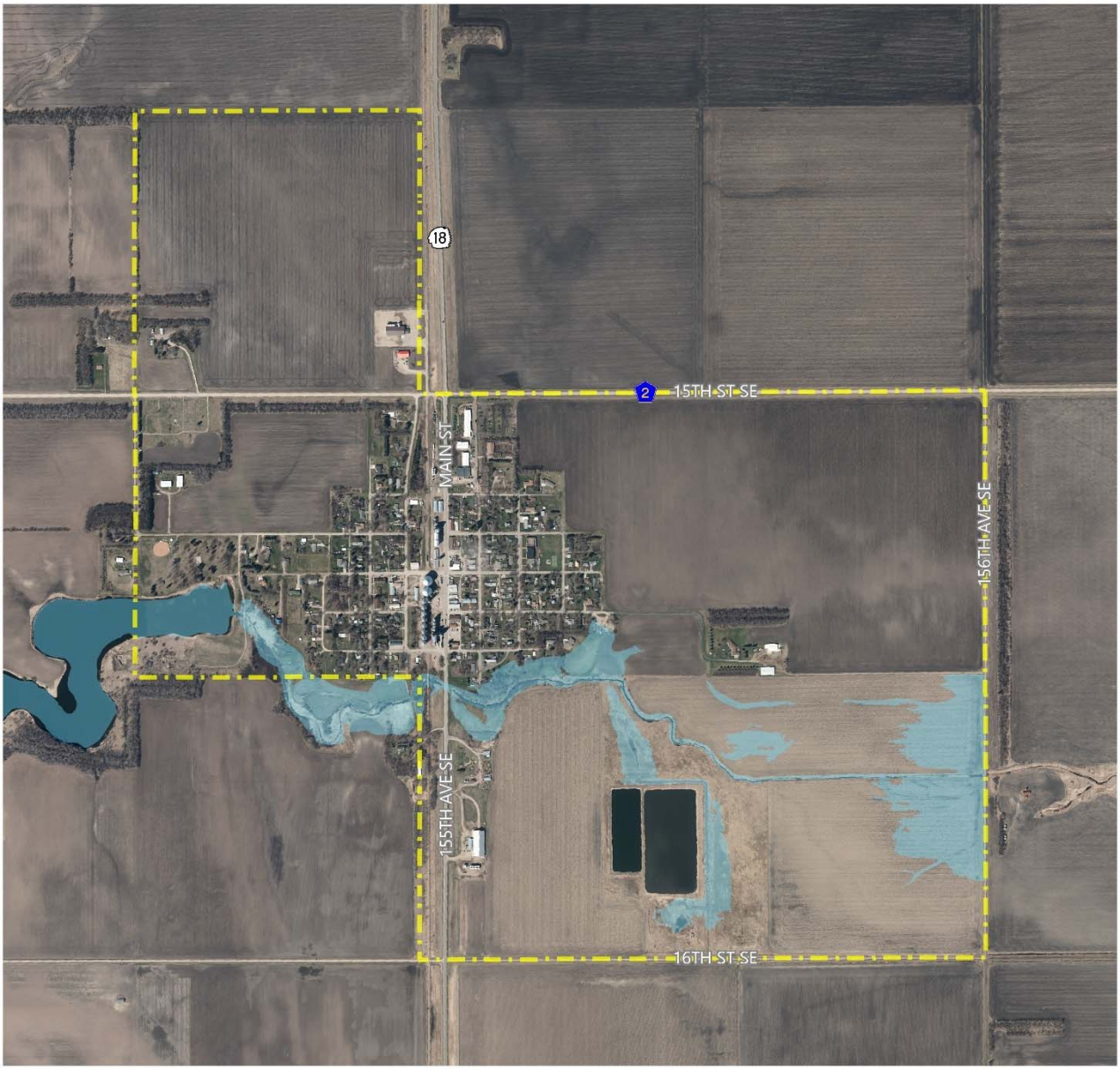
MITIGATION ACTIONS

Mitigation Action	1] Installation of generators at the water pump house and sanitary sewer lift station
Hazards Addressed	Severe Weather that may impact power
Responsible Agency	City of Hunter
Cost	To be determined
Description	The water intake station and sanitary sewer lift station are critical to homes and business in town having basic services. Generators would reduce the threat of discontinued service in the event of a power outage
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years
Priority	Medium

Mitigation Action	2] Dredging ditches and replacing culverts in town
Hazards Addressed	Flooding (localized due to drainage issues)
Responsible Agency	City of Hunter
Cost	To be determined
Description	This will increase capacity, reduce issues of standing water, and impacts to property and infrastructure.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending on funding availability
Priority	High

Mitigation Action	3] Upgrade the spillway capacity of the Hunter Dam to modern standards.
Hazards Addressed	Dam failure
Responsible Agency	City of Hunter
Cost	To be determined
Description	The dam's spillway capacity was built to the standards at the time. Upgrading it to modern standards will ensure it can function during the severe precipitation events that are more common nowadays.
Potential Funding Sources	North Dakota State Water Commission with local match
Timeline	4-5 years
Priority	Low

FLOODPLAIN MAP



19. Kindred

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Kindred is a town of around 780 residents situated in far south Cass County near the Sheyenne River. Serving as a bedroom community 20 miles southwest of the metropolitan area, it has seen growth over the years. A residential subdivision has been recently built on the east end of town adjacent to the airport.

Socio-Economic

Kindred has a higher median household income ($81,000) and a poverty rate that is near Cass's level (10.6% for the city compared to 11.2% for the county). Data indicates the presence of many young families given the lower median age of 30.3 years and the fact that 32.3% of residents are under the age of 18.

Housing

The vast majority of housing units are single detached (71%), but there is a notable share of triplexes or quadplexes (15%). Along Rustad Court between Dakota Street and Spruce Street are spots for 13 mobile homes. Most of the housing stock was built between the 1980s and 2010s.

The Housing Authority of Cass County has a low-rise apartment building for those with limited means. These structures do not have basements into which residents can seek shelter during tornados and high winds.

Transportation

Kindred is located just off of County Highway 46 on the very south edge of Cass County. Within town all of the roads are paved. Odegaard Field at Kindred Davenport Regional Airport has a 3,300 by 60 foot concrete lighted runway. Several aircraft service businesses and flight instruction are held at the airport.

Emergency Services

EMS is provided by Kindred Area Ambulance Service. The Kindred Rural Fire Protection District, a department consisting of 19 volunteer firefighters, serves the town and surrounding rural area. An expansion to the fire hall was completed in 2018.

Health Care

The nearest hospitals would be in Fargo which is an approximately 30 minute drive away.

Critical Facilities and Infrastructure

Critical infrastructure includes the school, city hall, a public works building, the airport, a water pump house, a water tower, three sanitary lift stations, two storm sewer lift stations, and the fire hall.

The older part of town does not have a storm sewer system, although installing a system is on the city's project list.

Businesses and Employers

Kindred is a town of small businesses, a lot of whom serve the local population. Many residents commute to places of employment in the metropolitan area. A notable employer is the Kindred Public School who employ 115 full-time equivalent.

Natural Hazards

Dam Failure	Kindred does not have any risk from dam failure.
Drought	Kindred receives its water from the Cass Rural Water District who indicated adequate supplies. The businesses serving the agricultural sector will feel the effects of drought.
Flooding	Flooding is the most prominent hazard for Kindred. Experience has shown overland flooding has come from southwest of the city but has not ever reached any structures. FEMA has not included the city itself within its floodplain maps. Rather, it has mapped the surrounding area. County Highway 15 can become inundated which blocks off Kindred's southern entrance. 24 homes are located adjacent to the Sheyenne River and therefore are in the SFHA. However, those are outside of the city limits of Kindred. The two school buildings and four daycare operations are not located within the mapped floodplain. There are no other facilities where vulnerable populations live or congregate.
Geological Hazards	County Highway 46 is close enough to the Sheyenne River to be at risk of riverbank slumping.
Severe Summer Weather	Kindred faces the same severe summer weather risk as other jurisdictions. The older housing units may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Kindred faces the same severe summer weather risk as other jurisdictions. The older housing units may experience higher heat loss compared to newer homes.
Urban Fire	The one facility that may present a higher than typical risk of fire is the grain elevator.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Kindred employs an auditor and public works superintendent. It contracts with a firm for engineering services. An active planning and zoning committee oversees the enforcement of the city's zoning ordinances. For larger

scale projects, they will have to turn to county, state, and federal entities for assistance.

PROGRESS SINCE LAST PLAN

The new levee and slope stabilization projects from the 2014 plan remain unfinished and are included in this update as well.

MITIGATION ACTIONS

Mitigation Action	**1] Build a new levee on the south of Highway 46**
Hazards Addressed	Flooding
Responsible Agency	City of Kindred with assistance from the City Engineer
Cost	$500,000
Description	A levee built on the south end of town will address overland flooding coming from the Sheyenne River
Potential Funding Sources	FEMA (PDM, HMGP, and FMA) with local match, Cass County flood control sales tax, ND State Water Commission
Timeline	5 years
Priority	Medium

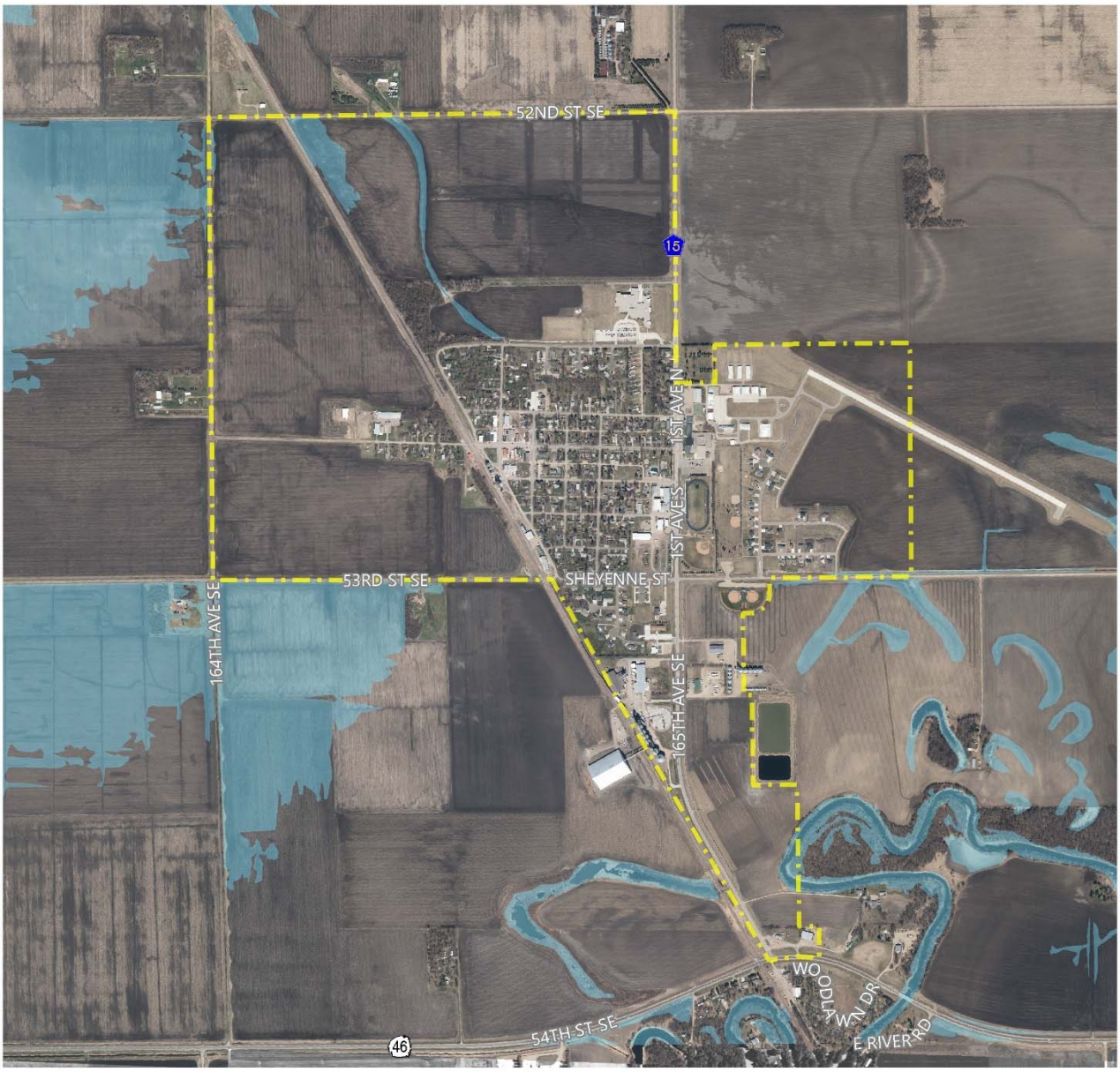
Mitigation Action	**2] Stabilize the slope south of Highway 46 along the bank of the Sheyenne River**
Hazards Addressed	Geological hazard
Responsible Agency	Cass County
Cost	$250,000
Description	Implementing stabilization measures will reduce the risk of damages to the county highway and nearby private property
Potential Funding Sources	FEMA (PDM and HMGP) with county match
Timeline	3 years
Priority	Medium

Mitigation Action	**3] Backup generators for three lift stations**
Hazards Addressed	Flooding
Responsible Agency	City of Kindred
Cost	$200,000
Description	Ensuring these remain operational during power outages will allow continued service and prevent damage caused by backups.
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	5 years
Priority	High

Mitigation Action	**4] Install storm sewer system and lift station in the original townsite.**
Hazards Addressed	Flooding
Responsible Agency	City of Kindred
Cost	To be determined
Description	Periodic internal flooding has occurred because of the city's poor drainage. The very high water table, likely caused by many homes having their sump pumps connected to the sewer system, has caused significant inflow and

	infiltration problems. Requiring homeowners to pump water above ground would only contribute to the existing drainage issues. Installing a storm sewer system and lift station would rectify these problems.
Potential Funding Sources	FEMA (PDM and HMGP) with local match, ND Department of Health (CWSRF), USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	5 years
Priority	Medium

FLOODPLAIN MAP



20. Leonard

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Leonard is a community of around 300 residents. The population has remained relatively stable over the years. New development does not occur often. A few businesses line Railroad Avenue while the remainder of town is residential.

Socio-Economic

Leonard has a higher than average median household income sitting at $60,125. Not unrelated, the poverty is quite low at 5.1%. The median age is 38.2 years. 26.1% of residents are under 18 years of age; 21% are 62 years or older.

Housing

The housing stock in Leonard is aging and some homes are becoming run-down. According to Census data, approximately 80% of the houses were built before 1980. In fact, 33% of the homes in Leonard were built before 1950. This indicates that many may not be built according to the stricter safety building codes. Additionally, there are several old structures which have been abandoned and thus present a risk to the public through vandalism and fire.

Transportation

County Highway 18 bounds Leonard on the eastern side. Within town, the majority of roads are unpaved gravel. Overall, the condition of the roads are good. Separating the town in half is a Red River Valley Western rail line, which serves the grain elevators.

Emergency Services

Leonard is jointly covered by Casselton Ambulance Service and Kindred Area Ambulance Service; both are around 20-minute drive away from town. The Leonard Fire Department has a steel structure fire hall with six-stall garage.

Health Care

Leonard does not have any health care facilities of its own. Rather, the nearest hospitals are in Fargo around 45-minute drive away.

Critical Facilities and Infrastructure

In 2018, Leonard was fully hooked up to Cass Rural Water. Previously most residents had their own wells. The City does not have an installed storm sewer system, but rather relies on ditches and culverts for stormwater management. It has been found through experience that the culverts' capacity will need to be expanded to handle increasingly stronger rains. A new pump station would help remove standing water quicker.

Businesses and Employers

Leonard has several small retail and service businesses in addition to the aforementioned grain elevator owned by Maple River Grain and Agronomy.

Natural Hazards

Dam Failure	Leonard does not have any risk from dam failure.
Drought	Leonard has recently been connected to Cass Rural Water District who has adequate supply of water. The businesses serving the agricultural sector will feel the effects of drought.
Flooding	Leonard is not within a mapped floodplain but the potential for flash flooding still exists. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Leonard has no risk of geological hazards.
Severe Summer Weather	Leonard faces the same severe summer weather risk as other jurisdictions. The older housing units may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Leonard faces the same severe summer weather risk as other jurisdictions. The older housing units may experience higher heat loss compared to newer homes.
Urban Fire	The one facility that may present a higher than typical risk of fire is the grain elevator.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

The City of Leonard has an active City Council and a contract with outside engineering services to assist the community in identifying and carrying out improvement projects. Due to its size, it does turn to state and county resources for larger scale projects. The city employs only one staff member: the auditor. In addition to the city council, there is an active planning and zoning committee.

PROGRESS SINCE LAST PLAN

The previous plan had the installation of a warning siren as an action item. Leonard does, in fact, have a warning siren. That item has been removed for this plan. Progress has not been made on the drainage improvement project but is still one Leonard will pursue.

MITIGATION ACTIONS

Mitigation Action	**1] Improve drainage by installing pump station to move water to legal drain approximately 1 mile south**
Hazards Addressed	Flooding (localized)
Responsible Agency	City of Leonard
Cost	$1 million
Description	The development of a permanent system to move standing water out of town by utilizing an already existing legal drain would reduce damages to public and private property and lessen strains on city infrastructure.
Potential Funding Sources	FEMA (HMGP and PDM) with local match, County Flood Sales Tax
Timeline	5-10 years depending on funding availability
Priority	Low

Mitigation Action	**2] Permanent backup generator for lift station**
Hazards Addressed	Flooding
Responsible Agency	City of Leonard
Cost	$50,000
Description	Installing a permanent generator saves time and effort in hooking up the portable generator the city already owns.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-3 years depending of funding availability
Priority	Medium

Mitigation Action	**3] Tear down dilapidated structure located on Railroad Avenue**
Hazards Addressed	Urban fire
Responsible Agency	City of Leonard
Cost	To be determined
Description	A building on Railroad Avenue that used to house a hardware store has fallen into disrepair and will need to be demolished.
Potential Funding Sources	CDBG with local match
Timeline	1-2 years
Priority	High

Mitigation Action	4] Harden the city shop to better withstand natural hazards
Hazards Addressed	All hazards
Responsible Agency	City of Leonard
Cost	To be determined
Description	The city shop building was acquired via tax forfeiture and is inadequately prepared against disasters. For example, it has no heat and is insufficiently insulated. An evaluation of the facility by a qualified professional will determine what can be done in terms of mitigation. This may include the installation of a backup generator.
Potential Funding Sources	Dependent upon specific items identified
Timeline	2-3 years
Priority	Low

Mitigation Action	5] Install new or upgrade existing culverts around Leonard
Hazards Addressed	Flooding (localized)
Responsible Agency	City of Leonard
Cost	To be determined
Description	The city's internal drainage can be enhanced by replacing culverts around town with those that are greater capacity.
Potential Funding Sources	ND Department of Health (Clean Water State Revolving Fund loan), USDA Rural Development (Water & Waste Disposal Loan and Grant)
Timeline	3-4 years depending on funding availability
Priority	Low

21. Mapleton

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Mapleton has an estimated population of around 900 people, an increase of nearly 40% since 2010. New residential subdivisions have sprung up on the south side of town. Over the years, new industrial operations have opened near interstate. Continued growth in that southeastern industrial area is limited due to inadequate flood protection.

Socio-Economic

Mapleton's median household income of $78,487 is higher than the county's. Only around 15% of the population earns less than $50,000 per year. Concurrently, the poverty rate is low at 1.6%. The median age is 31 year which is in line with Cass County. Around 35.1% of people are under 18 years of age, indicating the presence of young families. The town does have Mapleton Elementary School.

Housing

Nearly all of housing units are 1-unit detached structures, with most built between the 1980s and now. The level of households being cost burdened is negligible.

Transportation

Mapleton is located directly north of Interstate 29 with easy access to the metropolitan area. All of the roads are paved. A BNSF rail line passes through with two at-grade crossings.

Emergency Services

Mapleton is covered by Casselton Ambulance Service, which is located around 15 minutes away. The Mapleton Volunteer Fire covers the city and nearby rural areas. The department has been designated as ISO Class 6.

Health Care and Nonprofits

Mapleton does not have any health care facilities of its own, but rather the nearest hospital would be the Sanford Medical Center about a 15-minute drive away.

Critical Facilities and Infrastructure

Mapleton's critical infrastructure includes two water towers, a city hall and community center, a water pumping station where the city is connected to Cass Rural Water, six sanitary lift stations, and four storm sewer lift stations.

Businesses and Employers

Mapleton is not only a bedroom community to Fargo, but also has a relatively sizeable employment base in its own right with several manufacturing and agricultural enterprises located there.

Natural Hazards

Dam Failure	Mapleton does not have any risk from dam failure.
Drought	Mapleton is connected to Cass Rural Water District. The businesses serving the agricultural sector will feel the effects of drought.
Flooding	FEMA's floodplain map adopted in 2002 shows the city is well protected by a levee system but is surrounded by the Maple River whose floodplain limits where future development can be directed. There are several spots within the city that have problems with localized flooding. Maple Drive has an undersized storm sewer system and there is no detention ponds for larger storm events. The I-94 Industrial Park does have a storm sewer system but no detention pond, leading to those streets being flooded under heavy precipitation. Finally, Prairie View Estates in the northwest of Mapleton has drainage issues which does not affect structures or roads, but still poses a health risk with the amount of standing water that takes a long time to drain away. Mapleton Elementary School and the one licensed daycare are outside of the mapped floodplain. There are no other facilities where vulnerable populations live or congregate.
Geological Hazards	Mapleton has no risk of geological hazards.
Severe Summer Weather	Mapleton faces the same severe summer weather risk as other jurisdictions. The few older housing units may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	Mapleton faces the same severe summer weather risk as other jurisdictions. The few older housing units may experience higher heat loss compared to newer homes.
Urban Fire	Fires at businesses with grain storage are a rare occurrence in general. However, those would be the land uses in Mapleton with a higher risk of fire.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

Mapleton employs an auditor plus several public works staff and is contracted with an engineering firm who can work on the larger scale mitigation projects. The City may turn to county and state resources for financing said projects.

The Mapleton Volunteer Fire Department serves the city and the surrounding rural area. The department has an ISO Class Rating of 6. In the review last issued 2015, the department scored well in the emergency communications and the water supply categories. It did not score well when the engines, pumpers, and other equipment capacities were analyzed. Although, this is attributable to the small size of the department and the smaller population it serves relative to other departments.

The ordinances regulate development in the floodplain with a separate zoning category (F – Flood Plain District) that prohibit residential and commercial uses. In other zoning districts, those seeking to build have to obtain a permit that examines the location of the structure as it relates to the floodplain. The floodproofing code requires buildings to be elevated or resistant to water intrusion. Mapleton also enforces the ND State Building Code and International Fire Code.

PROGRESS SINCE LAST PLAN

The two items from the previous plan were the repair and recertification of the existing levee and the building of a new levee to protect the industrial area in the southeast part of town. The former has been completed; the latter has not and thus will remain an action item in this plan.

MITIGATION ACTIONS

Mitigation Action	**1] Permanent backup generators for lift stations**
Hazards Addressed	Flooding
Responsible Agency	City of Mapleton
Cost	$100,000
Description	Replacing the current temporary generators with permanently installed ones will save time and effort in getting backup power going, thus preventing interruptions in service.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-3 years
Priority	High

Mitigation Action	**2] Build levee to protect the southeast industrial area**
Hazards Addressed	Flooding
Responsible Agency	City of Mapleton
Cost	$500,000
Description	This would protect the industrial park area from overland flooding coming from the nearby creeks and channels, thus allowing for future development.
Potential Funding Sources	ND State Water Commission, Cass County flood control sales tax, local match
Timeline	5 years

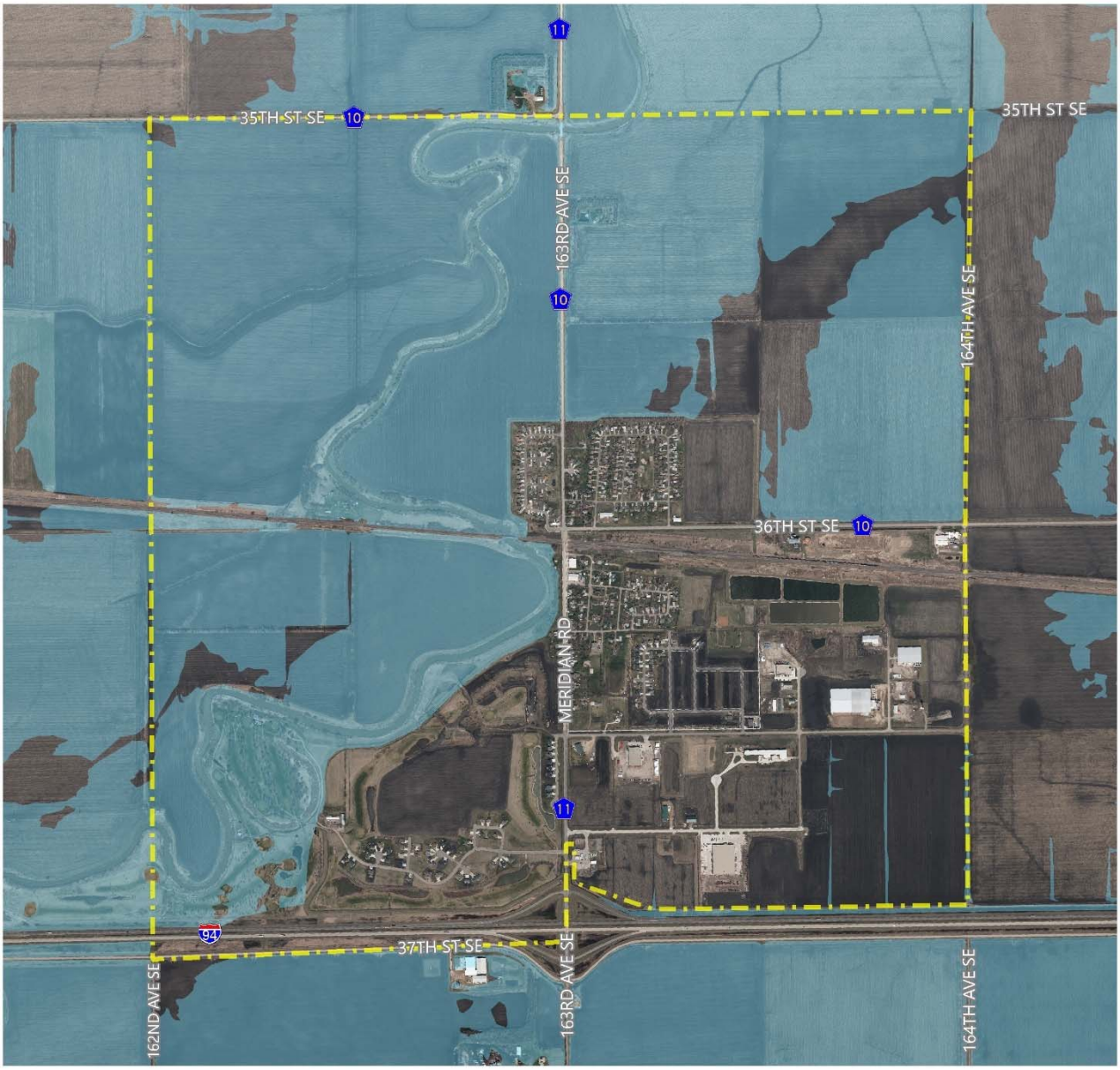
Priority	Medium

Mitigation Action	**3] Storm sewer improvements along Maple Drive**
Hazards Addressed	Flooding
Responsible Agency	City of Mapleton
Cost	$500,000
Description	The storm sewer system in the Maplewood neighborhood is undersized and there is no storm water detention in the area for larger precipitation events, thus leading to streets becoming flooded.
Potential Funding Sources	ND Department of Health (CWSRF), FEMA (PDM and HMGP) with local match
Timeline	5 years
Priority	Medium

Mitigation Action	**4] Storm sewer improvements in I-94 Industrial Park**
Hazards Addressed	Flooding
Responsible Agency	City of Mapleton
Cost	$750,000
Description	The industrial park on the east side of the city south of the railroad tracks has a storm sewer system, but no storm water detention pond. Roads can be inundated during storms.
Potential Funding Sources	ND Department of Health (CWSRF), FEMA (PDM and HMGP) with local match
Timeline	5 years
Priority	Medium

Mitigation Action	**5] Improve drainage in the Prairie View Estates neighborhood**
Hazards Addressed	Flooding
Responsible Agency	City of Mapleton
Cost	To be determined
Description	In the northeast quadrant of town, inadequate drainage does not necessarily cause flooding but it does lead to a large amount of standing water that poses a health and safety risk.
Potential Funding Sources	ND Department of Health (CWSRF)
Timeline	5 years
Priority	Low

FLOODPLAIN MAP



100 Year Floodplain

Mapleton City Limits

1,100 Feet

CASS COUNTY GOVERNMENT

source: Western Cass Flood Insurance Study
imagery date April 2016 | map updated January 2019

Disclaimer: This map is made available as a public service. Maps and data are to be used for reference purposes only and Cass County, ND, is not responsible for any inaccuracies herein contained. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, use, or misuse of the information herein provided.

22. North River

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

North River is a small community of around 60 residents located adjacent to the Red River and immediately north of Fargo. The town is entirely single-family residential. The potential for growth is limited since Fargo's boundaries extend around the town.

Socio-Economic

North River has a high median household income of $122,500. The median age is 35.3 years. A little over a third of residents are under 18 years of age; a shy over 11% is 62 years or older.

Housing

There are 23 houses in the city with nearly all built in the 1970s or 80s. Most of the homes are elevated so as to be out of the 100-year floodplain level, albeit are still in the 500-year level.

Transportation

The roads are all gravel. Visibility along County 31 leading into North River can easily become comprised during winter as snow blows across from the adjacent farm field.

Emergency Services

North River is in the coverage area for FM Ambulance Service and West Fargo Fire Department, the latter of which has received an ISO Class 3 designation.

Health Care

The nearest hospital to North River would be the Sanford Medical Center in southwest Fargo.

Critical Facilities and Infrastructure

The city does not have an installed storm sewer system, instead utilizing ditches and culverts. Mobile pumps are used to remove excess water as needed.

Businesses and Employers

There are no businesses in North River aside from any home-based businesses that may exist. Residents commute elsewhere for employment.

Natural Hazards

Dam Failure	North River does not have any risk from dam failure.
Drought	North River is connected to Fargo's system. There are no users that are more susceptible to drought than normal.
Flooding	North River is currently within the mapped floodplain. A levee protects the city to a major extent. Maintenance of the levee will ensure this protection remains for the future. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Some riverbank slumping has occurred over the years, especially on the south end where the Red River bends. Trees have fallen into the river, but homes remain far away enough to not cause a concern.
Severe Summer Weather	North River faces the same severe summer weather risk as other jurisdictions. The few older housing units may be less likely to withstand high winds compared to newer homes. There is no public storm shelter in town.
Severe Winter Weather	North River faces the same severe winter weather risk as other jurisdictions. The few older housing units may experience higher heat loss compared to newer homes. Due to the open fields to the west, winter storms easily lead to dangerous driving conditions that can cause accidents. Measures to reduce blowing snow should be explored by the County.
Urban Fire	There are no higher than normal risk of urban fire in North River.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from a dried-out farm field to the west of town as well as the forested areas along the Red River.

JURISDICTIONAL CAPACITY

Due to its small size and tax base, North River has limited financial and technical resources at its disposal. It will turn to county and state entities for assistance in the implementation of any mitigation-related activity.

PROGRESS SINCE LAST PLAN

The 2014 version of the mitigation plan had a warning siren as the sole action item. This was removed for the current version, since the City agreed that residents are able to adequately hear nearby sirens.

While not necessarily within the city limits of North River, floods have constricted access by inundating County Road 31. This road has been rerouted in 2016 to be further from the river.

MITIGATION ACTIONS

Mitigation Action	1] Perform dike maintenance and repair
Hazards Addressed	Flooding
Responsible Agency	City of North River
Cost	To be determined
Description	Portions of the existing dike have developed low spots over time and trees have grown on the dike. Removing those trees would leave their roots in which is a weak spot for water intrusion. Portions of the dike may need to be replaced and the dike recertified and reaccredited.
Potential Funding Sources	FEMA (HMGP, PDM, and FMA) with local match, Cass County flood sales tax
Timeline	1-3 years
Priority	High

Mitigation Action	2] Install living snow fence along County Road 31
Hazards Addressed	Severe winter weather
Responsible Agency	Cass County Highway Department
Cost	To be determined
Description	Visibility is problematic along County Road 31 during winter given that snow blows across from the adjacent farm field. This is the primary road that residents use when traveling to and from Fargo. Drivers can easily enter the ditch or get into accidents with other drivers.
Potential Funding Sources	Cass County
Timeline	1-2 years
Priority	Medium

Mitigation Action	3] Purchase new pump
Hazards Addressed	Flooding
Responsible Agency	City of North River
Cost	To be determined
Description	One of the city's storm water pumps was stolen while the other two are undersized. A new pump of sufficient capacity and rate will provide better protection for residents.
Potential Funding Sources	FEMA (HMGP, FMA, and PDM) with local match, Cass County flood sales tax
Timeline	1-3 years
Priority	Medium

FLOODPLAIN MAP

source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

100 Year Floodplain

North River City Limits

100 Feet

CASS COUNTY GOVERNMENT

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23. Oxbow

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Oxbow is situated south of Fargo alongside the Red River. Due to its proximity, it is connected to a few of Fargo's services such as the sewer system. Since the 2011 flood, Oxbow has undergone notable changes including homes along Schnell Drive and Oxbow Drive being bought out, the relocation of the clubhouse and several holes at the Oxbow Country Club, and a new residential subdivision were built. Growth would be limited to land within the ring dike, the construction of which was a condition of approval for the Fargo-Moorhead Diversion project.

Socio-Economic

Oxbow has a very high median household income at $136,932. Given the fact that only 2% of residents earn less than $50,000 as well as home values starting at $300,000 and going upwards to over a million dollars indicates that residents have the financial wherewithal to implement mitigation actions for their own properties.

Housing

Oxbow has only single-family housing, most of which are detached although there are attached units. Majority have been built since the 1980s. A new residential subdivision has opened allowing for more housing construction.

Transportation

US Highway 81 brushes Oxbow's west boundary. There is easy access to Interstate 29. All of the roads in town are paved.

Emergency Services

Oxbow is within the service boundaries of Kindred Area Ambulance Service, which is a 20-minute drive away. The Horace/Hickson Fire Department has its second fire station in Hickson, an unincorporated community next to Oxbow. The fire hall is a standard steel structure with two garage bays. Law enforcement is provided by the Cass County Sheriff department.

Health Care

The nearest hospital would be Essentia Health's on 32nd Avenue in Fargo. It is located roughly 20 minutes away.

Critical Facilities and Infrastructure

The City of Oxbow's critical infrastructure are the municipal well, a sanitary sewer system, and the storm sewer system that primarily diverts water back into the Red River.

Businesses and Employers

Aside from the golf course, Oxbow does not have any standalone businesses.

Natural Hazards

Dam Failure	Oxbow does not have any risk from dam failure.
Drought	Golf courses tend to be a heavy user of water. Drought would negatively impact the country club.
Flooding	The city would be highly exposed to the risk of flooding if protective infrastructure were not in place. The acquisition of properties along Schnell Drive and Oxbow Drive and the construction of levees has provided a measure of safety for the community. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Homes along the Red River have been bought out over the years, reducing greatly the risk of riverbank slumping.
Severe Summer Weather	Oxbow faces the same severe summer weather risk as other jurisdictions. The residents being of higher incomes would mean they are more financially able of preparing their homes against severe weather. There is no public storm shelter in town.
Severe Winter Weather	North River faces the same severe winter weather risk as other jurisdictions. The residents being of higher incomes would mean they are more financially able of preparing their homes against severe weather.
Urban Fire	There are no higher than normal risk of urban fire in Oxbow.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that to the west of town or the forested areas along the Red River to the east.

JURISDICTIONAL CAPACITY

The City of Oxbow has an active City Council, a Planning and Zoning Board, and contracts with outside engineering services to assist the community in identifying and carrying out improvement projects. Due to its small population size, Oxbow may need to turn to federal, state, and county resources for larger-scaled projects.

PROGRESS SINCE LAST PLAN

The two mitigation action items below were in the 2014 version of the plan. They remain uncompleted and therefore will be kept in this update.

MITIGATION ACTIONS

Mitigation Action	**1] Relocate lift station**
Hazards Addressed	Flooding

Responsible Agency	City of Oxbow
Cost	$300,000
Description	Relocation will reduce the potential for the list station to be inundated and discontinue functioning during floods.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	2-3 years
Priority	High

Mitigation Action	**2] Installation of backup power generator**
Hazards Addressed	All hazards
Responsible Agency	City of Oxbow
Cost	$100,000
Description	A generator at the lift station would reduce the threat of discontinued service during power outages.
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	3-5 years
Priority	Medium

FLOODPLAIN MAP

100 Year Floodplain

Oxbow City Limits

source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

1,000 Feet

CASS COUNTY GOVERNMENT

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24. Page

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Page is a town of approximately 300 residents in northwest Cass County. It has experienced moderate growth since 2010, seeing an increase in population of around 20%. Along Morton Avenue are several businesses such as a café, bank, grocery, bar, and churches. The rest of the city is mostly single-family with a few apartment buildings as well as the elementary school for Hope-Page School District.

Socio-Economic

Page's median housing income is slightly below that of the county's ($56,607 compared to $58,026). However, the poverty rate, sitting at 4.5%, is much lower than that of the county's 11.2%. Page's median age is very young at 23.7 years. This is a marked change since 2010 when the median age was 36.8. This change can be explained by the increase in the number of children under 18 years of age. In 2010, they comprised 10.7% of the population; in 2017 it was closer to 40.6%.

Page Housing Development owns and operates a 16-unit apartment complex with income-restricted units. These buildings are undergoing an extensive rehabilitation in 2019.

Housing

Around 80% of the housing stock is single-family detached with the remainder being a selection of small apartment buildings. Not uncommon with the other rural communities, most of the housing stock was built before 1950, potentially indicating that those units do not meet the latest building codes that allow for better protection against natural hazards.

Transportation

Page's roads are all paved. A rail line owned and operated by BNSF passes through the west side of town and serves a grain elevator.

Emergency Services

EMS is provided by Page Ambulance Service based out of a building shared with the Page Fire District.

Health Care and Nonprofits

The nearest hospital would be CHI Mercy Health in Valley City, a roughly 45-minute drive away.

Critical Facilities and Infrastructure

Page is connected to Cass Rural Water and maintains its own sanitary sewer and storm sewer systems. Critical infrastructure includes its elementary school, community center, and the hall for Page Fire Protection District.

Businesses and Employers

The elementary school is the largest employer in town. Along Morton Avenue are several retail and service businesses. Arthur Companies operates a grain elevator on the town's westside.

Natural Hazards

Dam Failure	Page does not have any risk from dam failure. To the north and west of Page are several homes that would be in the inundation zone for the Upper Maple River Dam.
Drought	As a rural community with some agriculture related businesses, Page will feel the economic impacts of drought. The city obtains its water from the Cass Rural Water District, who said that supplies are adequate.
Flooding	Page is not located in a mapped floodplain nor is it within the boundaries of the Upper Maple River Dam floodplain map study. However, past experience shows that there are areas within town with poor drainage that flood. The elementary school is the only facility where a vulnerable population more difficult to evacuate, in this instance youth, congregate.
Geological Hazards	Page does not have any risk exposure to geological hazards.
Severe Summer Weather	Page faces the same severe summer weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a cool temperature in heat waves. There is no public storm shelter in town.
Severe Winter Weather	Page faces the same severe winter weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a warm temperature in cold snaps.
Urban Fire	The grain elevator would be the structure in town with the higher risk of fire.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

As a city of around 250 people, the financial capacity upon which to implement mitigation actions is limited. Assistance from the county and state will be necessary for carrying out larger scale efforts. Page is contracted with an engineering firm, who can identify, design, and lead the construction of various projects.

PROGRESS SINCE LAST PLAN

A new backup generator for the lift station was listed as an action step in the previous plan. This has been installed in the meantime.

MITIGATION ACTIONS

Mitigation Action	1] Additional storm sewer installation and new lift station
Hazards Addressed	Flooding
Responsible Agency	City of Page
Cost	$500,000
Description	Increasing the city's storm sewer capacity will better protect against flash flooding.
Potential Funding Sources	FEMA (HMGP, PDM, and FMA) with local match, ND State Water Commission, Cass County flood sales tax, CDBG
Timeline	5 years depending upon funding availability
Priority	High

Mitigation Action	2] Installation of warning sirens
Hazards Addressed	Severe weather
Responsible Agency	City of Page and Red River Regional Dispatch Center
Cost	$50,000
Description	Installing a warning siren in town will allow for better response to severe weather as it arises
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending upon funding availability
Priority	Medium

25. Prairie Rose

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Prairie Rose is a small community, both in population and spatially, of around 70 people in 21 single-family homes. It is completely surrounded by the City of Fargo and therefore has no room for growth.

Socio-Economic

Prairie Rose has among the highest median household incomes in the county at $113,125. This implies a lesser need to assist homeowners financially with mitigation actions for their properties.

Housing

Most of the housing stock was built in the 1970s with the last one built in the summer of 1980. Additions have been added to several houses. Census data indicates there are no households who are deemed cost-burdened by having 35% or greater of monthly income being devoted towards mortgage or rent.

Transportation

Prairie Rose is bounded by 40th Ave S to the north and 36th St S and Interstate 29 to the west. All of those roads are within Fargo. In Prairie Rose, all of the roads are paved.

Emergency Services

EMS is provided by FM Ambulance Service. Prairie Rose is within the service area of Horace Fire Department, of which the fire hall is up to a 20-minute drive away.

Health Care and Nonprofits

The nearest hospital would be Essentia Health's on 32nd Ave S, a 10-minute drive from the town.

Critical Facilities and Infrastructure

Prairie Rose obtains its water from seven private wells which can have up to six houses hooked up to each. All of these wells are maintained by the households. It is also connected to Fargo's sanitary sewer system. Prairie Rose does not have an installed storm sewer system, instead relying upon ditches and culverts.

Businesses and Employers

Prairie Rose does not have any businesses other than any home-based ones that may exist.

Natural Hazards

Dam Failure	Prairie Rose does not face any risks from dam failure.
Drought	Prairie Rose does not have any water users particularly susceptible to the effects of drought. The city obtains its water from seven private wells which can have up to six houses hooked up to each. All of these wells are maintained by the households.
Flooding	Under the current floodplain map, the streets of Prairie Rose would be inundated during a 100-year flood event while the homes are elevated enough to be affected in 500-year floods. The City is completely encased by the city limits of Fargo, meaning that decisions on flood protection made by them will determine how Prairie Rose is protected. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Prairie Rose does not have any risk exposure to geological hazards.
Severe Summer Weather	Prairie Rose faces the same severe summer weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a cool temperature in heat waves. There is no public storm shelter in town.
Severe Winter Weather	Prairie Rose faces the same severe winter weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a warm temperature in cold snaps.
Urban Fire	There are no buildings in the city that are particularly susceptible to fire.
Wildfire	The risk of wildfire reaching the city is very low, given that it is located within the developed metropolitan area. These are typically contained before putting any structures in danger.

JURISDICTIONAL CAPACITY

Due to its small population base, Prairie Rose does not have the financial and technical resources at its disposal, therefore it may turn to state and county entities for assistance with larger scale projects.

PROGRESS SINCE LAST PLAN

The previous iteration of the plan listed a warning siren as the only action step. This has not been completed and will therefore remain.

MITIGATION ACTIONS

Mitigation Action	**1] Increase capacity of ditches and culverts**
Hazards Addressed	Flooding
Responsible Agency	City of Prairie Rose
Cost	To be determined
Description	Increasingly heavier precipitation events may create the need for the city's internal drainage capacity to be increased.
Potential Funding Sources	FEMA (HMGP and PDM) with local match, Cass County flood sales tax
Timeline	5 years depending on funding availability
Priority	Medium

Mitigation Action	2] Installation of warning sirens
Hazards Addressed	Severe weather
Responsible Agency	City of Prairie Rose and Red River Regional Dispatch Center
Cost	$50,000
Description	Installing a warning siren in town will allow for better response to severe weather as it arises
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	2-3 years depending upon funding availability
Priority	Low

FLOODPLAIN MAP

source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 | map updated January 2019

Disclaimer: This map is made available as a public service. Maps and data are to be used for reference purposes only and Cass County, ND, is not responsible for any inaccuracies herein contained. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, use, or misuse of the information herein provided.

26. Reile's Acres

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

The City of Reile's Acres has doubled in size since 2000, growing from 254 to 513 by 2010. Since 2010, approximately 65 new homes have been added. Today, Reile's Acres is estimated to have around 700 residents. Growth projections estimate that 50 new residents will be added per year for the next five years. It is located north of Fargo's city limits and west of the airport and Interstate 29. New residential development is occurring on the north half of the town. Spatially speaking, this will expand the city's footprint by roughly 40%. Due to this growth, several hazard mitigation action steps are to be undertaken.

Socio-Economic

Reile's Acres' median household income was high at approximately $130,000 in 2017. Those older than 62 years of age constituted only 6.3% of the population. Those under 18 were 34%, indicating many younger families choose Reile's Acres as home.

Housing

The entire housing stock is single-family detached. Around a quarter was built in the 1970s while a little over half was built in the 2000s. The number of cost-burdened households is under about 8% for those with mortgages and 4% for those without.

Transportation

Reile's Acres is about a mile away from Interstate 29 and has easy access to the rest of the metropolitan area. All of the roads within town are paved.

Emergency Services

FM Ambulance covers the city while the West Fargo Rural Fire Department provides firefighting protection and all-hazard emergency response. The Central Station on the intersection of 1st St and 1St Ave E serves all areas north of Interstate 94, which includes Reile's Acres. It is an approximately 10 to 15 minute drive away.

Health Care and Nonprofits

The nearest hospitals would be Sanford Medical Center or Essentia Health, both in Fargo.

Critical Facilities and Infrastructure

Critical infrastructure in Reile's Acres include three lift stations, sanitary and storm sewer systems, and the community center. The water lines have insufficient pressure for adequate fire suppression capabilities.

Businesses and Employers

There are no standalone businesses within city limits. Residents often commute to jobs elsewhere in the metropolitan area.

Natural Hazards

Dam Failure	Reile's Acres does not face any risks from dam failure.
Drought	Reile's Acres does not have any water users particularly susceptible to the effects of drought. It obtains its water from Fargo's system.
Flooding	Localized flooding has become less of a concern due to work done on the city's storm sewer system. Riverine flooding can be addressed through region-wide protection in lieu of city-specific protection. There are no nursing homes, daycares, schools, jails, or other such concentrations of immobile populations who are more difficult to evacuate.
Geological Hazards	Reile's Acres does not have any risk exposure to geological hazards.
Severe Summer Weather	Reile's Acres faces the same severe summer weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a cool temperature in heat waves. There is no public storm shelter in town.
Severe Winter Weather	Reile's Acres faces the same severe winter weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a warm temperature in cold snaps.
Urban Fire	There are no buildings in the city that are particularly susceptible to fire.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

In addition to the city council, Reile's Acres has a planning and zoning commission who administer the land use ordinances. These ordinances include provisions that deal with building standards for floodproofing and floodplain management. A development permit shall be obtained before construction is to begin within any of the designated special flood hazard areas.

Reile's Acres has adopted and enforces the 2017 North Dakota State Building Code. While smaller-scale mitigation projects may be within the city's capacities, larger-scale projects will require the assistance of county, state, and federal entities.

PROGRESS SINCE LAST PLAN

Permanent flood protection was a priority in 2014 and remains so. Numerous action step items have been added to the plan due to the city's continued growth.

MITIGATION ACTIONS

Mitigation Action	1] Increase permanent flood protection from the Red River
Hazards Addressed	Flooding
Responsible Agency	City of Reile's Acres for the localized flooding issues
Cost	To be determined
Description	Providing permanent flood protection for the entire city will reduce the potential for damages, reduce flood insurance costs for property owners, and encourage the continued development of the city. This includes protecting against flash flooding resulting from severe summer storms. The method for protection will be better determined upon the progress of new FEMA floodplain maps as well as the FM Diversion.
Potential Funding Sources	Federal (FEMA and USACE), Cass County, ND State Water Commission
Timeline	To be determined
Priority	High

Mitigation Action	2] Purchase and install backup power generators for three pump stations
Hazards Addressed	All hazards
Responsible Agency	City of Reile's Acres
Cost	$150,000
Description	Installing permanent generators saves time and effort in hooking up a portable generator to the pump stations, thus ensuring continued operation during events.
Potential Funding Sources	FEMA (HMGP) with local match
Timeline	1-3 years
Priority	High

Mitigation Action	3] Install warning siren on north side of the city
Hazards Addressed	All hazards
Responsible Agency	City of Reile's Acres
Cost	$50,000
Description	The city has expanded to the north with a new subdivision. Installing a warning siren there would ensure the entire city is within audible distance.
Potential Funding Sources	FEMA (HMGP) with local match
Timeline	1-3 years
Priority	Medium

Mitigation Action	4] Purchase and install an ICC 500 compliant storm shelter at the new public park in the north side of Reile's Acres.
Hazards Addressed	Severe weather
Responsible Agency	City of Reile's Acres
Cost	To be determined
Description	Building a storm shelter according to FEMA requirements will offer a safe space for park guests if a tornado or other dangerous storm were to hit.
Potential Funding Sources	FEMA (HMGP) with local match
Timeline	1-3 years
Priority	Low

Mitigation Action	**5] Improve the city's fire protection capabilities by installing infrastructure that will increase the pressure of the water lines to accommodate fire hydrants or a pumper truck.**
Hazards Addressed	Urban fire
Responsible Agency	City of Reile's Acres
Cost	To be determined
Description	Approximately 40% of the city's water lines cannot accommodate fire hydrants or pumper trucks, leaving it more difficult to respond adequately to fires. The city will consider a water tower that will pressurize water for distribution.
Potential Funding Sources	City
Timeline	3-5 years
Priority	Low

FLOODPLAIN MAP

source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping imagery date May 2017 | map updated January 2019

100 Year Floodplain

Reile's Acres City Limits

1,000 Feet

CASS COUNTY GOVERNMENT

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27. Tower City

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

Tower City is located on the very western edge of Cass County immediately north of Interstate 94. Its population of 275 has remain roughly the same since 2010 but that is a small increase from 252 in the 2000 Census. It is mostly residential in nature with a few businesses.

Socio-Economic

The median household income of $47,212 is lower than that of the county's. Its poverty rate sits at 7.6%. One thing to note is that Tower City's median age is higher at 42.5 years. Nearly a quarter of the population is 62 years or older.

Housing

Three-fourths of the housing stock is single-family detached. Regarding the year these homes were built a little over 20% were built before 1950, 20% were built in the 1970s, and in the 2000s there was a noticeable building boom as well. Tower City Development Corporation owns and operates apartment buildings on the south end of town that are available for low-to-moderate income households.

Transportation

As noted, Tower City is directly by Interstate 94. Within town, other than the principal streets the local roads are gravel. A BSNF rail line passes through the north side and serves a grain elevator.

Emergency Services

Tower City is covered by Casselton Ambulance Service which is around half-hour away. Cass County Sheriffs Department provides law enforcement.

Health Care

CHI Mercy Hospital in Valley City would be the closest one to Tower City. According to the Barnes County Multi-Hazard Mitigation Plan, the hospital is in the inundation zone.

Critical Facilities

Tower City's critical infrastructure includes a sanitary sewer system with attendant lift stations. A community hall is a public space for gatherings and city council meetings. Tower City obtains its water through Cass Rural Water District. There is no installed underground storm sewer system; instead, drainage is provided via ditches.

Businesses and Employers

Tower City has a few retail and service businesses as well as a company in the agricultural sector. Maple Valley High School is the largest employer in Tower City.

Natural Hazards

Dam Failure	Tower City does not face any risks from dam failure.
Drought	As a rural community, Tower City will feel the ripple effects of drought's impact upon agriculture. The city obtains its water from Cass Rural Water District, who have said the adequacy of the water supply is not a concern.
Flooding	Tower City has not been mapped by FEMA, therefore the potential risk is undetermined. Past experience has shown that flooding is not a concern. As far as places where vulnerable populations congregate, the school would be the only such facility.
Geological Hazards	Tower City does not have any risk exposure to geological hazards.
Severe Summer Weather	Tower City faces the same severe summer weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a cool temperature in heat waves. There is no public storm shelter in town.
Severe Winter Weather	Tower City faces the same severe winter weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a warm temperature in cold snaps.
Urban Fire	There are no buildings in the city that are particularly susceptible to fire.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town.

JURISDICTIONAL CAPACITY

As a small community, Tower City may turn to county, state, and federal entities for assistance in carrying out larger-scale projects. A contract with an engineering firm allows for capacity to design projects and to pursue funding opportunities.

The city regulates development that can be affected by flooding by restricting or prohibiting development in risky areas or by requiring structural floodproofing measures. A designated building administrator reviews all development applications for compliance with all of Tower City's ordinances.

PROGRESS SINCE LAST PLAN

The warning sirens were the only item in the 2014 version of the plan. This has not been completed and will remain in this plan albeit with an increase in the estimated cost.

MITIGATION ACTIONS

Mitigation Action	1] Installation of warning sirens
Hazards Addressed	Severe weather
Responsible Agency	City of Tower City and Red River Regional Dispatch
Cost	$50,000
Description	Advanced warning will allow for increased preparedness with potential to reduce property damage and lessen the potential of loss of life
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	1-5 years depending on funding availability
Priority	Low

Mitigation Action	2] Backup generators for sanitary lift station
Hazards Addressed	Flooding
Responsible Agency	City of Tower City
Cost	$100,000
Description	Installing permanent backup generators at the two lift stations will ensure continued service through an incidence of power loss, thus preventing
Potential Funding Sources	FEMA (HMGP and PDM) with local match
Timeline	2-3 years
Priority	Medium

Mitigation Action	3] Procure weather radios for residents and the fire hall
Hazards Addressed	Severe summer weather
Responsible Agency	City of Tower City
Cost	To be determined
Description	NOAA weather radios are a valuable tool to warn residents of an incoming severe storm or tornado. Procuring these and offering to residents will ensure everyone is made aware and seek appropriate shelter.
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	2-3 years depending on funding availability
Priority	Low

28. West Fargo

UNIQUE VULNERABILITIES

Land Use and Growth Patterns

West Fargo is the second largest city in Cass County and has been through phenomenal growth over the past few decades. From 1990 to 2017, the city's population has increased from 12,400 to 35,700 residents. This growth has manifested mainly in suburban-style patterns of development. Historical satellite imagery shows that in the mid-1980s, West Fargo extended no more than one and a half miles south from the intersection of Sheyenne Street and Main Avenue. In 2018, developments reached six miles south of said intersection, comprised mostly of commercial and residential. To the north of Main Avenue, manufacturing and other industrial uses were built.

Socio-Economic

West Fargo has a few areas of concentrated vulnerable populations. The core neighborhoods of River West, Francis, Sukuts, Southdale, and Eastwood have a higher share of non-white households compared to the rest of the city. Francis and Sukuts are a lower-income area vis-à-vis other neighborhoods. The City of West Fargo is in the process of examining the condition of infrastructure in these core neighborhoods. The infrastructure there – including the sanitary sewer, storm sewer, water distribution lines and roads - are old and needs to be replaced. However, this will place a significant cost upon lower-income households. Therefore, the City is looking into methods of assisting those households with the costs.

Housing

Many apartment buildings have been built south of Interstate 94 as the city has continued to grow in that direction. These buildings are relatively new and thus built to the more recent building codes. The Westwood, Charleswood River Estates, and West Charleswood neighborhoods have a higher prevalence of elderly households. For the latter two, this is attributable to the large nursing home facility found there.

West Fargo has one large mobile home community (Brookwood Mobile Home Park) with spots for around 380 units. Over the years, the park has seen several fires that have led to complete loss of the unit. While the park may not necessarily experience more fires compared to other neighborhoods, the severity of the fires is often greater. That mobile home park does not have a tornado shelter.

As of 2017, a shy over half of housing units were single-family detached. The second most common are apartment buildings of 20-units or greater. Over the years, several very large apartment complexes have been built. These larger and taller structures have made the Fire Department look at its capabilities to ensure adequate fire suppression and evacuation protocols can be carried out.

City staff are searching for grant funding that will help households in the aforementioned core neighborhoods – which contain the most number of older housing units - conduct necessary repairs and fix code violation issues. Incorporated within this program can be property-specific measures related to hazard mitigation.

The Housing Authority of Cass County administers the Housing Choice Vouchers program outside the city limits of Fargo. The organization also owns and operates affordable housing for those 55 years of age and upwards, as well as a public housing complex along Sheyenne Street. The complex will be undergoing an complete reconstruction with a modern and up-to-date facility.

Transportation

West Fargo was founded at the intersection of the Northern Pacific Railway and the Sheyenne River. Today the rail line, owned and operated by BNSF, remains a notable presence by serving numerous manufacturing and warehouse businesses in the northern part of the city. The construction of the Interstate had a direct effect upon West Fargo's growth trajectory.

Flooding is the natural hazard that presents the greatest threat to the city's transportation network. The Sheyenne River Diversion has greatly reduced the risk of riverine flooding that would inundate roads and block off access. Road segments near the river have experienced or can reasonably experience erosion as the result of riverbank slumping. Realigning certain roads further from the river are being explored.

Emergency Services

West Fargo is covered by FM Ambulance Service for paramedic services.

In 2018, the West Fargo Fire Department completed a four-year review for its Insurance Service Office (ISO) Rating. It achieved an ISO Rating of Class 3, the best rating the city has ever received. It places the department in the top 2 percent of all departments in North Dakota and top 10 percent in the country. There are two fire stations, one serving all areas north of the Interstate and the other serving to the south.

The West Fargo Police Department had 61 sworn officers, two K9 units, and 13 civilian employees as of 2018. The department is colocated in the same building as city hall.

Health Care

Sanford Health and Essentia Health have hospitals with emergency departments in Fargo.

Critical Facilities and Infrastructure

As mentioned, the Sheyenne River Diversion is a critical piece of infrastructure that has protected the city

numerous times from riverine flooding over its nearly three decades of operation. Internal drainage is provided by an extensive stormwater management system. The city employs detention and retention ponds for managing excess stormwater.

Currently, West Fargo utilizes a 460-acre network of waste stabilization ponds to treat wastewater. However, sewage is now being sent to Fargo's treatment plant. By 2025, the lagoons will have been completely decommissioned.

Prior to June 2016, West Fargo drew its water solely from the West Fargo Aquifer through nine production wells. The City's water mains were connected with Fargo's system, allowing for it to purchase water from the Fargo Water Treatment Plant. The old wells can work as a backup in instances of severe drought, however it will take months in order to bring them back online.

Businesses and Employers

As mentioned earlier, the area north of Main Avenue contains many industrial and warehouse-type operations. 13th Avenue South is a principal commercial corridor with numerous big-box retail outlets. These areas are protected by flooding via the Sheyenne River Diversion.

Natural Hazards

Dam Failure	West Fargo does not face any risks from dam failure.
Drought	West Fargo is connected to Fargo's water system and therefore follows Fargo's as well as Lake Agassiz Water Authority's drought management plans. West Fargo is a participating jurisdiction in the effort to bring Missouri River water to the Red River Valley in instances of severe drought. The City's old wells are not currently being utilized. However, they can be brought back online albeit with a timeframe of several months and at great expense.
Flooding	Flood risk within the City of West Fargo was more or less eliminated upon the completion of the Sheyenne River Diversion in 1992. It consists of 6.8 miles of diversion channel, 12.7 miles of protection levees, 4 diversionary structures, 2 pumping stations, and bridges for railroads and highways. Throughout its history it hasn't failed and it protected West Fargo during the record high floods of 1997 and 2009. Outside of the diversion in West Fargo's extraterritorial zoning, flooding remains a hazard. Flash flooding can still be an issue if drainage is inadequate in some spots.
Geological Hazards	There are problem spots along the Sheyenne River where structures are at risk of riverbank slumping. Targeted acquisition and removal would eliminate that risk. Over time, it appears that riverbanks are becoming more unstable in locations. The Southeast Cass Water Resource District and West Fargo will be undertaking an inventory of the banks and its vegetation. Trees that would take chunks of land with them when they collapse can be selectively removed.
Severe Summer Weather	West Fargo faces the same severe summer weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a cool temperature in heat waves.

	Among the parks in West Fargo only Armour, North Elmwood, South Elmwood, Herb Tintes, Rendezvous, Westside, and Shadow Wood have enclosed structures that can serve as shelter in dangerous weather. West Fargo Park District does not have any shelters that meet ICC 500 standards. West Fargo is recognized as a StormReady community by the National Oceanic and Atmospheric Association.
Severe Winter Weather	West Fargo faces the same severe winter weather risk as other jurisdictions. The older homes are less likely to withstand severe weather or maintain a warm temperature in cold snaps.
Urban Fire	Like other jurisdictions, older buildings are more susceptible to fires because of the lack of modern protective features. The oldest homes in West Fargo are in the core neighborhoods. West Fargo does have some industrial facilities that merit extra attention: the Magellan Pipeline Co. tank farm; Cargill's oilseed processing facility that has a hexane tank, ammonia tank, and combustible oil seed; and Busch Agricultural Resource's barley and grain storage facility. The West Fargo Fire Department has an active inspection program that routinely examines these and other facilities to ensure proper practices are followed and safety plans are being adhered to.
Wildfire	The risk of wildfire reaching the city is very low. These are typically contained before putting any structures in danger. Any wildfires would come from dried-out farm fields that surround the town to the north, west, and south. The trees along the Sheyenne River can also be considered an ignition source.

JURISDICTIONAL CAPACITY

Second in population to Fargo, the City of West Fargo has the financial and technical resources to accomplish many high ranking priorities on its own. Larger scale projects still require assistance from federal, state, and county entities. Staff capacity is robust with departments dedicated to planning and zoning, economic development, emergency management, finance, and fire. An inspection department enforces the 2012 International Building Code and the North Dakota State Plumbing Code.

West Fargo recently engaged in a thorough update of its comprehensive plan. This document includes the strategies which shall increase the community's resiliency: managing inland flooding, improving emergency preparedness, consideration of a zero waste initiative, increasing energy conservation and efficiency, and considering climate's impact in evaluating infrastructure investments. To further increase West Fargo's planning capabilities, it is also a participating jurisdiction in FM Metro COG.

West Fargo has an adopted and enforced flood damage prevention ordinance. This policy restricts or prohibits development in areas exposed to flood waters and erosion hazards, as well as development that increases erosion, flood heights, or velocities. It also controls the alteration of land features that help accommodate or

channel flood waters. Flood barriers that will unnaturally divert flood waters or will increase flood hazards in other areas are regulated.

PROGRESS SINCE LAST PLAN

The City has continued to diligently prepare for and mitigate against flooding by building out new and hardening existing infrastructure. Items from the last plan that have been completed include replacing three storm sewer outfalls along the Sheyenne River, replacing the flap-gate at an outfall and repairing the force main, replacing PTO pump stations at 2nd Avenue South and 21st Avenue South, installing new discharge structures with sluice gates, extending and connecting culverts at Hayden Heights, and establishing paved turnarounds at several diversion crossing sites.

While infrastructure-related projects remain important for this new iteration of the plan, more attention was given towards the role of policy in reducing risk and enhancing resilience. This includes potential adjustments to policy which shall affect where and how individual property owners construct or substantially improve their buildings. This need not be restrictive in nature, but rather additional flexibility can permit property owners to utilize innovative strategies.

MITIGATION ACTIONS

Mitigation Action	**1] Replace storm sewer outfalls along Sheyenne River and rehabilitate storm force-main and stabilize river bank at 9 locations**
Hazards Addressed	Geological hazard (river bank sloughing)
Responsible Agency	City of West Fargo
Cost	$1,500,000
Description	This action will reduce future losses of land due to sloughing in the area and maintain integrity of infrastructure and private property in the area
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**2] Acquire and remove around 12 residential homes along the Sheyenne River followed by stabilization of the riverbank and restoration of green space.**
Hazards Addressed	Geological hazard (river bank sloughing)
Responsible Agency	City of West Fargo
Cost	$3.5 million
Description	Will reduce future damages to the removed structures as well as allow additional green way in for emergency protection in case of a future event. Bank stabilization would be an added benefit to land beyond the immediate project area.
Potential Funding Sources	FEMA (PDM, HMGP, FMA)
Timeline	1-2 years

Priority	High

Mitigation Action	**3] Acquire and demolish condominiums at 530 6th Ave W and remove or repair attendant utilities.**
Hazards Addressed	Geological hazard (river bank sloughing)
Responsible Agency	City of West Fargo
Cost	$2-3 million
Description	This will remove residences currently at-risk from flooding. The additional green way can provide space for emergency protection if needed. Bank stabilization and utility rehabilitation or removal would be an added benefit to the entire system.
Potential Funding Sources	FEMA (PDM, HMGP, FMA) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**4] Riverbank stabilization by Main Avenue Self Storage**
Hazards Addressed	Geological hazard (riverbank sloughing)
Responsible Agency	City of West Fargo
Cost	$200,000
Description	This will prevent future erosion in the area and maintain the integrity of infrastructure and private property in the area
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**5] Address land subsidence along Center Street by stabilizing the riverbank and possibly realigning the road.**
Hazards Addressed	Geological hazard (riverbank sloughing)
Responsible Agency	City of West Fargo
Cost	$750,000
Description	This will prevent future erosion in the area and maintain the integrity of infrastructure and private property in the area
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**6] Restore all dike tops (outside and inside including tieback levees) by grading compaction and seeding.**
Hazards Addressed	Flooding
Responsible Agency	City of West Fargo
Cost	$150,000
Description	Maintenance of the dikes will preserve functionality for future flood events.
Potential Funding Sources	FEMA (PDM, FMA, and HMGP) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**7] Amend landscape ordinances that encourage the use of xeriscaping and plants native to the region.**
Hazards Addressed	Drought

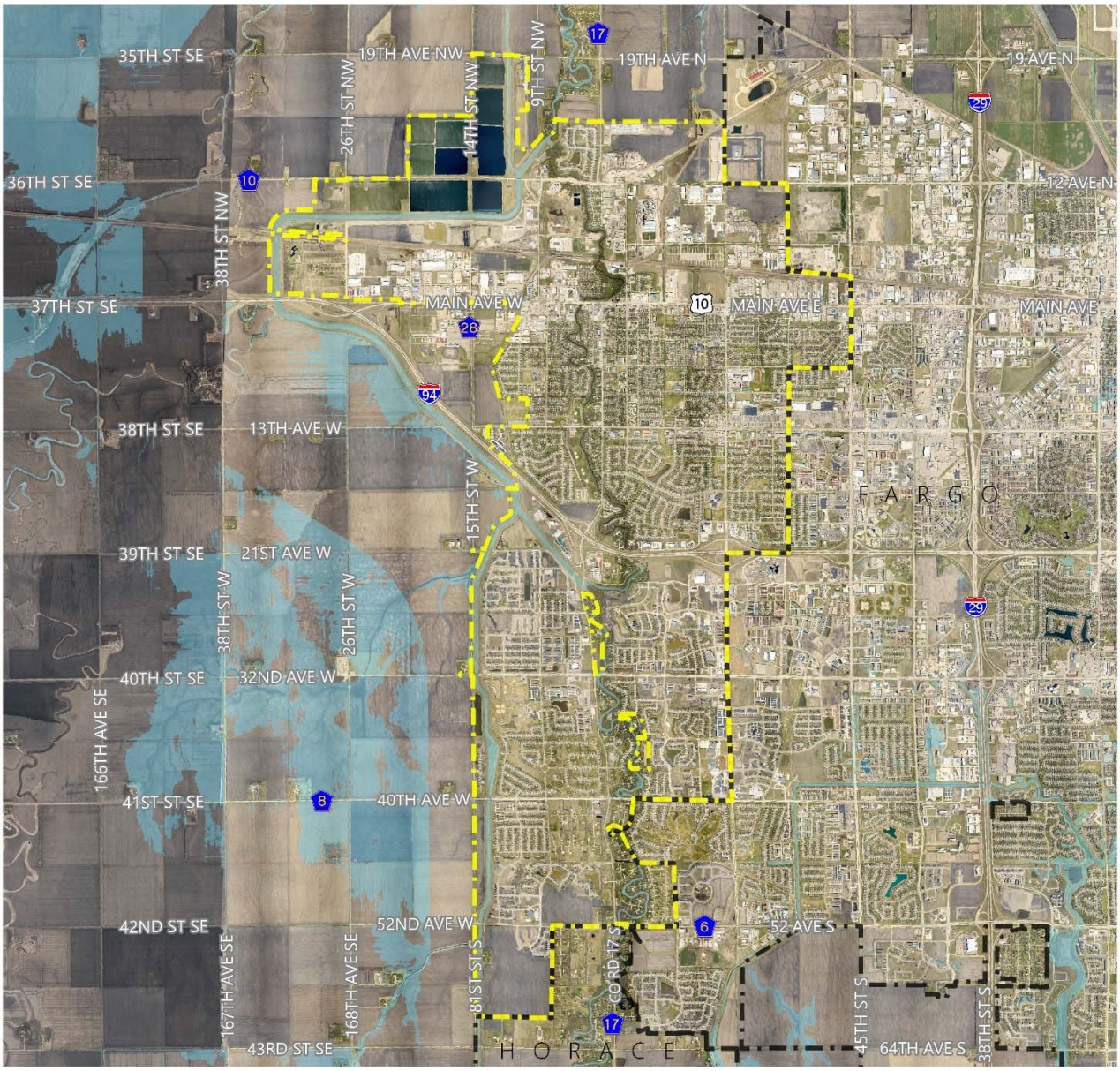
Responsible Agency	City of West Fargo with assistance from NDSU Extension and other technical assistance providers, if needed
Cost	To be determined
Description	Allowing property owners to use less water-demanding landscaping methods can lead to noticeable changes in overall water consumption if implemented on a wide-enough scale. This would be helpful during times of drought.
Potential Funding Sources	Incorporate within future department budgets
Timeline	2-3 years
Priority	Low

Mitigation Action	**8] Upgrade lift stations by installing onsite permanent generators, purchasing dedicated portable generators, and design lift stations with pads for installation of generators or pads for portable generator access.**
Hazards Addressed	Flooding
Responsible Agency	City of West Fargo
Cost	$200,000
Description	This will improve the system's existing capacity by ensuring efficient and effective removal of sewage in lines during disasters, thus reducing health issues and improving treatment capability.
Potential Funding Sources	FEMA (PDM and HMGP) with local match
Timeline	1-2 years
Priority	High

Mitigation Action	**9] Enroll West Fargo in the Community Rating System by implementing methods of educating the public with useful maps and introducing potential flood damage reduction methods.**
Hazards Addressed	Flooding
Responsible Agency	City of West Fargo
Cost	$200,000
Description	This will reduce the cost of flood insurance for residence and commercial property owners, as well as enhance the understanding among the community of flooding and ways they can better protect themselves.
Potential Funding Sources	Local
Timeline	3-4 years
Priority	High

Mitigation Action	**10] Evaluate river stabilization techniques and potentially remove residential homes in the Riverside and Chateau Cheyenne area**
Hazards Addressed	Geological hazard (riverbank sloughing)
Responsible Agency	City of West Fargo
Cost	$1,000,000
Description	Depending on what methods are needed, this will reduce future damages by removing structures as well as allowing additional green way in for emergency protection in case of a future event.
Potential Funding Sources	FEMA (PDM, FMA, and HMGP) with local match
Timeline	1-2 years
Priority	High

FLOODPLAIN MAP



source: Phase 9 with project no protection combined Red River peak and tributary peak 100-year flood plain mapping
imagery date May 2017 & April 2016 | map updated January 2019

100 Year Floodplain

West Fargo City Limits

1 Mile

CASS COUNTY GOVERNMENT

Disclaimer: This map is made available as a public service. Maps and data are to be used for reference purposes only and Cass County, ND, is not responsible for any inaccuracies herein contained. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, use, or misuse of the information herein provided.

APPENDIX A: JURISDICTION COMMITMENT LETTERS

APPENDIX B: JURISDICTIONAL PARTICIPATION

The following tables lists the extent of participation for each jurisdiction. This does not include the phone conversations, email correspondence, or meetings held with the stakeholder groups listed on Table 2.5 Responding Stakeholders.

Jurisdiction	Extent of Participation
Cass County	• Department representation on steering committee • Requested input from county commission members specifically
Alice	• Phone conversations and email correspondence with Lori Schmidt, who conferred with city council members
Amenia	• Phone conversations with William Stansbery
Argusville	• Email correspondence with Mary Howatt • Attended post-flood debrief meeting May 9th, 2019
Arthur	• Email correspondence with Greg Nelson
Ayr	• Mail correspondence with Diane Hovland
Briarwood	• Email and phone conversation with Mike Fritz
Buffalo	• Email and phone conversations with council members • Attended city council meetings on November 12th, 2018 and March 11th, 2019.
Casselton	• Email correspondence with Sheila Klevgard
Davenport	• Attended city council meeting May 6th, 2019
Enderlin	• Email correspondence with Cyndee Chesley
Fargo	• Department representation on steering committee • Requested input from city commission members specifically
Frontier	• Email correspondence with BJ Blanchette
Gardner	• Email correspondence Todd Kalm • Attended post-flood city council meeting June 10th, 2019
Grandin	• Conference call with city council May 14th, 2019
Harwood	• Email correspondence with Casey Eggermont • Attended city council meeting May 6th, 2019
Horace	• Email correspondence with Matt Lower
Hunter	• Email correspondence with Ben Olson

Kindred	• Email correspondence with Tabitha Arnaud
Leonard	• Phone conversation and email correspondence with Greg Wessels
Mapleton	• Attended city council meetings on February 12th and June 11th, 2019.
North River	• Attended city council meeting April 23rd, 2019.
Oxbow	• Email correspondence with Stacey Fett
Page	• Email correspondence with Judy Johnson
Prairie Rose	• Email correspondence with Rick Callens and Bob Staloch
Reiles Acres	• Email correspondence with Shane Amundson
Tower City	• Email correspondence with Jody Haselu
West Fargo	• Department representation on steering committee • Requested input from city commission members

APPENDIX C: EXECUTED RESOLUTIONS OF ADOPTION