2020

Pembina County Multi-Hazard Mitigation Plan

2020 UPDATE

PEMBINA COUNTY DEPARTMENT OF EMERGENCY SERVICES

PCDES | 301 Dakota St W #8, Cavalier, ND 58220

Contents

Executive Summary

Commented [DKB1]: Informative executive summary.

Disasters can strike at any time in any place. In many cases, actions can be taken before disasters strike to reduce or eliminate the negative impacts. These actions, termed mitigation, often protect life, property, and economic interests. The Pembina County Multi-Hazard Mitigation Plan addresses major hazards county-wide through a collaborative and ongoing planning

process, including review of county and city mitigation plans, Pembina County hazards were identified, researched, profiled, and prioritized.

~~Twelve~~ Nine major hazards have been identified by the planning team including:

- Communicable Disease
- Extreme Summer Weather
- Hazardous Materials
- Dam Failure
- Extreme Winter Weather
- Terrorism or Unrest
- Drought
- Flooding
- Fire

Other hazards which are seen as extremely unlikely or impossible in this area have been omitted. Examples include:

- Tsunamis;
- Hurricanes;
- Avalanche;
- Other threats or hazards which would cause significant harm, but whose likelihood does not warrant mention in this plan.

Each hazard was profiled in terms of its description, geographic location, previous occurrences, probability, magnitude, and vulnerabilities. The vulnerabilities to jurisdictions, buildings and property, critical facilities and infrastructure, and new and future development are evaluated for each hazard.

The following purpose statement and goals are outlined in the plan's mitigation strategy, based on the results of the risk assessment:

- **Purpose**: Minimize the vulnerability of the life and health of people, property, environment, and economy of Pembina County and its communities from the impacts of natural and technological hazards as well as adversarial threats.
- **Goal 1**: Develop and enhance county and city planning related to hazard understanding and mitigation.
- **Goal 2**: Enhance the public's awareness of hazards.
- **Goal 3**: Reduce impacts of hazards to future development through planning.

Much of the updates made in the 2020 addition are based on findings from the THIRA initiative pushed by the state of North Dakota and the US Government to better assess threats and hazards nationwide. While Pembina County Department of Emergency Services completed the THIRA and wrote this document, input has been garnered from community partners including – but not limited to:

- PC Public Health
- ND Parks and Recreation
- Cavalier Ambulance Service
- NDDES
- ND Pipeline Assn.
- US Dept. of Agriculture
- PC Highway Department
- ND Game and Fish
- US Border Patrol
- Kittson County, MN EM
- National Weather Service
- National Resource Conservation Service
- PC Fire Chiefs Assn.
- PC Sheriff's Dept.
- US Customs and Protection
- Enbridge Energy*
- ND State Water Commission
- Farm Service Agency

**Enbridge Energy provided additional utility assistance in their replacement of pipeline through Pembina County, including technical information as well as industry-specific information.*

Threat and Hazard Identification and Risk Assessment (THIRA) Findings

Based on review from the above agencies, and understanding that the Pembina County THIRA was completed prior to the COVID-19 pandemic, there were relatively few changes made to the priorities in the 2015 MHMP update. However, it did provide greater clarity into the capabilities that the county has and specifically how the threat impacts communities in the

Commented [DKB2]: The list has only nine hazards, not 12

Commented [DKB3]: Consider discussing how the risk assessment shaped the strategies. For example, based on the assessment, what types of projects were identified? What became the priorities since the last update. It would help address requirement **Requirement: D3.** Was the plan revised to reflect changes in priorities?

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region. Six threats were identified, and in no specific order they are: Critical Threat Incident, Hazardous Materials Release, Severe Summer Weather, Severe Winter Weather, Dam Failures and Flooding.

Much of this plan emphasizes the additional data researched to gain an accurate picture, especially as it relates to severe weather and their secondary effects, such as flooding or draught. While seeking out this information, many inroads were made with additional government agencies that traditionally are not part of emergency response – mainly agricultural and natural resource agencies. This paints a much broader picture to the larger climate trends that may be much larger scale (climate change), or more immediate (dry spells and draught).

Other issues, such as Critical Threat Incidents, Dam Failures and Hazardous Material Incidents, while rare, impact massive regions and require equipment or training that cannot feasibly be developed in Pembina County. Events like this will require additional training and mitigation practices –where feasible – to reduce the risk of the event, or potential casualties in case of the event. Specific to Critical Threat Incidents, several large employers and a couple of schools have already taken the opportunity to meet with law enforcement and emergency management to put more proactive practices into place to harden themselves against adversaries. As these are rare events and affect a relatively small area, they are not mentioned in detail in this plan, but are filed elsewhere in emergency operations plans, or in standard operating procedures for law enforcement.

Adoption Documentation

Pembina County's Multi-Hazard Mitigation Plan, prepared by emergency management and the local emergency planning committee and required by North Dakota Department of Emergency Services in conjunction with the Federal Emergency Management Agency (FEMA) has been adopted by Pembina County by powers of the County Commission, City Majors and their Councils.

The adoption also provides assurances that that Pembina County will continue to comply with all applicable federal and state statutes and regulations in effect with respect to the periods for which the county receives grant funding, as stated in 44 CFR 13.11(c), and will amend this plan when necessary to reflect changes in state or federal laws or statutes as required in 44 CFR 13.11(d). The applicable text from the Code of Federal Regulations (CFR) follows:

> *TITLE 44--EMERGENCY MANAGEMENT AND ASSISTANCE*
>
> *CHAPTER I--FEDERAL EMERGENCY MANAGEMENT AGENCY, DEPARTMENT OF HOMELAND SECURITY*
>
> *PART 13-UNIFORM ADMINISTRATIVE REQUIREMENTS FOR GRANTS AND COOPERATIVE AGREEMENTS TO STATE AND LOCAL GOVERNMENTS*

Purpose, Vision, and Values

Purpose of the Multi-Hazard Mitigation Plan

Pembina County and the participating Pembina County jurisdictions of the City of Bathgate, the City of Canton (Hensel), the City of Cavalier, the City of Crystal, the City of Drayton the City of Hamilton, the City of Mountain, the City of Neche, the City of Pembina, the City of St. Thomas, and the City of Walhalla have developed this Multi-Jurisdictional Multi-Hazard Mitigation Plan (MHMP) to create a safer community. This MHMP is the representation of the commitment of the County and participating jurisdictions to reduce risks from natural and other hazards, and serves as a guide for decision-makers as they commit resources to reducing the effects of natural and other hazards. This MHMP serves as a basis for the North Dakota Department of Emergency Services (ND DES) to provide technical assistance and to prioritize project funding. (See IFR §201.6).

While the Disaster Mitigation Act of 2000 (DMA 2000) requires that local communities address only natural hazards, the Federal Emergency Management Agency (FEMA) recommends that local comprehensive mitigation plans address man-made and technological hazards to the extent possible. Towards that goal, Pembina County and the participating jurisdictions have addressed an expansive set of hazards.

Pembina County continues to aggressively implement a widely recognized, comprehensive program of mitigation that goes beyond that of solely reducing hazard vulnerability, but also incorporates complementary goals that can address multiple community needs and lead to safer, more sustainable communities. In so doing, the county is helping the Division of Homeland Security in carrying forward a revitalized approach to traditional emergency management. Rather than focusing on short-term solutions to inevitably long-term problems, the county's work emphasizes the need to ensure communities become better able to withstand the forces of nature while at the same time improving their residents' overall quality of life. By avoiding unnecessary exposure to known hazards, communities will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events. The team has been addressing the needs of current residents and also the needs of future generations. It is hoped that this focus on an integrated, future-oriented approach will result in communities that are less vulnerable and more sustainable.

Unless otherwise specified, reference throughout this Plan to the MHMP or Pembina County includes Pembina County and the cities of Bathgate, Cavalier, Crystal, Drayton, Hamilton, Hensel, Mountain, Neche, Pembina, St. Thomas, and Walhalla.

Commented [DKB4]: Are all these jurisdictions participating? I thought you had a jurisdiction want to go its own way during the last plan development. Was that Drayton?

Commented [AK5R4]: So far, yes. Unless I hear something back this week, we got Drayton on board!

Commented [AK6R4]:

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Each community mentioned is addressed in more detail within the plan with specifics to community groups and city councils. County officials and government have access to this plan and its research in order to build better resiliency to threats and hazards in the region. Of note, the Pembina County Commission has shown willingness to interpret the findings of this document and provide funding for projects listed herein. This is especially critical when identifying "soft" resources to include technical knowledge and staffing, but is also visible with assistance funding projects like hydrology studies or constructing community shelters.

~~The County of Pembina is required to adopt a federally approved Hazard Mitigation Plan to be eligible for certain disaster assistance and mitigation funding. The purpose of this Multi-Hazard Mitigation Plan is to fulfill federal, state, and local hazard mitigation responsibilities; promote pre and post disaster mitigation measures, short and long range strategies that minimize suffering, loss of lie, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the county are exposed; eliminate or minimize conditions that would have an undesirable impact on the citizens, economy, environment, and wellbeing of the county; serve as a consolidated, comprehensive source of hazard information; educate the communities, including government leaders and the public, on their vulnerabilities; prioritize and promote cost-effective mitigation solutions; support requests for grant funding; and encourage long-term community sustainability.~~

~~Effective mitigation planning promotes a broader understanding of the hazards threatening the communities and provides a clearer vision and competitive edge for future mitigation grant funding. By integrating mitigation concepts into local thinking, the communities will find many more opportunities for disaster resistance beyond grant funding. For example, the consideration of disaster mitigation when designing new facilities or subdivisions will result in cost-effective solutions and greater disaster resistance, thus saving the communities money in the long-term and contributing to the communities' sustainability.~~

FIGURE 1: FROM NORTH DAKOTA ENHANCED MULTI-HAZARD MITIGATION PLAN, 2011

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The Plan is a living document that will be reviewed and updated annually to reflect changing conditions and improvements by new information, especially information on local planning activities. The Multi-Jurisdictional Hazard Mitigation Plan is written to meet the statutory requirements of DMA 2000 (P.L. 106-390), enacted October 30, 2000 and 44 CFR Part 201 – Mitigation Planning, Interim Final Rule, published February 26, 2002.

Goals Shared with State Multi-Hazard Mitigation Plan

Pembina County's MHMP supports the goals that it shares with the State of North Dakota Multi- Hazard Mitigation Plan, namely:

Goal 1: Save Lives and Reduce Injuries
Goal 2: Avoid Damages to Property
Goal 3: Protect the Environment

Commented [DKB7]: You met the following requirement: **Requirement C3.** Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?

Goal 4: Promote Hazard Mitigation as an Integrated Policy

Goal 5: Reduce long-term vulnerabilities to hazards identified in this plan

Support of Broader County Vision

The Multi-Jurisdictional Hazard Mitigation Plan supports the broader vision and values of Pembina County as stated in the County's Mission, Vision and Values Statements below.

Mitigation personnel will also work with other county and city agencies to incorporate hazard planning into other agencies and agency documents. Agencies include, but are not limited to:

Pembina County Water Resource Board	Drayton Police Department
Cavalier Economic Development	Northeastern Special Response Team
Pembina County Emergency Operations Plan	US Customs and Border Protection
Pembina County Sheriff's Department	US Border Patrol
Pembina County Public Health	ND Parks and Recreation
Cavalier Police Department	ND Game and Fish
Walhalla Police Department	ND Emergency Management Support Team

Plans that can incorporate information in the MHMP:

Pembina County Emergency Operations Plan	Dam Emergency Action Plans
Pembina County Economic Development Plan	Pembina County Threat/Hazard Identification Risk Assessment
Hospital EOPs	Dam Emergency Action Plans

Several agencies provided plans from within their organization. In some cases, these plans had a major impact on the overall MHMP. Notable influences include:

Dam EAP's from the ND Water Commission: Information includes pool volume and flow studies, allowing the planning team to predict property loss. In addition to the technological hazard of dam breach, each EAP also shows the amount of water each dam can retain, allowing us to predict relief from snow melt and rainfall. In addition, the information also predicts the rate that water can be released from each retention site.

Public Warning System Information from Pembina County 911: 911 provided planners with the status of emergency notification equipment, such as sirens, radio towers, and mass-notification systems. Many sirens in the county are reaching end of life limits and need to be upgraded. In a few cases, city growth is pushing the limits of sirens, and new infrastructure must be built.

Pembina County Public Health: Provided input to the MHMP especially in terms of communicable diseases. In some cases, Public Health was able to provide information on environmental hazards, although they were most critical in determining at-risk populations and steps to be taken at medical facilities and long-term care facilities.

Community Plans

Several larger communities in the county have the staff and means to develop their own zoning policies, risk mitigation procedures and emergency operations plans. While county emergency management does not directly control planning in communities separate from county government, PCDES does help provide input and planning structure for communities upon request.

Commented [DKB8]: Excellent addition.

Commented [DKB9]: A few modifications here can ensure compliance with not one but two requirements!

Requirement A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information?
Requirement C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?

While Requirement A4 looks at how existing plans, reports, etc., were incorporated into the plan, Requirement C6 looks at how the 2020 plan will be incorporated into EACH jurisdiction's plans, codes, ordinances, etc. FEMA revised its interpretation of this standard since your last update, hence the emphasis on each.

For each jurisdiction, you will need to list planning mechanisms such as building codes, zoning ordinances, comprehensive plans, etc. It's not uncommon – not all jurisdictions have plans. So, the way we are addressing this situation in North Dakota is to include a statement that lists those jurisdictions that don't have planning mechanisms and indicate they support county level planning initiatives.

Consider expanding this chart to include the documents you referenced in plan development in one column and a second column that discusses which elements were used to inform those plans (such as the risk assessment, mitigation strategy). Also indicate the process for incorporation --That way you answer the question about the process for integration.

For Requirement A4, since you referenced other resources in the risk assessment, consider adding a statement that plan development also required review of several hazard-specific sources. These elements were incorporated into to the risk assessment to give context to hazards.

For Requirement C6, be sure to discuss the process for integration – such as county and city officials will be encouraged by Planning Team members to incorporate data into other plans.

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Mission

To provide quality service with dignity, integrity and respect.

Vision

- To ensure basic health, safety, and protection of people.
- To facilitate commerce and trade in order to promote a high quality of life.
- To promptly resolve issues in an honest and consistent manner.
- To provide useful and effective service utilizing both public and private means.

Values

- *Fiscal Responsibility* – We respect our obligation to the taxpayer and shall act in a fiscally responsible manner.
- *Pride in Service* – We take pride in our mission, our organization, and the unique abilities of each individual employee to deliver quality service.
- *Integrity and Ethics* – We shall conduct our business through honest and direct communication with integrity, trust, and a high standard of ethics and respect.
- *Decisive Leadership and Accountability* – We value initiative and leadership, and are accountable for our performance.
- *Innovation* – We encourage innovative programs to increase efficiency and streamline operations.
- *Working Together* – We encourage partnerships and cooperative agreements which enhance our ability to accomplish our mission.

The Planning Process

Pembina County Department of Emergency Management is responsible for the development of the MHMP. Pembina County and the cities of Bathgate, Canton (Hensel), Cavalier, Crystal, Drayton, Hamilton, Mountain, Neche, Pembina, St. Thomas, and Walhalla utilized a community effort for planning to design an effective mitigation plan. The input from a variety of stakeholders that will be part of the disaster recovery were involved in the process, the following agencies were invited to participate: elected officials, first responders, emergency management, health care providers, public works, road departments, businesses, and the public.

Since the approval of the previous Pembina County Multi Hazard Mitigation Plan the jurisdictional participation has not changed. All jurisdictions listed above have been invited to participate in planning meetings.

The Multi-Hazard Mitigation Plan was prepared to address all hazards that pose significant risk to Pembina County. Each hazard has been assessed using consistent methodology, while also providing historical background and assessing vulnerability and potential loss. The mitigation strategy adopted within this plan establishes the long-term goals and objectives for the Pembina County and lists possible actions to achieve them.

The mitigation priorities adopted within this plan address long-term, permanent solutions to problems caused by hazards throughout the county. While these priorities may shift following a particular disaster event, they are designed to provide the mitigation team with long-term mitigation objectives and solutions. This mitigation element includes policy, planning, and initiatives that will reduce the vulnerability of Pembina County and its communities to all identified hazards. The mitigation element also includes a strong outreach strategy that will be implemented throughout all phases of emergency management. Disaster preparedness, response, and recovery operations are not focused on within this plan but are instead covered in the local emergency operations plan (LEOP).

Plan Updates

The 2020 Pembina County MHMP acts as a revision of previous plans from 2003, 2010 and 2015. Core information was generated by the 2015 MHMP process. Essential updates were made to reflect changes in the nature of hazards, new hazards such as hazardous materials, and update at-risk areas such as new flood-prone properties.

With the foundation of the plan in place, Pembina County Emergency Management (PCEM) will update information as necessary to reflect changes in hazards and government/agency policy. PCEM will work closely with the Pembina County Local Emergency Planning Committee (LEPC) in order to develop a ~~more clear~~clearer view of concerns from various departments from different regions in the county. PCEM will also work closely with the North Dakota Department of Emergency Services (NDDES) in order to meet state and federal standards to ensure compliance with the latest policy and secure continued funding for Pembina County.

The Pembina County MHMP was initially reviewed and discussed with the planning team to determine the status of the prior plan and what changes would need to be met to meet the current crosswalk guidelines and to continue the previous Emergency Managers progress of the plan update. According to the findings, it was agreed that the plan as a whole needed to be updated and reformatted to be comparable to the North Dakota State plan.

Each section of the plan has been updated to include disaster information since the previous approval in 2015. It is understood by the planning team that this plan will need to be reviewed on a yearly basis.

A county map was added to the beginning of the plan to assist with understanding the distance between jurisdictions in the county.

Resolutions for the plan were also added to the beginning of the plan per a request from the Department of Emergency Services.

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Commented [DKB10]: You likely were planning to address this since you did in the previous plan with a chart of meetings, but add a section here or in the appendices that describes the planning process in more detail: **Requirement A1**. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction?

Here's what the Planning Guide says:
Documentation typically is met with a narrative description, but may also include, for example, other documentation such as copies of meeting minutes, sign-in sheets, or newspaper articles.

Documentation of how the plan was prepared must include the schedule or timeframe and activities that made up the plan's development as well as who was involved. Documentation typically is met with a narrative description, but may also include, for example, other documentation such as copies of meeting minutes, sign-in sheets, or newspaper articles. Document means provide the factual evidence for how the jurisdictions developed the plan. b. The plan must list the jurisdiction(s) participating in the plan that seek approval. c. The plan must identify who represented each jurisdiction.

Commented [DKB11]: Also for Requirement A1: The Plan must provide, at a minimum, the jurisdiction represented and the person's position or title and agency within the jurisdiction.
Identify at least one representative for Pembina County and the cities of Bathgate, Cavalier, Crystal, Drayton, Hamilton, Hensel, Mountain, Neche, Pembina, St. Thomas, and Walhalla.

It may be easiest to develop a chart with jurisdiction, name, title and agency.

Commented [DKB12]: Requirement A2: Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process?
The Plan Review guide says: The Plan must provide the agency or organization represented and the person's position or title within the agency. c. The plan must identify how the stakeholders were invited to participate in the process

Identify: 1) neighboring communities (such as Kittson); and 2) regulatory agencies like the Pembina County Water Resource Board and planning commissions. Discuss how they were invited to participate and include the agency, person's title and name. This will ensure you meet this requirement/

Risk Assessment Methodologies

A key step in preventing disaster loss in Pembina County and the incorporated jurisdictions is developing a comprehensive understanding of the hazards that pose risk to the communities. Hazard, risk, and vulnerability are utilized throughout the plan for each of the hazards relevant to the county.

The assets and community inventory section includes the methodology of loss of structures for the county and the seven repetitive loss structures specific to Pembina County.

Hazards identified within the plan have descriptions of the hazard and record of the hazard history as it pertains to the county.

Maps of hazards for each jurisdiction have been included with structure and facility locations and are updated continuously depending on the hazard the county is affected by.

Critical facilities and infrastructure were mapped by Pembina County utilizing the ArcGIS and InteractiveGIS software with land value input from the tax office. The mapping shows the proximity of facilities for each identified hazard throughout the plan. These are updated through June 2014. Critical infrastructure inventory for Pembina County will be monitored through the Emergency Management Coordinator as of June 2014. This information will available on a need-to-know basis by application to the appropriate person(s). Some infrastructure will be made available in the new updates of the plan.

Population vulnerabilities were assessed for areas in the county that would have the most impact by an event.

Community Input

To the amount that they are willing and capable of helping, the general populace of the county must be involved with drafting and reviewing the plan. In order to accomplish this task in a reasonable timeframe with the current emergency management staff, a reasonable effort will be made to make the public aware of drafting meetings and to allow avenues for resident input. Help will be requested of participating jurisdictions to make a reasonable effort to elicit input from their respective residents and to then amass public participation into the drafted plan.

~~As the plan becomes more developed, drafts of the plan may be distributed to public gathering places, such as city administration buildings, churches, cafes, post offices, or similar locations. Locations and times may be advertised in area newspapers, radio and other media in order to illicit the greatest turnout. In the more advanced stages of planning, it may be possible to hold a public meeting with public open discussion to ensure all specific needs and concerns have been met.~~

This task has been made much more difficult with the COVID-19 Pandemic and public involvement has been relegated to brief discussions in small groups, online polls, and video livestreams. For this reason, planning with city councils has been avoided where possible and conducted via mail. Contacts were then tasked to discuss concerns with their respective policy-making bodies including city councils and park boards, etc. in order to create a comprehensive picture of community concerns. Representatives from each jurisdiction – and their positions – are as follows:

City of Bathgate	Ted Zaharia, Mayor	City of Cavalier	Keli Truver, Auditor
City of Crystal	Larry McColluum, Mayor	City of Drayton	Sheir Kuznia, Auditor
City of Hamilton	Wendy Keena, Mayor	City of Hensel	Katie Foster, Mayor
City of Mountain	Tim Moore, Mayor	City of Neche	Stuart Symington, Mayor
City of Pembina	Lisa Hall, Auditor	City of St. Thomas	Tim Higdem, Mayor
City of Walhalla	Mike Belanus, Mayor		

As mentioned beforehand, other agencies and jurisdictions were also consulted with the planning process. Major planning went into the following organizations.

Commented [DKB13]: Requirement B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods?
Andrew, FEMA just updated its listing and I just gained access this week to the database. FEMA is working on a sorting issue. As soon as it is resolved I will send you the number.

Commented [DKB14]: You are well on your way to meeting this requirement: **Requirement A3:** A3. Does the Plan document how the public was involved in the planning process during the drafting stage?

Make sure to have sign-in sheets, results from the online polls and a discussion of video livestreams. Do you have copies of any media stories?

Commented [DKB15]: Has this taken place? This section indicates it may happen. You may want to change verb tense here.

Commented [AK16R15]:

Commented [AK17R15]:

Pembina County Water Resource District – LuAnn Kemp, Office Administration

The water resource district is a critical partner, especially when it comes to hydrology, flood protection and flood damages. The WRD was able to provide emergency action plans for all water retention structures in the county and the potential impact of each release. Important information relating to water conveyance through legal drains towards streams also provides useful information when it comes to severe storm events and snowmelt runoff.

Kittson County, Minnesota – Scot Olson, Emergency Manager

An important neighbor to the east, Kittson County provides several unique challenges, including policies in a separate state and FEMA region. Despite the differences, the counties share similar demographics, economic inputs, community sizes and risk profiles. Most notably, the Red River of the North separates the two counties and similarly inundates each. This mutual threat has provided opportunity for resources sharing and disaster communications for all neighboring counties, and occasionally into Canada as well.

In the summer of 2020, Enbridge Energy replaced a section of pipeline that transects both counties and was a target for several environmental fundamentalist groups threatening to disrupt construction. Personnel from both counties, as well as private industry representatives met several times to discuss planning and contingencies. At the time of this writing, construction in Pembina County is complete, and work in Kittson County is slated for 2021. Additional meetings are anticipated, as well as resource sharing between the jurisdictions.

Northeastern Special Response Team – Andreas Alt, Commander

The Northeastern Special Response Team and a group of law enforcement and medical personnel from Cavalier, Pembina and Walsh Counties, providing rapid response to critical threat incidents in the area. The team has also provided critical input into threat reduction in major business, hospitals and schools to harden targets against adversaries.

Plan Maintenance

Jurisdictions participating in the MHMP have a vested interest and responsibility to help maintain the plan and participate in future plan updates. The above signed entities entering into agreement in this plan understand that by combining mitigation plans, community resources, and collective manpower, more effective preparedness and response can be established in Pembina County as a whole.

Public input is provided in several direct and indirect ways. The primary and most easily accessed method is through immediate contact with the planning group or emergency management to discuss specific complaints. While this is often the clearest, many times suggestions cannot be taken into effect without approval from a governing body, such as county commission, city council, or other policy-making board.

This leads to another way of garnishing public input, by referencing community meetings and policy changes from council meetings or policy changes. Often, this is quite evident with zoning or planning updates, but may also be put into effect with budget changes that impact budgets of response agencies or 911 equipment funding. Emergency management can help influence these decisions by meeting with policy makers and helping to explain concerns or response requirements.

Departments within participating jurisdictions will be asked to maintain current rosters and equipment lists for use in planning and mutual aid responding. Volunteers will be asked to stay current on pertinent planning for their position and will be asked to attending large-scale county planning to learn to work with each other and how to respond to larger-scale incidents. Any major changes to communities, such as changes in roads or utilities, changes in Tier II storage, areas of public gathering, location of assets, contact information of chief elected officials, fire chiefs, etc. should remain available to responders and local planning committee. An annual review of this information will be made in order to maintain current information and to aid the next ~~5~~

Commented [DKB18]: Requirement A5: Is there discussion of how the community(ies) will continue public participation in the plan maintenance process?

Discuss such approaches as posting the plan to the website, inviting the public to comment at LEPC meetings if you discuss the plan, setting up an emergency management/hazard mitigation booth at community events, etc?

~~year~~5-year update. All changes to the document itself will be made by the emergency manager on an as-needed basis, with coherent, in-depth changes made in 2025 with input from community partners and the local emergency planning committee.~~.~~

Finally, all participating jurisdictions will be asked to participate in the next MHMP scheduled update in 2025.

Commented [DKB19]: Requirement A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)?

The Plan Review Guide requires identification of the person by title or name of the agency responsible for leading plan monitoring, evaluation and update. That's usually the emergency manager, but also consider providing the annual review to the LEPC for it to evaluate the effectiveness of the plan and to make any recommended changes. Or assign the evaluation to you as well as the update.

Pembina County Profile

Pembina County is located in the northeast portion of North Dakota. Pembina County is 1,117 square miles making it the 34th largest county in the state. It is 39 miles from north to south and 34 miles from east to west. Pembina County is bounded by Manitoba, Canada to the North, Cavalier County to the West, Walsh County to the South and Kittson County, Minnesota to the East. Cavalier is the county seat and incorporated towns include Bathgate, Canton (Hensel), Cavalier, Crystal, Drayton, Hamilton, Mountain, Neche, Pembina, St. Thomas, and Walhalla. Pembina County is on the eastern side of the continental divide and drains through the Pembina, Tongue and Park Rivers. The Red River forms the eastern boundary of Pembina County, eventually running into Lake Winnipeg and the larger Hudson Bay system.

The average elevation in Pembina County is recorded at 957 feet above mean sea level (msl). The county consists of prairies, croplands, river valleys, and rolling hills.

According to the 2010 census, the population of Pembina County is 7,016. This represents a 1.1**%** decline in population utilizing the 2014 estimate in population. (United States Cencus Bureau, 2018)

Climate

The county's geographic location results in a sub-humid continental climate characterized principally by marked fluctuations in daily and seasonal maximum and minimum temperatures, and light to moderate precipitation. The precipitation tends to be irregular in occurrence, amount, and area of coverage. The inconsistency of the county's weather arises from the interaction of three major air masses which originate in distinct global regions: cold, dry air from the polar region; warm, moist air from the Gulf of Mexico; and cool, moist air from the Northern Pacific. Both the temperature and the moisture characteristics of a Northern Pacific air mass change as the air moves across the Rocky Mountains. The resulting air, which is usually mild and dry, reinforces the continental nature of the county's climate. The polar air mass tends to dominate the other two, but its influence is considerably lessened during the summer.

Normally the temperature is moderate until the beginning of July, after which short, hot periods are experienced until the end of August. The freeze-free period is the number of days between the average last occurrence of freezing temperatures in the spring and the average first occurrence of 32˚ F or lower in the fall. The length of the freeze-free period approximates the length of the growing season which ranges from fewer than 110 days to over 130 days between May 12th and September 23rd. Topography and local weather conditions can produce subfreezing temperatures at the ground surface while the air temperature a few feet above the ground remains above 32˚ F.

Pembina County experiences a fairly high frequency of hazardous weather phenomena throughout the year. In any year, the winter season may bring less than a half-dozen storms or more than a dozen, ranging in duration from a few hours to a couple of days. The spring season may bring dry conditions and slight riverine snowmelt run-off, gentle rains and minor to moderate riverine snowmelt flooding, or it may bring major riverine and/or overland snowmelt flooding compounded by locally heavy rains. The summer season may bring scattered occurrences of large hail or damaging straight-line winds, or it may bring numerous such events, along multiple tornadoes and broad areas of flash flooding. The autumn season can be somewhat dry and pleasant or it can be cool and wet with periods of high winds or local flooding. Through the course of a year, the northern plains and Pembina County experience some of the highest frequency, variety and variability of hazardous weather in the United States.

Seasonally Average Expectations

- **Winter** – Typically 35-40 inches of snow, with 2.5 to 3.0 inches of water equivalent. Perhaps 6-8 winter storms, with 2-3 reaching blizzard intensity, the remainder having a combination of heavy snow, freezing rain, or windblown snow. These storms may generally last from 6 to 24 hours. Extremely cold wind chills of less than -40F usually occur a few times a winter.

- **Spring** – Typically the spring will bring one or two late season heavy snow or blizzard events, and perhaps another high wind event affecting most of the county. An average season's snowmelt will generally cause minor river flooding, though it may be aggravated by heavier rains or heavier snowfall in upstream portions of the river and reach to moderate levels. Prior to spring green-up there is typically a slight wildfire risk, especially for grassland acreages and roadsides.

- **Summer** – Typical summer season precipitation will fall from the nearly one hundred thunderstorms which occur on around 30 days from late spring through fall. Of these, perhaps 20 storms will reach severe intensity and produce 10-15 distinct large hail events (events separated by 10 miles or 15 minutes), a half-dozen damaging wind events, and perhaps one weak tornado or flash flood each year.

- **Autumn** – Typically the fall will transition from thunderstorms, to widespread rain storms, to winter storms, with a month or so of dry and pleasant weather. A typical fall will have one or two high wind periods, each lasting from 4 to 20 hours.

Annual EAS Activations

The National Weather Service issues forecasts and warnings for specific weather hazards for the protection of life and property and for the enhancement of the national economy. Certain of these hazards require activation of the Emergency Alert System (EAS) to alert the public. In a typical year the NWS will issue 52 routine weekly EAS tests, 6-8 winter storm watches and 6-8 winter storm warnings, 1-2 flood or flash flood watches or warnings, 5 severe thunderstorm or tornado watches for 20-25 severe thunderstorm, and another 1-2 high wind watches or warnings. This will result in nearly 100 county-wide EAS activations during the course of the year, half as part of the system test and half for real life-threatening weather situations.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept.	Oct	Nov	Dec	Annual
Average Max Temp. (˚F)	12.9	18.9	31.7	50.9	66.9	75.0	80.7	79.7	68.6	55.2	34.6	19.7	49.6
Average Min Temp. (˚F)	-6.4	-1.5	12.8	29.1	40.9	51.1	56.1	53.2	43.4	32.6	17.1	1.5	27.5
Average Total Precip. (Inches)	0.55	0.36	0.76	1.30	2.39	3.29	3.00	2.52	2.13	1.41	0.77	0.53	19.03
Average Snow Fall (Inches)	6.9	4.6	5.7	2.8	0.6	0.0	0.0	0.0	0.0	4.6	5.9	7.4	35.6

Economy

The median income for a household in the county was $64,962. About 7% of families were below the poverty line. Merchant wholesaler sales totaled $367,854,000 in 2007. Retail services totaled $89,953,000 the same year and accommodation and food service sales were at $5,623,000 (United States Cencus Bureau, 2018).

Economic development in Pembina County is being addressed by a nonprofit company in Drayton (Drayton Economic Development Corporation) and the Champion REAP Alliance for Pembina County. Individuals or businesses looking to create new jobs and work towards retention and expansion of local manufacturing and service companies can contact these groups. Other opportunities include the Pembina County Job Development Authority (JDA) monitored by the Red River Regional Council. Various other state and regional financing opportunities exist.

Commented [DKB20]: Requirement D1. Was the plan revised to reflect changes in development? I The plan must describe changes in development that have occurred in hazard prone areas and increased or decreased the vulnerability of each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction's overall vulnerability, plan updates may validate the information in the previously approved plan.
You meet this requirement, but if you want to knock it out of the ballpark, consider describing whether any new businesses have been setup, or any new construction since the last plan update.

Transportation Systems

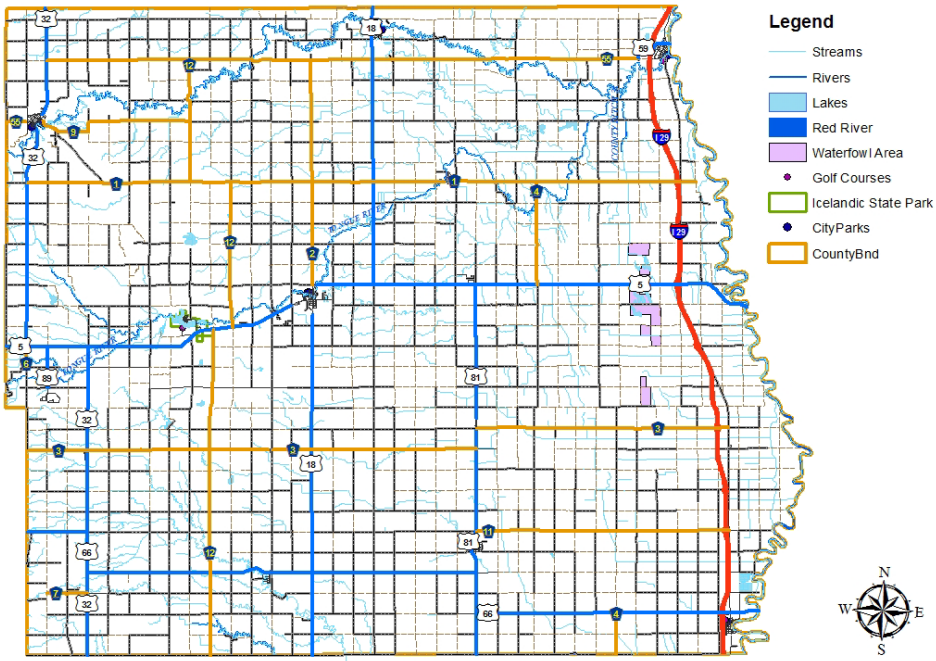
Because of its rural nature, the county is highly dependent upon its network of federal, state, and county roads, and highways. State Highways 5 and 66 are the major east-west routes across the county. Interstate 29, U.S. Highway 81, State Highways 18 and 32 are major north-south routes. ND Highways 5 and 66 are the major arteries east and west. These state and federal highways along with the hard surfaced and graveled county and township roads provide a good transportation network. The U.S. Port of Entry in Pembina, ND is the busiest U.S./Canadian port between Blaine, WA, and Detroit, MI. Some public transportation does exist in the form up on-call vans and buses that may be used to travel between towns, businesses and other destinations.

Pembina County has a number of community airports; Cavalier (2C8), Pembina (PMB), and Walhalla (96D). The cities of Drayton and St. Thomas have grass landing strips available. The nearest major airline facilities are located in Grand Forks County. The Burlington Northern Santa Fe Railroad, Canadian Pacific Railroad, and numerous motor transport carriers support freight needs.

Major Recreation Areas

- **Pembina Hills Recreation Area** – although not completely within Pembina County, this network of trails in the Pembina Gorge is managed by North Dakota Game and Fish and Parks and Recreation out of offices in Walhalla. The trails boast 12 miles of trail maintained to accommodate type 1, 2 & 3 OHVs as well as foot and bike traffic.
- **City Parks** – towns in the area devote time and resources to maintain city parks. Sometimes simply a few picnic benches, but up to jungle gyms and swimming pools, these parks are frequently used by citizens in the summer months for picnics and events.
- **Country Clubs** – several towns in the region operate nine-hole golf courses. Walhalla, Pembina, Cavalier and Drayton all have independent country clubs that are open to the public, often cater through their club houses to community events, and are the venues for high school athletics in the spring and fall.
- **Hunting and Fishing** – other lakes and streams in the region provide habitat for many species of fish and wild game. Hunting and fishing seasons generally regulate the presence of hunters and anglers and are often responsible for large groups of tourists to visit the area. With growing acres of CRP in the county and relatively large unposted hunting land, these activities take place county-wide.
- **Icelandic State Park** – managed by North Dakota Parks and Recreation, the 200 acre park features several miles of trails used for hiking in the summertime and repurposed as cross-country skiing and snowshoeing in the wintertime. The park incorporates an 8400 acre-foot man-made lake created by a retention project on the Tongue River. The lake, sometimes referred to as Renwick Dam, provides opportunities for fishing, recreational boating and swimming in the summer time and ice fishing in the wintertime. Approximately 160 campsites are maintained by park staff along with several rentable cabins. Other assets include historical buildings and a heritage center.

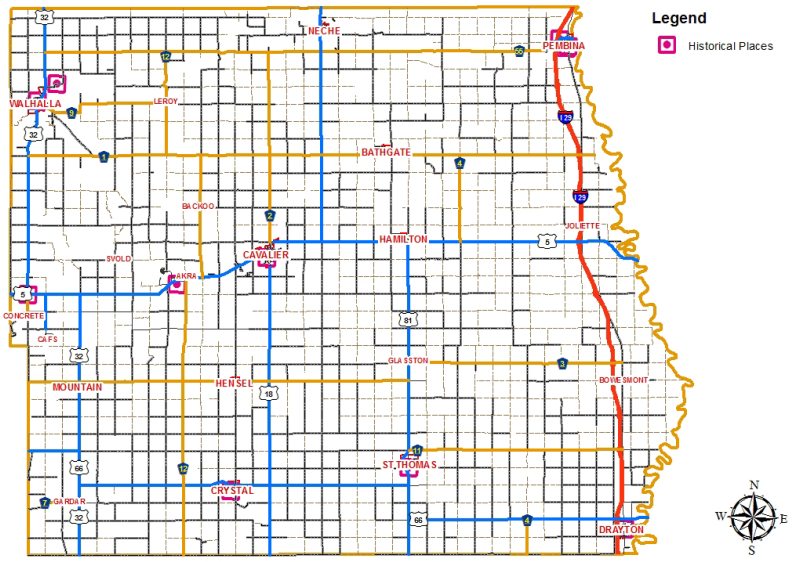
- **Off-Road Vehicle Use** – with the proliferation and increasing affordability of off-road vehicles including snowmobiles, local residents maintain a rough network of trails throughout the county. These vehicles are often seen in town picking up supplies or fueling up. Much of the traffic spreads county to county and often across state lines. International traffic is generally regulated to carrying recreational vehicles in by trailer or light truck.



Historical Setting

Before developing areas for construction of homes, businesses, and recreation resources such as parks, camping, water recreation, etc. and when planning mitigation measures it must be established that historic archeological sites will not be negatively impacted. According to the North Dakota Historical Society Pembina County contains 121 historic/archeological sites.

Historic Place Name	Address	City	Historical Registry
Gunlogson Farmstead Historic Site	13571 ND Highway 5	Cavalier	National Park Service
Pembina County Courthouse	301 Dakota St W	Cavalier	National Park Service
Crystal Bridge	Appleton Ave over Cart Creek	Crystal	National Park Service
Drayton United Methodist Church	ND Highway 44	Drayton	National Park Service
Grace Episcopal Church	152 Ramsey St W	Pembina	National Park Service
US Customs House and Post Office – Pembina	125 Cavalier St S	Pembina	National Park Service
O'Connor House	Off US Highway 81	St. Thomas	National Park Service
Gingras House and Trading Post	Northeast of Walhalla off of ND Highway 32	Walhalla	National Park Service
Walla Theater	909 Central Ave	Walhalla	National Park Service
Pembina State Museum	805 Highway 59	Pembina	ND Historical Society
Oak Lawn Church	Intersection of Highway 5 and Highway 32	Concrete	ND Historical Society



Land Use and Development Trends

Census data shows that the County has approximately 481 farms that average 1,438 acres. There are approximately 691,493 acres under cultivation in the county. Soil erosion due to wind and water is a problem. On steep gradients, rain washes out gullies in cultivated fields, and fields cultivated in the fall suffer extensive damage from wind. The county has 33,912 acres enrolled in the Conservation Reserve Program (CRP) which has helped mitigate the erosion problem. However, the county continues to study a variety of mitigation activities. Soil erosion, water supply, and water quality are major land use concerns of the county (USDA: Census of Agriculture, 2017).

Modern farming practices compel many farmers in the region to remove long-established shelter belts to increase their farming acres. This has the benefit of removing old trees that pose a risk of damaging infrastructure and buildings in case of high winds or storms, however opens the area up and leaves the area more susceptible to blowing snow in winter. Additionally, with less shelter, the more long-term threat of soil erosion may impact the region, reducing the viability of the land and nutrients within and causing long-term harm to the agricultural economy.

Furthermore, some landowners have taken to the practice of draining low-lying areas and developing sophisticated draining practices that greatly increase the speed and severity of floods. This also reduces the ability of fields to retain moisture and may in some cases contribute to the worsening of draught. The county and the state continue to struggle with the balance of short-term gain of these practices with long-term sustainability of the land.

Land use concerns regarding fish and wildlife include draining of wetlands, construction of dams and levees, constant flooding of areas between the Red River and I-29, loss of habitat through the clearing for construction (encroachment), the management of major industry, transportation of hazardous materials over bridges, pesticides, and overgrazing.

Commented [DKB21]: Good information regarding soil erosion. This not required, but I would urge summarizing what the profile data tells you about the county and the cities as it relates to hazard risk and vulnerability.

Low crop prices, loss of young people and the loss of farmers due to economic conditions represent other land use concerns. Both have been influenced by the last ten years of excessive wet weather.

Natural Lakes are few (North Salt and Rosa Lakes), but they are important rest areas for migratory waterfowl. Many artificial reservoirs have been constructed since 1950 for recreation and flood control.

Communicable Disease

Hazard Description

Diseases affect humans, animals, and plants continuously. Each species has its own natural immune system to ward off most diseases. The causes and significance of diseases vary. Of significance in the emergency management realm are communicable diseases with the potential for high infection rates in humans or those which might necessitate the destruction of livestock or crops. Such diseases can devastate human populations and the economy.

Disease transmission may occur naturally or intentionally, as in the case of bioterrorism, and infect populations rapidly with little notice. New diseases regularly emerge or mutate. Known diseases, such as influenza, can be particularly severe in any given season. Terrorism experts also theorize about the possibility of attacks using biological agents.

Animal and plant diseases, particularly those that infect livestock or crops, can distress the agricultural community. Such diseases could lead to food shortages and negative economic impacts, depending on the animals or plants infected and the geographic extent of the disease. Of most concern are those diseases that spread rapidly and cause widespread economic losses. The North Dakota Department of Agriculture is charged with conducting regular and emergency inspections and licensure of animal and plant producers and shippers. The effects of these regulatory activities are to mitigate any effects from contaminated or suspect products entering the food chain.

Insect Infestation

Insect infestation occurs when an undesirable type of insect inhabits an area in a manner that causes serious harm to agriculture crops, livestock, or poultry, wildland trees, plants, or animals, or humans. Countless insects live on, in, and around plants, animals, and humans in all environments. Many are harmless, while others can cause fatal damage. Under some conditions, insects that have been present and relatively harmless can become hazardous. For example, severe drought conditions can weaken trees and make them more susceptible to destruction from insect attacks. The major forms of insects are:

Chewing insects or defoliating insects. They generally strip plants of green matter such as leaves. Caterpillars and beetles make up the largest proportion of chewing insects. Under normal conditions, trees can usually bounce back from an attack of these defoliators, though repeat infestation will weaken a tree and can eventually kill it by starving it of energy.

Boring, or tunneling, insects cause damage by boring into the stem, roots, or twigs of a tree. Some lay eggs which then hatch and the larvae burrow more deeply into the wood, blocking off the water-conducting tissues of the tree. Boring insects generally feed on the vascular tissues of the tree. I f the infestation is serious, the upper leaves are starved of nutrients and moisture, and the tree can die. Signs of borer infestation include entry/exit holes in the bark, small mounds of sawdust at the base, and sections of the crown wilting and dying.

Sucking insects do their damage by sucking out the liquid from leaves and twigs. Many sucking insects are relatively immobile, living on the outside of a plant and forming a hard protective outer coating while they feed on the plant's juices. Quite often they will excrete a sweet, sticky substance known as honeydew which contains unprocessed plant material. Honeydew can cause sooty mold to form on leaves and can become a nuisance. Signs of infestation include scaly formations on branches, dieback of leaves, and honeydew production.

In conjunction with the above outlined problems, insects can carry and spread disease to plants, animals, and people.

Grasshoppers and potato leaf hoppers are the two primary insect problems in the region. The seed corn maggot can be a serious pest of DEB when temperatures are unfavorable for germination and emergence of DEB. Spring hatching cutworms can cause problems during stand establishment. Aphids, bean leaf beetles, armyworms, green cloverworm, cabbage looper, velvetbean caterpillar, and thistle caterpillar are all potential pests in the region but seldom require management. European corn borer can

Commented [DKB22]: These recommendations are for all hazards and for the following three requirements:
Requirement B1: Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction?
Requirement B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?
Requirement B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction?

Based on what you have, consider structuring the hazard profiles as follows:

Hazard Description -- Good job describing the hazard.

Also include the description or as separate headers:

Location – What area would be impacted (all as with a winter storm or a specific area as with a geologic hazard).

Extent – This means strength or magnitude such as the Enhanced Fujita Scale (p. 26)… how would you measure tornado strength? Flood depth grids, etc.

Probability – What is the likelihood of a hazard occurring.

Previous – What hazard events have occurred since the last plan was developed.

Impacts – List the consequence or effect of the hazard.

A vulnerability assessment is required for each of the hazards. You can either include it in the profile, or it looks like you were considering adding it in each community's profile. See page 149 for vulnerability analysis suggestions.

Modify the list with other categories you think are hazard specific, such as the Plans and Program section of this hazard. It's not required, but it does add value for the users of the plan.

Of note, the requirements above are for all natural hazards identified in the plan. It's encouraged, but not required, for the technological hazards and adversarial threats.

be found in dry bean fields, but information on field scouting and possible treatment guidelines have not been determined for the region.

Specific Insects - Crops

Grasshoppers Clearwinged grasshopper (*Camnula pellucida*), Two-striped grasshopper (*Melanoplus bivittatus*), Migratory grasshopper (*Melanoplus sanguinipes*), differential grasshopper (*Melanoplus differentialis*), and Redlegged grasshopper (*Melanoplus femurrubrum*). In the northern plains, eggs of crop pest grasshoppers hatch from late April to early May. Most grasshoppers emerge from eggs deposited in uncultivated ground. Bean growers expect to find grasshoppers feeding first along bean field margins adjacent to these sites. Later, infestations can develop when grasshopper adults migrate from ripening small grain fields. In DEB, grasshoppers will feed on leaves and pods. Along with the damage potential from migrating grasshopper in August, bean fields become sites for significant egg laying. These conditions put the next crop at risk to early season feeding when nymphs hatch throughout the field site. Grasshopper control is advised whenever 20 or more adults per square yard are found in field margins or 8 to 14 adults per square yard are occurring in the crop.

Potato Leafhoppers *Empoasca fabae.* Potato leafhoppers do not overwinter in North Dakota. Migrations of potato leafhoppers can occur from May through August, moving with weather fronts originating over southern states. The extent of seasonal problems is influenced by the time of migration and the numbers of leafhoppers that are transported into the region. Leafhopper adults are wedge shaped and pale green. Adults are very active and jump or fly when disturbed. Adults are very mobile and move readily within and between fields. Nymphs are wingless, run backwards or sideways, feed on the underside of the leaf, and complete their growth on the leaves near their hatching site. Hopper-burn is the term used to describe leafhopper damage. Leaves become dwarfed and curled, and small triangular brown areas appear on leaf tips. Feeding damage reduces plant vigor and yield. The recommended treatment threshold is one leafhopper per trifoliate leaf. Insecticides used to manage leafhoppers are very effective. It is not uncommon for growers to use reduced rates of certain insecticides to control early leafhopper migrants while DEB are still small and before the plant canopy has closed.

Seedcorn maggot *Delia platura* Seedcorn maggot attack DEB seed, preventing sprouting or weakening the seedlings. The yellowish white maggot is found burrowing in the seed or emerging stem. The adult flies emerge in spring when soil temperatures reach 50F. They deposit eggs in soil where there is abundant organic matter and decaying crop residue, or on the seed or seedling. Losses due to seed corn maggots are most severe when wet, cool conditions are present during DEB seeding. Seed treatments that contain an approved insecticide provide the best defense against injury. The statewide pesticide use survey did not report seed treatments for DEB (Zollinger et al. 1998). In 1998 and 1999 regional DEB surveys, 12% and 27% of the respondents reported using an insecticide seed treatment (lindane or chlorpyrifos) on 29% of the their acres, respectively (Lamey et al. 1999, 2000).

Cutworms Most damage by cutworms occurs when bean plants are in the early stage of development. Damage consists of young plants being chewed off slightly below or at ground level. Some cutworm feeding injury may occur on foliage. Because cutworms primarily feed at night, feeding damage often is overlooked until stand loss occurs. Scouting for cutworms requires digging in the soil to a depth of one to two inches at the base of recently damaged plants. Treatment is warranted when one cutworm or more is found per 3 feet of row and the larvae are still small (<3/4 inch long). Post-emerge insecticide applications to manage cutworms are effective, but timing is critical to minimize plant loss.

Bean Leaf Beetle *Cerotoma trifurcate* This beetle occurs at a low incidence in North Dakota. Adults emerge from overwintering, moving into bean fields as the seedlings emerge. The white larvae develop in the soil, feeding on the roots and nodules. New adults emerging in July feed on foliage and pods. The injury to pods results in secondary infections by fungi and bacteria, causing rotting and discoloration. Due to the low incidence of this insect in North Dakota, no local control guidelines have been developed.

Specific Insects – Livestock

The most common pests for cattle are flies, lice, and internal parasites. Depending on the season and location, cattle grubs, mange, and ticks can be problems. Other insects, such as gnats and mosquitoes, can be quite numerous and a severe nuisance, but do not generally cause serious problems with dairy cattle. In addition to their direct effects on cattle, flies are a great nuisance to dairy workers.

Sites with heavy fly infestations produce irritable animals, maggots (fly larvae) in feeds and manure, sticky fly excrement covering milking equipment and building surfaces, and an increase in spiders and their webs. Dust and animal hair adhering to fly excrement and spider webs can find their way into lungs and the milking lines.

Horn flies and face flies are most commonly found in pastures, usually coming into buildings only when on the cows' backs. These flies sit on the face, neck, shoulders, and back of the animal and feed on either their blood or secretions from the nose, mouth, and eyes. Although healthy cows may be able to withstand as many as 200 horn flies without reductions in weight gain, their presence is certainly annoying and can be troublesome to dairy operators. There are other types of flies that are associated with buildings; stable flies and house flies are the most common of these. House flies are more of a nuisance and general sanitation problem than as a direct pest on cattle. Stable flies, along with deer flies and horse flies, feed on blood from the back and legs. Stable flies have a long, bayonet-like proboscis that causes a painful sting, and as few as five stable flies on the legs of cattle have been shown to reduce performance in weight gain. Gnats and mosquitoes are mainly a nuisance and can be kept from buildings by screens and ventilation fans. In addition, flies can spread diseases such as pinkeye. In northern Illinois, Indiana, Ohio and Iowa and across through to Nebraska and north, the fly season lasts from June to early September. In southern Illinois, Indiana, Ohio and through Missouri and Kansas the fly season lasts from early May to mid-October.

Cattle grubs, also known as heel flies, gadflies, or warble flies, are often found at muddy stream crossings. In scattered areas, they can be a serious pest but are not extremely. The adults bite and lay their eggs in the hair of the hocks and legs. When the eggs hatch, the larvae burrow through the skin and, while maturing, migrate through the tissues of the cow. The larvae eventually exit through the skin of the back. Meat quality can be reduced and the hide is scarred by the exit holes.

Mange mites are microscopic insects that live on the skin. Some live on oily secretions while others live on skin cell contents. The irritation from the mites causes animals to rub themselves excessively to relieve the discomfort, often rubbing hair off. One uncommon type of mange, cattle scabies, can produce large, spreading sores and requires quarantine.

Lice are tiny, biting insects that feed on blood. Rather large populations may live on adult cows without major health problems. In severe infestations, the cows may scratch hair off in order to relieve the itchy feeling or develop respiratory infections due to reduced thriftiness. These insects spread easily between animals, especially during winter when animals are housed together for long periods of time. Young calves are most affected and large lice populations may cause death. Calves are stunted in their growth, and become susceptible to secondary infections such as pneumonia.

Internal parasites rob animals of the nutrient value from their digested feed. Roundworms and flukes often attack the organs of both calves and cows. Their eggs pass through the manure and hatch in pastures or weeds alongside of feed lots. Cows become infected when they eat grass that has larvae growing on it. Internal parasites can cause dehydration, coccidiosis, pneumonia, malnutrition, and other secondary diseases of the liver, heart, lungs, stomach, and intestines in cows and calves. If left untreated, the cows show reduced milk production and calves are stunted in growth and may appear gaunt due to weight loss.

Identified Risk

The climate in Pembina County makes it possible for insects to reproduce with little natural hindrance to their proliferation.

Effects of agriculture and commercial and industrial structures - If a given insect is particularly hazardous to crops, livestock, forest, or property, it can cost the County millions of dollars in lost revenue in eradication and replacement.

Insect infestation to wild land trees - not only leaves dead stands of trees but, as a result, also increases the fuel available to wildfires, thereby exacerbating the negative effect on ecotourism. Insect infestation is an ongoing threat to agriculture and Public Health in Pembina County. The effects on people and property can be disastrous and costly.

Plans and Programs

Pesticide use in North Dakota is monitored ensuring the continued availability and use of these vital tools for agriculture. A vital function of this program is the recording of all agricultural pesticide applications submitted by growers and/or commercial applicators which is done by the North Dakota Pesticide Impact Assessment Program. Departmental personnel provide out-reach to the general community and to growers. As a final measure, commodities are sometimes sampled prior to harvest and analyzed for pesticide residues. All this provides protection for the consumer, the worker, the environment, and the grower, making Pembina County and North Dakota agriculture products safer for the state.

As required by the North Dakota Department of Agricultural Century Code, the Agricultural Commissioner compiles and records information in the annual crop and livestock report regarding the gross production and value of the county's commodities. Various research institutions, schools, banks, government agencies, and businesses use this valuable information to the benefit of the local economy. Also, disasters to agriculture are surveyed and the information collected is used by other agencies offering disaster relief. Statistics promote and protect the continued production and prosperity of agriculture in Pembina County.

Insect Infestation
Location – full extent of Pembina County, concentrated on fields and rangeland.
Extent – varying severity, seasonal.
Probability – high probability with low impact. Low probability of severe threat.
History – no significant events on record.
Impacts – potential to have minor to major impact on agricultural economy. Second order effects to industries that support agriculture.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected

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Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info and Warning
Level of Impact	D	D	D	D	C	D	B	D	D	C	D	A	D	A	B	C	C	D

Rationale

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- Logistics and Supply Chain: may impact contracted transportation services potentially carrying contaminated product, or reduction in product carried.
- Environmental Health and Safety: disease or insects may disrupt ecosystem.
- Fire Management: diseased crops may provide increased fire hazard.
- Economic Recovery: a major hit to the agricultural economy would have severe impacts on the county's economy as a whole.
- Natural and Cultural Resources: disease or bests may spread to other natural resources and threaten them.
- Planning: relief supplies and programs would need significant planning with partner agencies.
- Operational Coordination: coordination with support agencies.
- Situational Assessment: severity of the disease or infestation and how second or third order effects may impact emergency resources.

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Human Disease Hazard

Human related Public health-related hazards may be the result of a naturally occurring event or terrorism. Key hazards of concern to Pembina County today are described below.

West Nile Virus (WNV) is a mosquito-borne virus that has been found in parts of Asia, Eastern Europe, Africa, and the Middle East. The virus arrived in the Western Hemisphere in 1999 in New York City. The more severe forms of West Nile virus are West Nile encephalitis, West Nile meningitis, and West Nile meningoencephalitis. Encephalitis refers to an inflammation of the brain, meningitis is an inflammation of the membrane around the brain and the spinal cord, and meningoencephalitis refers to inflammation of the brain and the membrane surrounding it.

Avian Influenza (Bird Flu) and Avian Influenza A (H5N1) Virus is an infection by avian (bird) influenza (flu) viruses. These influenza viruses occur naturally among birds. Wild birds worldwide carry the viruses in their intestines, but usually do not get sick from them. However, avian influenza is very contagious among birds and can make some domesticated birds, including chickens, ducks, and turkeys, very sick and kill them. Infected birds shed influenza virus in their saliva, nasal secretions, and feces. Susceptible birds become infected when they have contact with contaminated secretions or excretions or with surfaces that are contaminated with secretions or excretions from infected birds. Domesticated birds may become infected with avian influenza virus through direct contact with infected waterfowl or other infected poultry, or through contact with surfaces (such as dirt or cages) or materials (such as water or feed) that have been contaminated with the virus. Infection with avian influenza viruses in domestic poultry causes two main forms of disease that are distinguished by low and high extremes of virulence. The low pathogenic form may go undetected and usually causes only mild symptoms (such as ruffled feathers and a drop in egg production). However, the highly pathogenic form spreads more rapidly through flocks of poultry. This form may cause disease that affects multiple internal organs and has a mortality rate that can reach 90-100% often within 48 hours. Usually, avian influenza virus refers to influenza A viruses found chiefly in birds, but infections with these viruses can occur in humans. The risk from avian influenza is generally low to most people, because the viruses do not usually infect humans. However, confirmed cases of human infection from several subtypes of avian influenza infection have been reported since 1997. Most cases of avian influenza infection in humans have resulted from contact with infected poultry or surfaces contaminated with secretion/excretions from infected birds. The spread of avian influenza viruses from one ill person to another has been reported very rarely, and transmission has not been observed to continue beyond one person.

Bovine Spongiform Encephalopathy (BSE) is widely referred to as "mad cow disease." It is a chronic degenerative disease that affects the central nervous system of cattle. BSE is named because of the spongy appearance of the brain tissue of infected cattle examined under a microscope. BSE belongs to a family of diseases known as the transmissible spongiform encephalopathies (TSEs). TSE animal diseases found in the United States include scrapie in sheep and goats, chronic wasting disease in deer and elk, transmissible spongiform encephalopathy in mink, feline spongiform encephalopathy in cats, and in humans: kuru, both classic and variant Creutzfeldt-Jakob disease, Gerstmann-Straussler- Scheinker syndrome, and fatal familial insomnia.

The agent that is responsible for BSE and other TSEs has not been fully characterized. Although other types of agents have been implicated, the theory that is most accepted in the scientific community is that the agent is a prion, which is an abnormal form of a normal protein known as a cellular prion protein. The TSE agents are extremely resistant to heat, ultraviolet light, ionizing radiation, nor mal sterilization processes, and common disinfectants that normally inactivate viruses and bacteria.

There is no evidence to date that BSE emanated from TSEs in other animals. Regarding feeding practices, it is known that cattle can become infected with BSE by eating feed contaminated with the infectious BSE agent.

Current scientific research confirms that BSE infectivity occurs in the brain, trigeminal ganglia, tonsils, spinal cord, dorsal root ganglion, and distal ileum of the small intestine of cattle experimentally infected with the BSE agent. Research also confirms that BSE infectivity is in the brain, spinal cord, and retina of the eyes of cattle infected with the agent under field conditions.

BSE is not a contagious disease. There is no evidence that the disease is transmitted through direct contact or animal-to-animal spread. The primary means by which animals become infected is through consumption of feed contaminated with the infectious BSE agent.

Botulism is a serious paralytic illness caused by a nerve toxin that is produced by the bacterium Clostridium botulinum. There are three main kinds of botulism. Food borne botulism is caused by eating foods that contain the botulism toxin. Wound botulism is caused by toxin produced from a wound infected with Clostridium botulinum. Infant botulism is caused by consuming the spores of the botulinum bacteria, which then grow in the intestines and release toxin. All forms of botulism can be fatal and are considered medical emergencies. Food borne botulism can be especially dangerous because many people can be poisoned by eating a contaminated food.

Campylobacter jejuni (Pronounced “camp-e-low-back-ter j- june-eye") was not recognized as a cause of human food borne illness prior to 1975. Now, the bacterial organism is known to be the most common cause of food borne illness in the U.S. (Salmonella is the second most common cause). Food is the most common vehicle for the spread of Campylobacter and poultry is the most common food implicated. Some case-control studies indicate that up to 70% of sporadic cases of campylobacteriosis are associated with eating chicken. Surveys by the USDA demonstrated that up to 88% of the broiler chicken carcasses in the U.S. are contaminated with Campylobacter while a recent Consumer Reports study identified Campylobacter in 63% of more than 1000 chickens obtained in grocery stores. Other identified food vehicles include unpasteurized milk, undercooked meats, mushrooms, hamburger, cheese, pork, shellfish, and eggs.

Canine Distemper is a viral disease of young dogs characterized by high fever and respiratory inflammation. It can affect wild animals and County pets. Other animal diseases which can affect humans include rabies and toxoplasmosis (an opportunistic infection caused by the microscopic parasite Toxoplasmosis gondii, found in raw or undercooked meat and cat feces), as well as parasites such as roundworms, whipworms, hookworms, ringworms, and mange.

E. coli is found in the family of bacteria named Enterobacteriaceae, which is informally referred to as the enteric bacteria. Most forms of E. coli are harmless; however, there are strains that cause serious illness. Other enteric bacteria are the Salmonella bacteria (also a very large family, with many different members), Klebsiella pneumoniae, and Shigella, which many people consider to be part of the E. coli family.

Exotic Newcastle Disease (END) is a contagious viral disease affecting many species of birds including poultry and wild birds. This is probably one of the most infectious diseases of poultry in the world with a death rate of almost 100 percent in unvaccinated poultry flocks and so virulent that many birds die without showing any clinical signs. The disease can even infect and cause death in vaccinated poultry. END is extremely contagious. The spread is primarily through direct contact between healthy birds and the bodily fluids of infected birds. It can be transmitted through infected bird droppings as well as secretions from the nose, mouth and eyes. It spreads rapidly among confined birds…. like commercially raised chickens. The disease is also easily spread by virus-bearing material picked up on shoes and clothing

and carried from an infected flock to a healthy one. END can also spread from poultry flocks to wildlife as wild birds come into contact with infected poultry, possibly when wild birds enter a pen to feed on spilled grain. Although experiments have documented that several wild species including ducks and pheasants can develop the disease, widespread illness and death has only been documented in double-crested cormorants in the United States and Canada. This disease affects the respiratory, nervous and digestive systems, with an incubation period ranging from two to 15 days. The available information suggests that Newcastle disease can affect people; however, it does not pose a significant health risk. I n humans, the disease is usually limited to conjunctivitis, which is a mild inflammation of the tissues around the eyes and is seen in persons associated with infected birds or facilities where infected birds are housed. It should be noted that poultry products in the Arizona marketplace, including eggs and meat, continue to be safe to consume.

Hantavirus infection is caused by a group of viruses that can infect humans with two serious illnesses: hemorrhagic fever with renal syndrome (HFRS) and Hantavirus pulmonary syndrome (HPS). Hantaviruses are found without causing symptoms within various species of rodents and are passed to humans by exposure to the urine, feces, or saliva of those infected rodents. Ten different Hantaviruses have been identified as important in humans.

Hepatitis A is one of five human hepatitis viruses that primarily infect the human liver and cause human illness. The other known human hepatitis viruses are hepatitis B, C, D, and E. Hepatitis A is relatively unusual in nations with developed sanitation systems such as the U.S. Nevertheless, it continues to occur here. Each year, an estimated 100 persons die as a result of acute liver failure in the U.S. due to hepatitis A. Approximately 30 - 50,000 cases occur yearly in the U.S. and the direct and indirect costs of these cases exceed $300 million. Hepatitis A is totally preventable, and need not occur.

Listeria monocytogenes is a pathogenic (disease-causing) bacterium that is food-borne and causes an illness called listeriosis. It is frequently overlooked as a possible cause of illness due to its unique growth capabilities. First, it is somewhat difficult for laboratories to grow, and when they do so, Listeria can be confused with common harmless contaminants and disregarded. Second, most bacteria grow poorly when temperatures fall below 40°F, while Listeria survives at in temperatures from below freezing (20°F) to body temperature and it grows best at 0°F to 50°F, including the temperature range that we use for refrigeration. As a result, Listeria may be transmitted in ready-to-eat foods that have been kept properly refrigerated.

Lyme Disease (Borrelia burgdorferi) is a systemic, tick borne disease with protean manifestations, including dermatologic, rheumatologic, neurologic, and cardiac abnormalities. The best clinical marker for the disease is an initial skin lesion that occurs in 60%-80% of patients.

Monkeypox is a rare viral disease that occurs mostly in central and western Africa. It is called monkeypox because it was first found in 1958 in laboratory monkeys. Monkeypox was reported in humans for the first time in 1970. I nearly June 2003, monkeypox was reported among several people in the U.S. Most of these people got sick after having contact with pet prairie dogs that were sick with monkeypox. This was the first time that there had been an outbreak of monkeypox in the U.S. The disease is caused by Monkeypox virus. It belongs to a group of viruses that includes the smallpox virus (variola), the virus used in the smallpox vaccine (vaccinia), and the cowpox virus. In humans, the signs and symptoms of monkeypox are like those of smallpox, but usually they are milder. Another difference is that monkeypox causes the lymph nodes to swell.

Norwalk virus is a virus that attaches to the outside of cells lining the intestine. Once attached, it transfers its genetic material into that cell. There it reproduces, finally killing the human cell to release new copies of it that attach to more cells of the intestine's lining. Common names of the illness caused by the Norwalk and other small round structured or caliciviruses are viral gastroenteritis, acute nonbacterial gastroenteritis, food poisoning, and food borne infection. This illness occurs worldwide. Humans are the only known hosts. The viruses are passed in the stool of infected persons. Of

viruses, only the common cold is reported more like viruses are increasingly being recognized as leading causes of food-borne disease in the United States. People most often get Norwalk virus infection by swallowing infected food or water. Outbreaks in the U.S. are often linked to eating raw shellfish, especially oysters and clams. Steaming does not kill the virus or prevent its transmission.

Novel Coronavirus (COVID-19) is a unique strain of the coronavirus related to the common cold and other respiratory infections which has proven highly contagious and presents in numerous symptoms. The virus has been difficult to predict or contain due to its "novel" status among viruses and has caused much concern for governments trying to protect populations. While – at the time of this writing – the Coronavirus-19 dominates much of the news and hazard planning, so little is known at this time that this plan will not dwell on specific mitigation actions for COVID-19.

Commented [DKB23]: Good addition!

Plague is a disease caused by Yersinia pestis (Y. pestis), a bacterium found in rodents and their fleas in many areas around the world. Pneumonic plague is different from the bubonic plague. Both are caused by Yersinia pestis, but they are transmitted differently and their symptoms differ. Pneumonic plague can be transmitted from person to person; bubonic plague cannot. Pneumonic plague affects the lungs and is transmitted when a person breathes in Y. pestis particles in the air. Bubonic plague is transmitted through the bite of an infected flea or exposure to infected material through a break in the skin. Symptoms include swollen, tender lymph glands called buboes. Buboes are not present in pneumonic plague. If bubonic plague is not treated, however, the bacteria can spread through the bloodstream and infect the lungs, causing a secondary case of pneumonic plague. Patients usually have fever, weakness, and rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery sputum. Nausea, vomiting, and abdominal pain may also occur. Without early treatment, pneumonic plague usually leads to respiratory failure, shock, and rapid death.

Salmonella is a type of bacteria that causes typhoid fever and many other infections of intestinal origin. Typhoid fever, rare in the U.S., is caused by a particular strain designated Salmonella typhi. But illness due to due to other Salmonella strains, just called "salmonellosis," is common in the U.S. Today, the number of known strains of this bacteria total over 2300.

SARS is a respiratory illness of unknown cause that has recently been reported in a number of countries. According to the World Health Organization (WHO), the main symptoms and signs of SARS include a fever greater than 100.5° F (38° C), and cough, shortness of breath, or difficulty breathing. The cause of SARS is not known at this time. Researchers at CDC and around the world are working to find the cause of SARS. At this early stage of the investigation, it seems more likely that SARS is caused by an organism that we have less experience with rather than a commonly occurring, known organism.

The **Shigella** germ is a bacterium that can cause sudden and severe diarrhea (gastroenteritis) in humans. Shigella lives in the human intestine and is commonly spread both through food and by person-to-person contact. The illness is also known as "bacillary dysentery." About 25,000 or so laboratory confirmed cases of shigellosis are reported each year in the U.S. However, many cases go undiagnosed and/or unreported, and the best estimates are that 450,000 cases of Shigella infection actually occur annually in the U.S.

Tularemia is a potentially serious illness that occurs naturally in the U.S. It is caused by the bacterium Francisella tularensis found in animals (especially rodents, rabbits, and hares). Tularemia is also known as rabbit fever. Tularemia is usually a rural disease and has been reported in all U.S. states except Hawaii. Tularemia is a widespread disease in animals. About 200 human cases of tularemia are reported each year in the U.S. Most cases occur in the south-central and western states.

State Public Health

According to the North Dakota Department of Health, the Regional Epidemiologist located in Fargo, North Dakota, Health Alert Network, and sentinel surveillance facilities will take whatever measures are necessary to investigate and control reported or suspected diseases and conditions. Such measures include, but are not limited to, confirmation of a clinical or laboratory diagnosis, determination that an unusual disease or disease outbreak exists, determination and investigation of the source, and the prevention and control of the disease.

The Public Health Laboratory System in North Dakota is a unique and diverse system of 39 autonomous County and City facilities, working in close cooperation with the North Dakota Department of Health state laboratories. The Pembina County Public Health Laboratory provides extensive laboratory services to the people of North Dakota for diagnostic and epidemiological investigations. The Health Department Laboratories are staffed by Public Health Microbiologists. These professionals are certified by the State of North Dakota, health related degrees and have been trained in approved public health laboratories. Laboratories vary in size of how many certified Public Health Microbiologists there are depending on population and level of service provided. An approved Laboratory Director supervises each laboratory. State Public Health laboratories have been critical in the large-scale screening of the COVID-19 virus.

Generally, actions may include obtaining information pertaining to the incident, assess the health risk to the community, notify appropriate agencies, and coordinate disease prevention and control with community, local, regional, state and federal agencies. If necessary, the North Dakota Public Health Department will also initiate Quarantine measures within the County.

If, after consultation with appropriate local, regional, state or federal agencies, the North Dakota Public Health Department determines that an imminent or actual health threat exists, local response will be initiated in accordance with emergency response and notification protocols. Depending on the nature of the event, potential responders may include local, state and/or federal emergency/disaster, law enforcement and health agencies.

Local Public Health

The local public health office primarily oversees routine health duties, including vaccinations, school health, recordkeeping and other health initiative projects. Public health also monitors health trends and coordinates with state and federal officials, as well as private health partners in the region.

Public health officials are capable of conducting mass testing and mass vaccination events and are able to rapidly mobilize points of distribution or PODs to conduct these activities. Officials are able to integrate into incident command and the emergency operations center during disaster for healthcare advices and planning.

~~Identified Impacts for Communicable Disease~~

- ~~Business Interruptions~~
- ~~Hazmat Release~~
- ~~School Closure~~
- ~~Loss of Potable Water~~
- ~~Mass Casualties~~

Human Disease
Location – full extent of Pembina County, concentrated in population centers.
Extent – varying severity, typically seasonal.
Probability – high probability with low impact. Low probability of severe threat.
History – 2005 H5N1 “Avian Flu”; 2009 H1N1 “Swine Flu”; 2014-2016 Ebola Outbreak; 2020 SARS-CoV-2 “COVID-19”
Impacts – seasonal outbreaks of influenza, rare wide-spread outbreaks similar to 2020 with varying degrees of severity from one individual to another.

Local Risk Analysis Criteria

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Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning
Level of Impact	D	C	D	B	C	D	D	C	A	D	D	A	A	C	A	A	A	A

Rationale

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- Critical Transportation: may be impacted due to affected drivers or in 2020, the closure of the Canadian Border.
- Mass Care Services: chance to impact emergency sheltering operations.
- Logistics and Supply Chain: an increased demand on shipping and logistics companies as more commerce is focused on on-line ordering.
- Economic Recovery: residents may stay away from local businesses reducing sales numbers, or store owners and employees may not be able to report to work.
- Natural and Cultural Resources: staff normally charged with keeping cultural resources such as museums, or natural resources such as state parks may be impacted in their ability to work and keep facilities.
- Planning: close interaction with health partners and medical resources.
- Operational Coordination: coordination with support agencies, including cohesive messaging.
- Situational Assessment: awareness of ready state of partners, such as hospital beds or resources such as medications.
- Public Information and Warning: clear and concise messaging with the public with what they can do to stay safe and healthy.

Extreme Weather

Extreme Summer Weather

Hazard Description

Severe summer storms can result in loss of life, injuries, and damage to property and crops. Although thunderstorms affect relatively small areas when compared to other hazards such as winter storms, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms.

Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. The National Weather Service considers a thunderstorm severe if it produces hail at least ¾ inches diameter, winds of 58 mph or stronger, or a tornado. Thunderstorms are most likely to happen in the spring and summer months during the afternoon and evening hours, but they can occur year round and at all hours. Annually, the central and northern parts of North Dakota may have an average of 10 to 30 days with thunderstorm activity, while the southern part of the state averages between 30 to 50 days.

Thunderstorms form when moisture, unstable air, and lift are present in the atmosphere. Thermal instability, fronts, and the sun's heat are capable of lifting the air to help form thunderstorms. All thunderstorms proceed through a three-stage life cycle.

> *The cumulus stage* occurs when thunderstorm development begins. At this stage, the storm consists only of upward-moving air currents called updrafts. These updrafts reach heights of around 20,000 feet above the ground, but the base of the storm may lower, as moisture becomes more plentiful. As a thunderstorm develops, towering cumulus clouds indicate rising air. There is usually little rain during this stage and only occasional lightning.
>
> *The mature stage* is the strongest and most dangerous stage of a storm's life cycle. As the storm matures, the clouds have a black or dark green appearance. Hail, heavy rain, frequent lightning, strong winds, and tornadoes are most likely to occur during this phase, lasting an average of 10 to 20 minutes. At this stage, the storm contains both upward and downward moving air currents (updrafts and downdrafts) with precipitation in the downdraft area. These updrafts and downdrafts can reach velocities of 170 mph. When the cool downdraft hits the ground, it spreads out and forms a gust front, which may include damaging wind called a downburst. The updraft also causes the top of the storm to spread out.
>
> In *the dissipating stage*, the precipitation and downdraft dominate the storm and weaken the updraft. As the gust front moves away from the storm, the inflow of energy into the storm is cut off. As the thunderstorm dissipates, rainfall may decrease in intensity, but lightning and strong winds remain a danger.

Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. Thunder is caused by the rapid expansion of the heated air (National Weather Service, 2014).

Lightning occurs with all thunderstorms, and averages 80 to 93 deaths and 300 injuries in the United States each year. Lightning also causes several hundred million dollars in damage to property and forests annually. Most lightning deaths and injuries occur when people are caught outdoors, especially under or near tall trees, in or on water, or on or near hilltops. Between 1984 and

1994, over 15,000 lightning induced fires nationwide resulted in several hundred million dollars in damages and the loss of two million acres of forest. Lightning can cause fatalities, injuries, and property damage directly and indirectly. Lightning 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.

Strong winds can form along the leading edge of a thunderstorm. Downburst winds occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

Straight-line winds are responsible for most thunderstorm wind damage. During the summer in the western states, thunderstorms often produce little rain but very strong wind gusts and dust storms. Downbursts can be extremely dangerous to aviation. Damage attributed to tornadoes is frequently caused by straight-line winds from a downburst. Downbursts can produce a "roaring" sound and damage similar to a tornado. These strong winds can damage trees, blow vehicles off the road, break windows, down power lines, damage roofs and fences, and cause other structural damages. Individuals caught outside are also at risk of injury from blowing dust and debris.

Strong winds can also occur outside of tornadoes and severe thunderstorms. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the stronger the winds are. Strong winds can occur at any time of year.

Hail is precipitation in the form of a lump of ice. 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 affect only relatively small plots of land, while the latter case is rarer (National Oceanic and Atmospherica Adminsitration).

Hail causes considerable damage to crops and property in the United States, occasionally causing death to farm animals, but seldom causing loss of human life. The damaging aspects of hail falls include the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds; hail risk is a combination of these factors plus the frequency of hail at a point or over an area. Crop hail losses in recent years nationally are estimated at $1.3 billion annually, representing between 1 and 2 percent of the annual crop value. Hail losses vary considerably regionally, representing, for example, 1 to 2 percent of the crop value in the Midwest, 5 to 6 percent of the crops produced in the High Plains, and much less elsewhere in the nation. Property hail losses have been increasing with time, now appearing to approximate crop-hail losses recently with crudely estimated annual losses of $1 billion.

A **tornado** is a violently rotating column of air extending from a thunderstorm to the ground. A tornado is initially 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.

Tornadoes are nature's most violent windstorm. In an average year, the United States experiences an average of 1,200 tornadoes that result in an average of 70 to 80 deaths and 1,500 injuries. Most fatalities occur when people are struck by flying debris or do not leave mobile homes and automobiles.

Tornadoes can vary greatly in shape, size, and wind speed. Most tornadoes have wind speeds less than 110 mph and a lifetime of less than ten minutes. These weak tornadoes result in less than five percent of tornado deaths. The average tornado moves 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 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.

A funnel cloud is the rotating column of air extending out of a cloud base, but not yet touching the ground. The funnel cloud does not become a tornado until it touches the ground. Once in contact with the surface, it can create great damage over a small area. In 1971, Dr. Theodore Fujita developed the Fujita tornado damage scale to categorize various levels of tornado damage. In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds.

Fujita Scale		Enhanced Fujita Scale	
Scale	Estimated Wind Speed	Scale	Estimated Wind Speed
F0	<73 mph	EF0	65-85 mph
F1	73-112 mph	EF1	86-110 mph
F2	113-157 mph	EF2	111-135 mph
F3	158-206 mph	EF3	136-165 mph
F4	207-260 mph	EF4	166-200 mph
F5	261-318 mph	EF5	>200 mph

FIGURE 2: TORNADO SEVERITY SCALE

Extreme Heat is defined by FEMA as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level 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. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

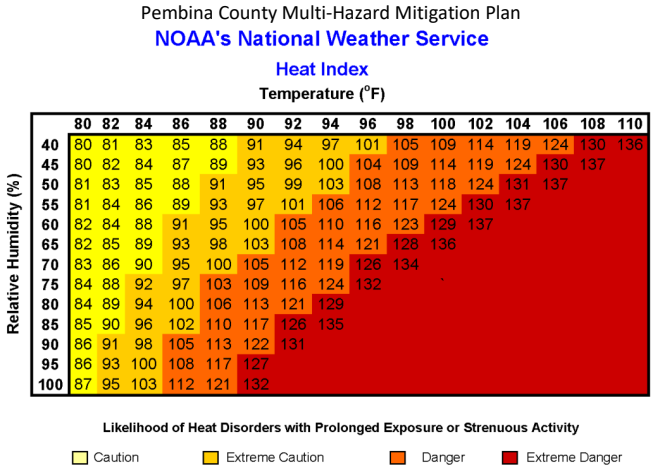

FIGURE 3: HEAT INDEX CALCULATOR

(National Weather Service, 2014)

Public Information and Warnings

To protect people and property, the National Weather Service issues informational products alerting the public to varying degrees of hazardous weather. The following may be issued for severe thunderstorm events:

- Hazardous Weather Outlook: Hazardous weather outlooks alert the public to the possibility for severe weather in the area from one to seven days in advance.
- Severe Thunderstorm Watch: Severe thunderstorm watches are issued by the Storm Prediction Center when conditions for severe thunderstorms appear favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
- Severe Thunderstorm Warning: Severe thunderstorm warnings are issued when Doppler radar indicates or the public reports a thunderstorm with wind gusts of 58 mph or greater and/or hail ¾ inch or larger in diameter. The warning is usually valid for 30-60 minutes.
- Tornado Watch: Tornado watches are issued by the Storm Prediction Center when conditions for tornadoes appear especially favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
- Tornado Warning: Tornado warnings are issued when Doppler radar indicates or the public reports a tornado. The warning is usually valid for 15-45 minutes (National Weather Service, 2014).

The National Weather Service issues the following products for non-thunderstorm high winds:

- High Wind Watch: A high wind watch is issued when conditions are favorable for non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more, but the timing, location, and/or magnitude are still uncertain.
- High Wind Warning: High wind warnings are issued when non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more are expected.

The public can receive these warnings, watches, and statements through a variety of means including NOAA Weather Radio, local emergency services, and television and radio media.

Most summer storms occur during the hot summer months and may be associated with other summer hazards. Lightning in thunderstorms may spark wildfires. Slow-moving thunderstorms often trigger flash floods due to the extended duration of the 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 even possibly lead to a hazardous material release. Should winds be strong enough, they can take down power and communication infrastructure and lead to long-term outages. Severe thunderstorms associated with the passage of a strong cold front may usher in cooler temperatures and relieve extreme heat and drought conditions.

Extreme Summer Weather
Location – full extent of Pembina County.
Extent – varying severity, seasonal.
Probability – high probability with low impact. Low probability of severe threat.
History – see below.
Impacts – minor damage to individual residences and property to wide-spread damage to public buildings and infrastructure.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

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Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning
Level of Impact	B	C	C	B	C	B	D	D	D	C	C	B	D	C	C	A	A	A

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Rationale

- Infrastructure Systems: some storms may cause damage to roads or other infrastructure, disrupting service.
- Critical Transportation: conditions may make driving difficult or impossible due to visibility or water/debris on roads.
- Mass Care Services: stranded drivers or displaced individuals may require sheltering.
- Logistics and Supply Chain: impacted based on infrastructure damage.
- Housing: damage to homes or property may displace individuals.
- Fire Management: response to fires based on lighting strikes; or more likely, firefighters responding for traffic control or debris removal.
- Law Enforcement: typically involved in traffic control and damage assessment.
- Economic Recovery: damage to business or crops/livestock may have a detrimental effect to business owners, even with insurance.
- Natural and Cultural Resources: damage to parks or outdoor historical properties or monuments.
- Planning: pre-planning for events in the short term with meteorological partners.
- Operational Coordination: ensuring critical resources make it to damage sites.
- Situational Assessment: warning areas before a storm and damage assessment following.
- Public Information and Warning: proper forewarning about potential events and up-to-date tracking of severe storm cells.

~~**Identified Impacts for Extreme Summer Weather**~~

- ~~Blocked Roads~~
- ~~Building Collapse~~
- ~~Business Interruptions~~
- ~~Delayed Response~~
- ~~Downed Power Lines~~
- ~~Downed Trees~~
- ~~Flooding (structure)~~
- ~~HAZMAT Release~~
- ~~Increased Fire Potential~~
- ~~Increased Public Safety Runs~~
- ~~Loss of Potable Water~~
- ~~Loss of Medical Facilities~~
- ~~Evacuation (localized)~~
- ~~Explosion~~
- ~~Flooding (street)~~
- ~~Loss of Power~~
- ~~Mass Casualties~~
- ~~Property Damage~~

~~**Notable Events**~~

~~June 17, 2016~~

Hazard: Extreme Winter Weather

Winter storms take many forms and vary significantly in size, strength, intensity, duration, and impact. The composition of a storm varies with the temperature, wind, and amounts of precipitation. Important factors in winter storms include temperature, wind, wind chill, rain, sleet, snow, and blowing snow. Exceptional winter storms can and do cause problems for the communities, residents, and travelers. Examples of these types of storms include blizzards, ice storms, heavy snow events, and extended extreme cold temperatures. While these types of events may not sound serious, the combinations of cold temperatures, wind, snow, wind chills, ice, and reduced visibility can make these storms very deadly and costly.

The winter season can begin as early as September and last into May. The bulk of North Dakota's winter weather is from mid-November until early April. On average, there are around ten winter storms (ice storms, heavy snow events, winter storms, and blizzards) each year. Three to four of these storms reach blizzard intensity, thus North Dakota typically leads the nation in blizzard frequency (National Weather Service, 2014).

Other hazards are prolonged periods of cold often associated with high winds, which produce life-threatening situations. Winter weather too often catches people unprepared. Researchers have said that 70 percent of the fatalities related to ice and snow occur in automobiles and about 25 percent are related to people who have been caught off guard out in the storm. Ice storms with wind, or heavy snow without wind, have been extremely dangerous and costly to business, industry, state and local governments, and citizens. Blizzards can last from less than 24 hours (in the fast moving storms) to more than four days (in the slower moving ones).

There are two major winter storm tracks that occur in the United States. The northern track produces the Alberta Low Pressure System, commonly called the "Alberta Clipper." This usually is a fast moving storm producing blizzard conditions for a relatively short period of time. Extremely low temperatures usually follow storms of this nature. Alberta Lows have traveled as fast as 90 mph and have not been known to become stationary systems. The southern track produces the Colorado Low Pressure System. These types of storms move more slowly and more erratically. The Colorado Low has traveled as fast as 60 mph, but has also been known to stop and become stationary for as long as 18 hours. Both of these types of storm systems can become very deadly.

Blizzard, as defined by the National Weather Service, 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 3 hours or more. A blizzard, by definition, does not 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. The National Weather Service issues the following products for blizzards and blowing snow:

- Blizzard Watch: Blizzard watches are issued to give the public 12-48 hours of advance notice of possible blizzard conditions (sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more).
- Blizzard Warning: Blizzard warnings are issued when blizzard conditions (sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more) are occurring, imminent, or have a high probability of occurring.
- Blowing Snow Advisory: Blowing snow advisories are issued for visibilities intermittently at or below ½ mile because of blowing snow (National Weather Service, 2014).

Ice storm develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into a warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface.

Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for ice storms:

- Freezing Rain Advisory: Freezing rain advisories are issued when an accumulation of ice will make roads and sidewalks slippery, but significant and damaging accumulations of ice are not expected.
- Ice Storm Warning: Ice storm warnings are issued when a significant and damaging accumulation of ice is occurring, imminent, or have a high probability of occurring (National Weather Service, 2014).

Snow storm - large quantities of snow may fall during winter storms. Six inches 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. Heavy wet snow before the leaves fall from the trees in autumn or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for heavy snow events:

- Snow Advisory: Snow advisories are issued when snow accumulations of 3-5 inches are expected.
- Sleet Advisory: Sleet advisories are issued when sleet accumulations causing hazardous conditions are expected.
- Heavy Snow Warning: Heavy snow warnings are issued when snow accumulations of 6 inches or more in 12 hours or 8 inches or more in 24 hours are expected (National Weather Service, 2014).

Extended periods of cold temperatures frequently occur throughout the winter months in North Dakota. Heating systems compensate for the cold outside. Most people limit their time outside during extreme cold conditions, but common complaints usually include pipes freezing and cars refusing to start. When cold temperatures and wind combine, dangerous wind chills can develop.

Wind chill is 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 actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. The figure below shows the current wind chill chart. The wind chill index changed in 2001 to better reflect the conditions felt by humans. This chart depicts the new, more accurate representation.

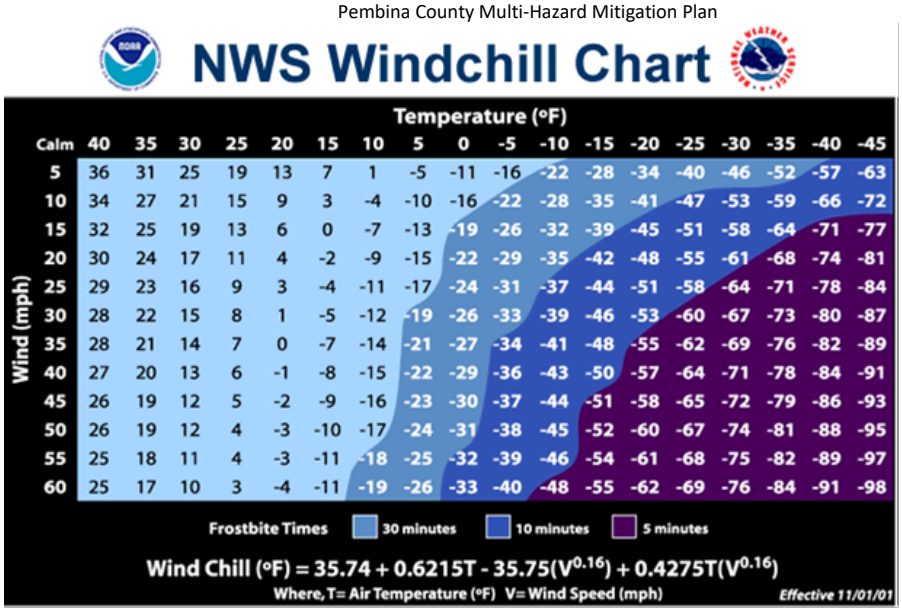

FIGURE 4: WINDCHILL CALCULATOR

(NATIONAL WEATHER SERVICE, 2014)

The National Weather Service issues the following products for significant wind chills:

- Wind Chill Watch: Wind chill watches are issued to give the public 12-48 hours advanced notice of the potential for wind chills of -40°F or colder with a wind speed of 10 mph or higher.
- Wind Chill Advisory: Wind chill advisories are issued when wind chills of -20°F to -39°F with a wind speed of 10 mph or higher are expected.
- Wind Chill Warning: Wind chill warnings are issued when wind chills of -40°F or colder with a wind speed of 10 mph or higher are expected (National Weather Service, 2014).

Wind chill conditions become very relevant when human tissue is exposed to the outside air. This can occur when people become stranded in a blizzard and attempt to walk to safety and become lost. Overexertion due to winter activities can and does cause heart attacks. Lowering of the body core temperature leads to the condition known as "hypothermia." The lack of adherence to simple but important and necessary precautions or even apathy can result in loss of property, injury, and even death.

Hypothermia has often been called "the killer of the unprepared'. It also claims the lives of many outdoor sports enthusiasts. This condition occurs when the body or "core temperature" is lowered. The blood is cooled, thereby reducing the amount of oxygen which is carried to the brain, thus dulling the senses. The victim becomes fatigued, delirious, and loses dexterity and control of arms and legs. If the body core temperature continues to drop and nears 85°F, the victim eventually slips into unconsciousness. If treatment is not started immediately, the result is arrest of the circulatory and respiratory systems and death.

Winter storms can often be associated with other hazards. The most common hazards thought of during winter weather events are transportation accidents. Roadways become hazardous quickly during snow, blowing snow, and ice events. Most accidents involve passenger vehicles; however, an accident involving a commercial vehicle transporting hazardous materials is also possible.

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.

Heavy snow can alleviate drought conditions, improve agricultural conditions, and decrease the wildfire threat, but in doing so, can often increase the probability of flooding come spring.

~~Identified Impacts for Extreme Winter Weather~~

- ~~Blocked Roads~~
- ~~Building Collapse~~
- ~~Business Interruptions~~
- ~~Delayed Emergency Response~~
- ~~Downed Power Lines~~
- ~~Downed Trees~~
- ~~HAZMAT Release~~
- ~~Increased Fire Potential~~
- ~~Increased Public Safety Runs~~
- ~~Loss of Potable Water~~
- ~~Loss of Medical Facilities~~
- ~~Loss of Power~~
- ~~Mass Casualties~~
- ~~Sewer Backup~~
- ~~Evacuation (localized)~~
- ~~Explosion~~
- ~~Flooding (street)~~
- ~~Flooding (structure)~~
- ~~Property Damage~~
- ~~School Closure~~

~~History~~

Commented [DKB24]: Good section

~~Pembina County is no stranger to blizzards and winter storms. During the blizzard of 1966, the city of Walhalla received 20-35" of snow (based on personal accounts) and wind speeds of 70-100 mph.~~

~~In 1988, a snow event dumped 15" in some places of the county.~~

~~The winter of 1996-1997 brought an unprecedented amount of snow into the region, emphasized by a blizzard in early April that brought in 10" of snow that quickly drifted, due to high winds. "Blizzard Hannah" is thought to be a major contribution to the flood of 1997 along the Red River.~~

~~The winter of 2013-2014 broke several records of cold, including consecutive days below zero, coldest March temperature, and lowest wind chills.~~

~~Significant Events~~
~~(Below)~~

Severe Winter Weather
Location – full extent of Pembina County.
Extent – varying severity, seasonal.
Probability – high probability with low impact. Low probability of severe threat.
History – see below.

Impacts – limiting visibility, severe cold, infrastructure damage or blockage.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

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Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning
Level of Impact	A	A	C	C	A	C	D	D	D	C	C	D	D	C	A	A	A	A

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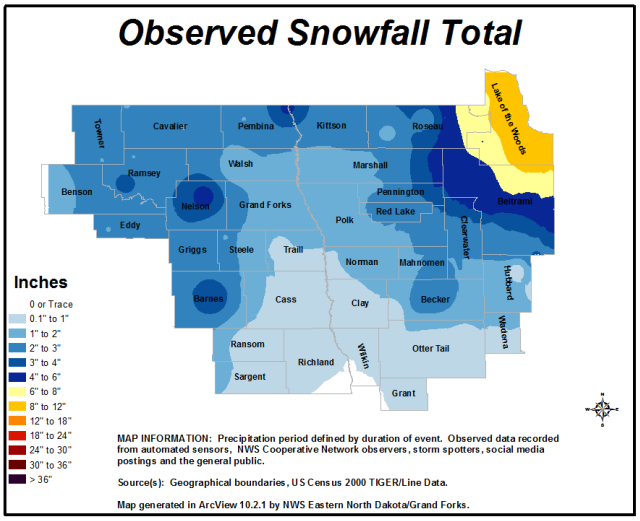
Rationale

- Infrastructure Systems: critical damage to overhead lines and blockage of roads.
- Critical Transportation: impassable roads due to snow or ice.
- Mass search and rescue: locate and retrieve any stranded motorists.
- Mass Care Services: emergency housing of stranded motorists.
- Logistics and Supply Chain: disruption of critical goods due to reduced transportation.
- Housing: damage to homes or loss of critical utilities.
- Fire Management: assisting with damaged utilities and possible auto extrication.
- Law Enforcement: search and rescue of stranded motorists. Assisted by county public works with snow plows.
- Natural and Cultural Resources: damage to state parks or historic sites.
- Planning: pre-planning for events in the short term with meteorological partners.
- Operational Coordination: ensuring critical resources make it to damage sites.
- Situational Assessment: warning areas before a storm and damage assessment following.
- Public Information and Warning: proper forewarning about potential events and up-to-date tracking of severe storm cells.

March 16-18, 2016

Heavy snow fell March 16, 2016 and continued into March 18, 2016 in northwest Minnesota then moving into eastern North Dakota. A foot of snow fell 5 miles SW of Baudette in Lake of the Woods county. As the snow band moved to the west, many areas in eastern North Dakota received 1 to 3 inches which melted fairly quickly, but there were slick roads during the morning hours. This snow event was caused by a very slow moving area of low pressure near the surface coupled with plentiful moisture near the surface for mid-March.

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PRECIPITATION IN NORTH DAKOTA...                          SNOWFALL
  LOCATION (COUNTY):                                     IN INCHES
CAVALIER (PEMBINA).....................................   2.0
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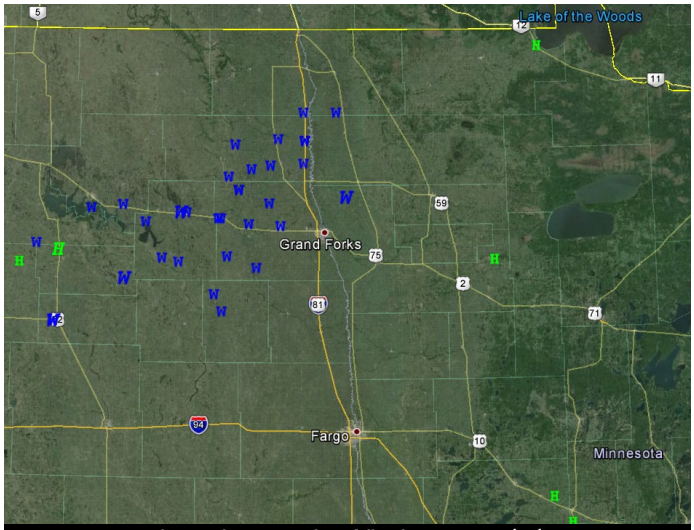
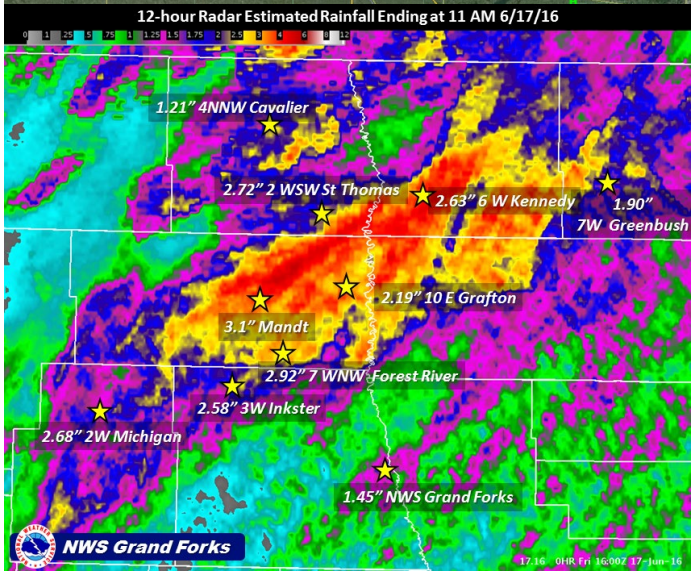
June 17, 2016

A line of thunderstorms moved through eastern North Dakota and Northwest Minnesota on the morning of June 17th, producing damage from large hail, winds, and flooding. Ahead of the east-west moving line of storms, a nearly stationary NE to SW line of thunderstorms inundated parts of northeast ND and northwest MN with over 2 inches of rain. Roads were closed in areas. Also, the broad scale 70 to 80 mph winds (gusts possibly pushing 90 mph in some locales) snapped trees and produced significant structural damage across parts of the region. Additional information will be released as it becomes available.



Pictured Left: Wind (blue W) and hail (green H) reports for June 17, 2016 storm.



Pictured Left: Rainfall amounts for the June 17, 2016 storm.

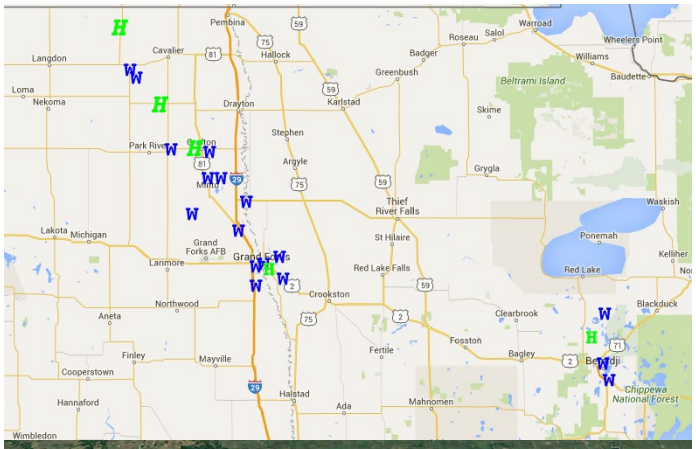
Below: Reported damages for the June 17, 2016 storm.

0855 AM	**TSTM WND** DMG	1 W DRAYTON		48.56N 97.20W
06/17/2016		PEMBINA	ND	EMERGENCY MNGR
0850 AM	**FLASH FLOOD**	2 SW DRAYTON		48.54N 97.21W
06/17/2016		PEMBINA	ND	EMERGENCY MNGR
0435 AM	**HAIL**	CAVALIER		48.80N 97.62W
06/17/2016	E0.25 INCH	PEMBINA	ND	TRAINED SPOTTER
0413 AM	**HAIL**	7 NW CAVALIER		48.87N 97.73W
06/17/2016	M0.50 INCH	PEMBINA	ND	CO-OP OBSERVER

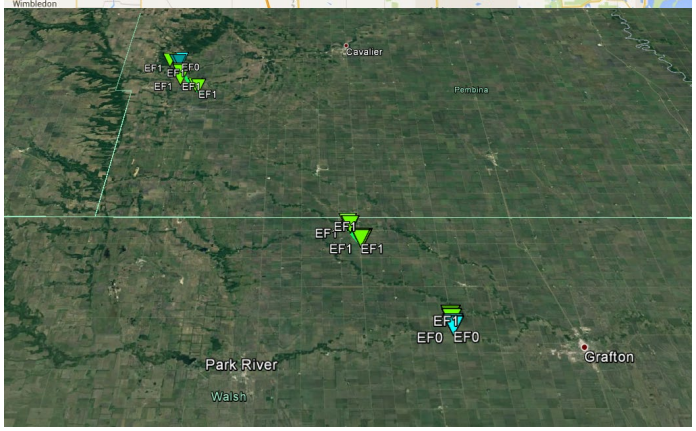
July 19, 2016

Commented [DKB25]: Descriptions here are well done – good detail.

A severe storm started in Canada and built south into a very unstable air mass during the afternoon and evening hours of July 19th. This storm produced very large hail and significant wind damage, along with three brief tornadoes. Additionally, heavy rainfall during the event produced areas of street flooding.



Pictured Left: Wind (blue W) and hail (green H) reports for July 19, 2016 storm.



Pictured Left: Satellite view of storm track.

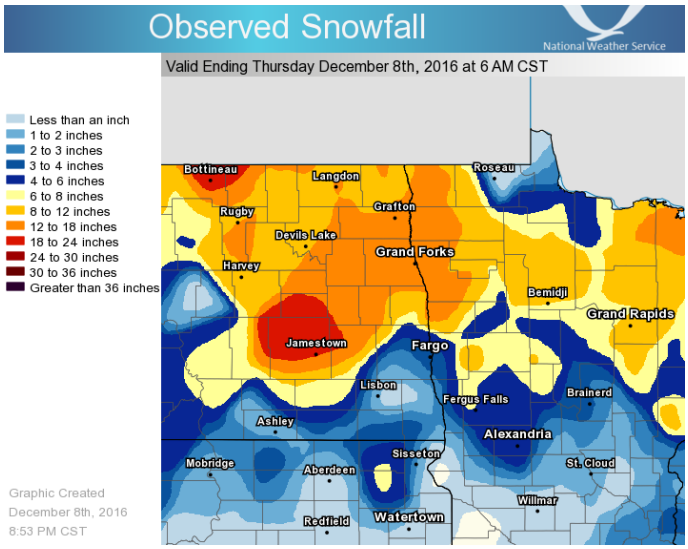
Pictured Left: Hail stones collected in Crystal, ND for the July 19, 2016 storm.

Below: Reported damages for the July 19, 2016 storm.

0458 PM	HAIL	WALHALLA		48.92N 97.92W
07/19/2016	E2.50 INCH	PEMBINA	ND	PUBLIC
	HAILED FOR 15 MINUTES AT HIGHWAY 32 DINER IN WALHALLA			
0535 PM	TSTM WND DMG	4 N MOUNTAIN		48.74N 97.86W
07/19/2016		PEMBINA	ND	TRAINED SPOTTER
	SEVERAL LARGE TREES BROKEN DOWN NEAR THE TONGUE RIVER.			
0540 PM	TSTM WND GST	3 NE MOUNTAIN		48.71N 97.82W
07/19/2016	M67.00 MPH	PEMBINA	ND	PUBLIC
	MEASURED ON A PERSONAL DAVIS SYSTEM			
0621 PM	TSTM WND GST	4 ESE CRYSTAL		48.58N 97.59W
07/19/2016	M54.00 MPH	PEMBINA	ND	PUBLIC
	MEASURED ON A PERSONAL DAVIS SYSTEM			
0623 PM	HAIL	CRYSTAL		48.60N 97.67W
07/19/2016	M3.00 INCH	PEMBINA	ND	STORM CHASER

December 5-7, 2016

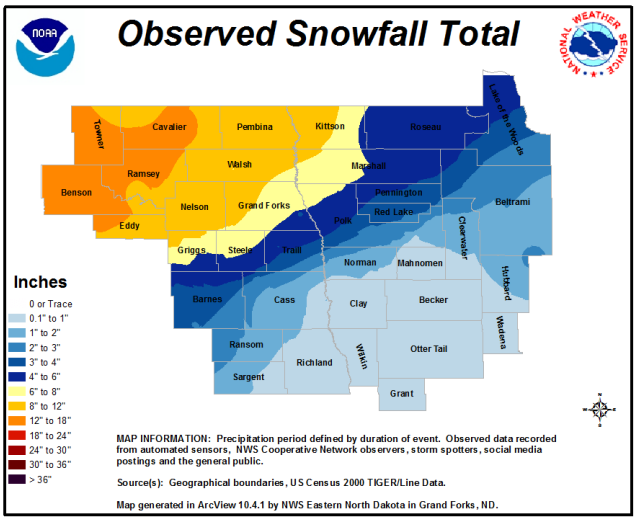
A major winter storm system struck the Northern Plains beginning during the late afternoon of Monday, December 5th and continuing through midweek. Heavy snow moved into portions of northeastern North Dakota and northwestern Minnesota during the late afternoon and early evening and continued through Monday night. The snow decreased in intensity during the day on Tuesday but winds increased significantly. This created blizzard conditions for much of the area Tuesday and into Tuesday night. Even with southeastern North Dakota and west central Minnesota receiving less snow than locations further north, the winds brought white-out conditions and travel difficulties to large portions of the region. Winds decreased for a while Wednesday morning but conditions deteriorated again by the afternoon across the Devils Lake Basin.



North Dakota...	Snowfall
Location (County):	(inches)
Pembina (Pembina)	9.7
Cavalier 8 WNW (Pembina)	9.6

December 25, 2016

A powerful winter storm moved through the region over the holidays, affecting the region Christmas day and into Monday. Freezing drizzle on the morning of the 25th led to icy roads. Heavier precipitation moved into the region during the afternoon hours of the 25th and continued into the evening and overnight hours. This precipitation started as freezing rain across southeast North Dakota and west central Minnesota, with some locations receiving significant ice accumulation which led to sporadic power outages. Temperatures across this area eventually rose above freezing for a brief period of time which led to rain and limited ice impacts. This precipitation transitioned to sleet and snow further to the north. The heavy snow across northeast North Dakota and adjacent portions of Minnesota occurred with strong winds, leading to blizzard conditions. As the system moved off to the east Monday morning, winds switched to the north/northwest and gusts up to 50 mph lead to blizzard conditions across much of eastern North Dakota and adjacent portions of Minnesota into Monday afternoon. Most major roadways were closed from late Sunday night through much of Monday afternoon.



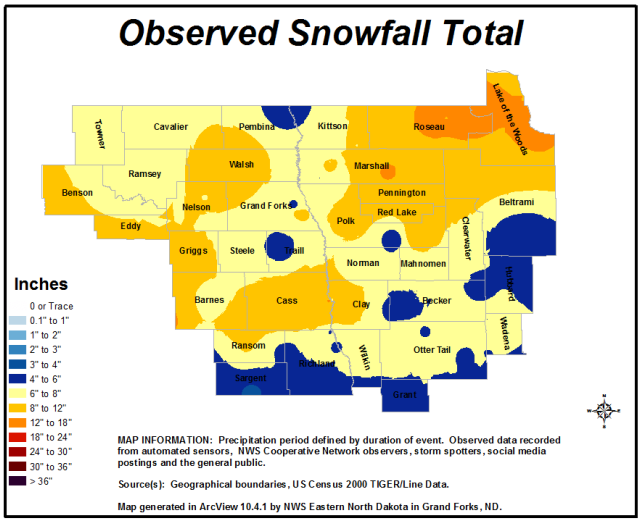
LOCATION	SNOW FALL (INCHES)	TIME/DATE OF OBSERVATION	LAT	LON
...PEMBINA COUNTY...				
NECHE	10.0 E	734 AM 12/26	48.98N	97.55W
CAVALIER	11.9 M	236 PM 12/26	48.80N	97.62W

Liquid Equivalent Reports

...Christmas Storm 2016 Liquid Equivalent Reports...
Pembina ND 0.94 in

January 2-3, 2017

A series of weather systems brought a couple rounds of heavy snowfall to the region to start the new year. A narrow band of heavy snow affected southeast North Dakota and adjacent portions of Minnesota during the early morning hours of January 2nd, with lighter snowfall elsewhere. A brief break during the afternoon hours was replaced by heavy snow across northeast North Dakota and northwest Minnesota by the late afternoon hours of January 2nd, which continued through the overnight hours. Increasing winds led to reduced visibility and significant drifting of snow during the early morning hours of January 3rd.

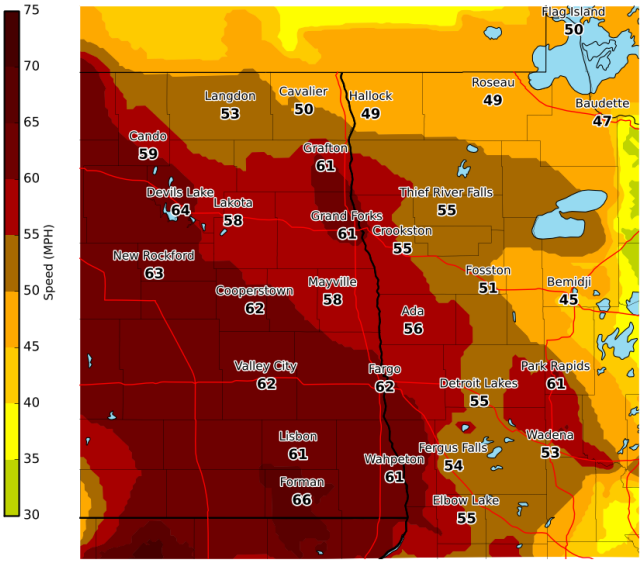


...Wind Reports...

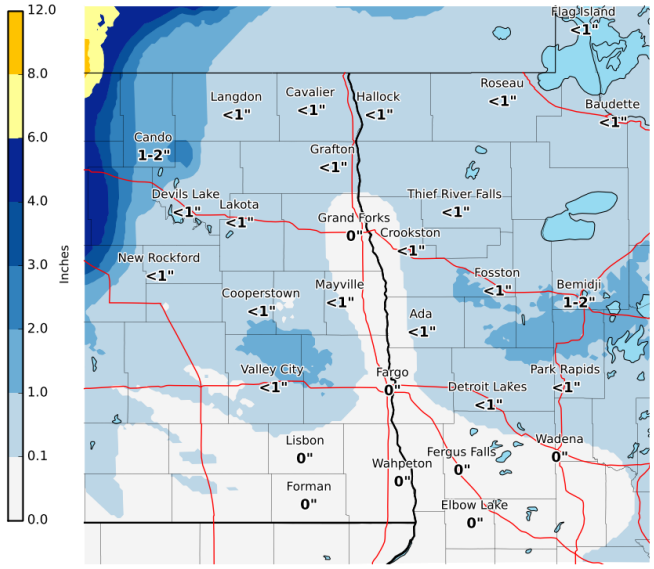
Location	Speed	Time/Date
Cavalier ND (APT)	41 MPH	0355 AM 01/03
Walhalla ND (APT)	36 MPH	0255 AM 01/03

March 6, 2017

A strong low pressure system brought light snow and long-lived strong winds to eastern North Dakota and northwest Minnesota beginning the evening of Monday, March 6, 2017 and continuing into the early morning hours of Wednesday, March 8, 2017. Although this system brought generally light snow accumulations to the area, the long period of strong winds allowed for blizzard conditions to persist across portions of the Devils Lake basin throughout much of Tuesday, March 9, 2017. Reduced visibilities were also experienced for brief periods across the northern Red River Valley and into northwest Minnesota on Tuesday as quick bouts of snow easily blew around in 50-60 mph wind gusts.



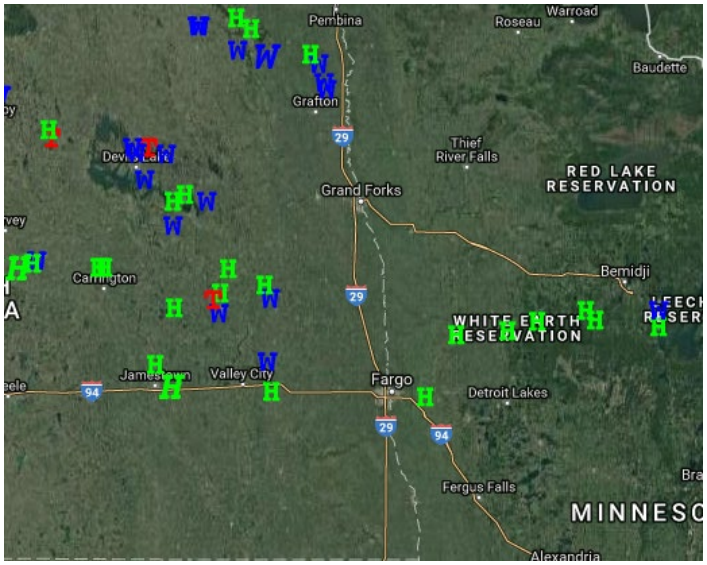
Pictured Left: Wind speeds in the March 6, 2017 storm.



Pictured Left: Snowfall totals in the March 6, 2017 storm.

June 9-10, 2017

This is a summary of the severe weather outbreak that occurred from late Friday afternoon into early Saturday morning, June 9 & 10, 2017. There are preliminary reports of funnel clouds observed in Cavalier county and tornadoes observed in Benson and Griggs counties. Additionally, there are several reports of wind damage across portions of northeast North Dakota. This "Top News" article will be updated as more information becomes available.

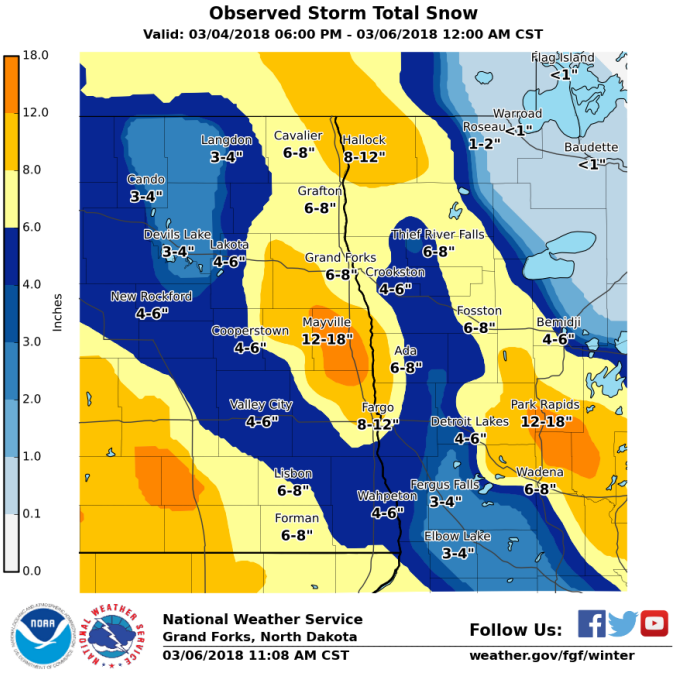


Pictured Left: Wind (blue W) and hail (green H) reports for June 9, 2017 storm.

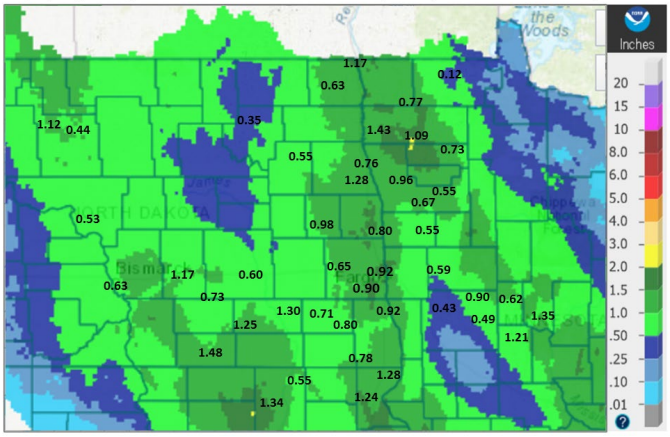
```
0702 PM     HAIL               CONCRETE                48.75N 97.93W
06/09/2017  E1.00 INCH         PEMBINA            ND   TRAINED SPOTTER
0724 PM     TSTM WND GST       6 W CRYSTAL             48.60N 97.80W
06/09/2017  M91.00 MPH         PEMBINA            ND   MESONET
0740 PM     TSTM WND GST       2 WSW ST. THOMAS        48.61N 97.49W
06/09/2017  M64.00 MPH         PEMBINA            ND   MESONET
            PEEAK WINDS MEASURED AT THE ST. THOMAS NDAWN STATION.
0745 PM     TSTM WND GST       1 S ST. THOMAS          48.61N 97.45W
06/09/2017  E70.00 MPH         PEMBINA            ND   TRAINED SPOTTER
            VERY STRONG WINDS AND VERY HEAVY RAIN WITH DIME TO NICKEL
            SIZED HAIL.
0750 PM     HAIL               1 S ST. THOMAS          48.61N 97.45W
06/09/2017  E1.50 INCH         PEMBINA
```

March 4-5, 2018

A strong Colorado Low storm system moved through from the afternoon of Sunday March 4th through late in the evening on Monday March 5th. Initially, thunderstorms developed, producing cloud to ground lightning, heavy rain, and occasionally pea sized hail. Rain transitioned to sleet and freezing rain, then eventually to snow. Snow continued from late Sunday night through Monday night, producing widely varying amounts across the area from less than an inch to 14 inches.

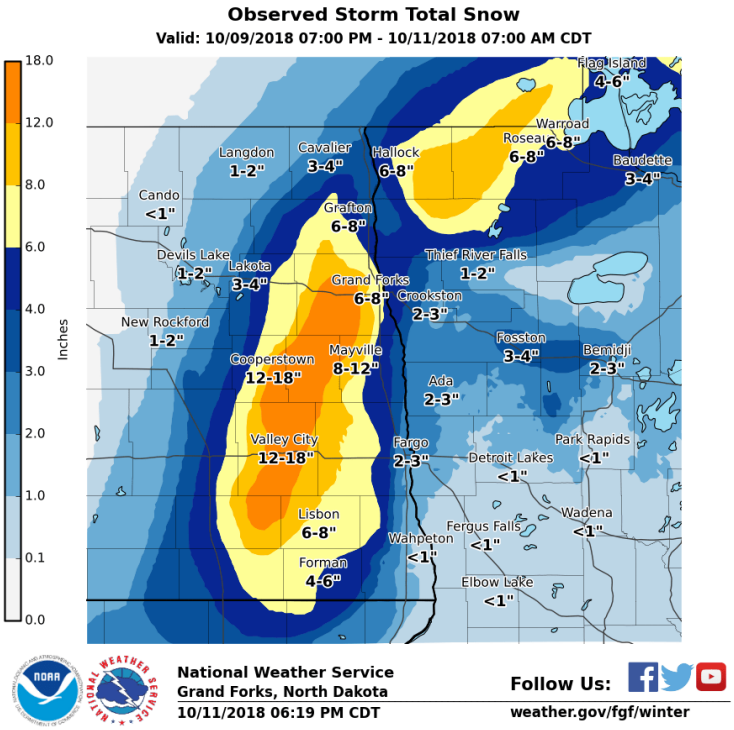


Precipitation for March 4-5, 2018, Winter Storm Episode:
***(LE) Liquid Equivalent*... Radar Estimated w/Co-op and CoCoRaHS reports**



October 10-11, 2018

An early winter storm occurred in eastern North Dakota and northwest Minnesota on October 10 into the morning of October 11. This storm was defined by a band of snow in eastern North Dakota that provided over a foot snow for many locations. The highest total snowfall reports were from the Grand Forks AFB south to the Valley City area. This snow was wet and heavy unlike the dryer snow that we typically get in the winter. The wetter, heavier snow occurred because of the early time of the storm with warmer temperatures. The heavily weighted nature of this snow stuck to foliage remaining on trees causing some limbs to break under the snow's weight.

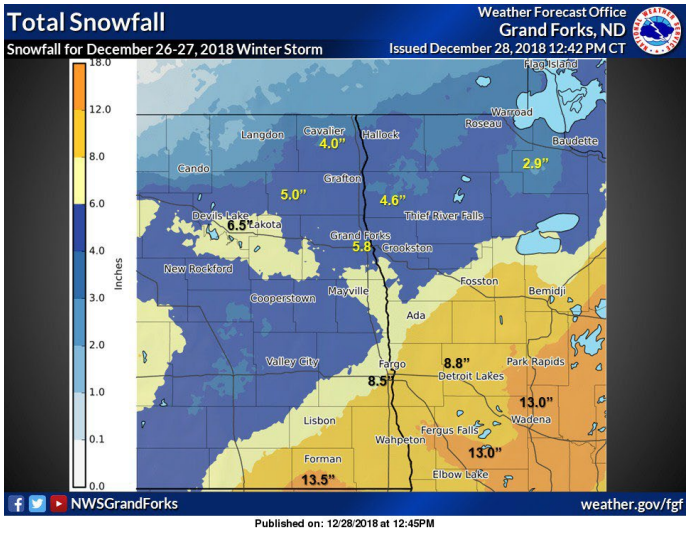


...SNOWFALL REPORTS FOR OCTOBER 10-11, 2018...

LOCATION	AMOUNT	TIME/DATE	LAT/LON
2 S SAINT THOMAS	4.0 IN	0254 PM 10/10	48.59N/97.45W
1 NNE BACKOO	4.0 IN	0700 AM 10/11	48.85N/97.70W
3 W LEROY	2.2 IN	1000 AM 10/11	48.92N/97.81W
DRAYTON	2.0 IN	0930 AM 10/10	48.56N/97.18W
PEMBINA	1.8 IN	0700 AM 10/11	48.97N/97.24W

December 26-27, 2018

Over a two day period a strong storm system moved through the Northern Plains and brought heavy snow, strong winds, and blizzard conditions to parts of eastern North Dakota and much of the Red River Valley. This caused headaches for travelers across the region returning home for the holidays.

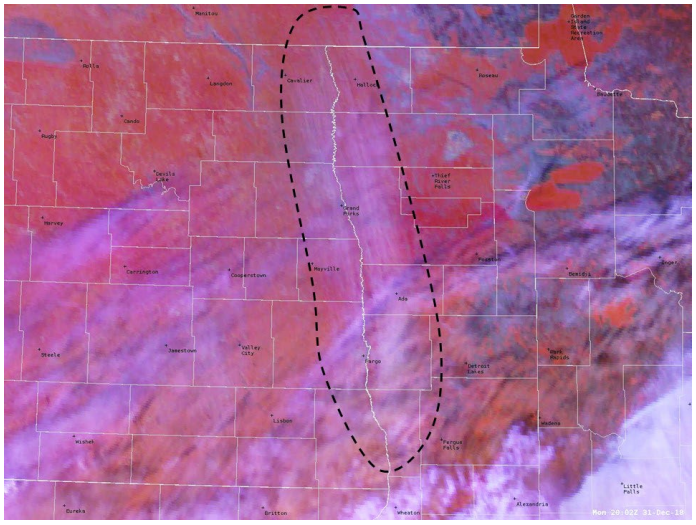



```
...WIND REPORTS...
LOCATION                      SPEED     TIME/DATE
CAVALIER ND                   43 MPH    0915 PM 12/27
WALHALLA ND                   43 MPH    0935 PM 12/27


..TIME...   ...EVENT...       ...CITY LOCATION...      ...LAT.LON...
..DATE...   ....MAG....       ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..
1030 AM     SNOW              PEMBINA                  48.97N 97.25W
12/28/2018  M3.3 INCH         PEMBINA            ND    CO-OP OBSERVER
            OFFICIAL TWO DAY TOTAL
```

December 30-31, 2018

An arctic cold front moved through the region during the overnight December 30, 2018. Northerly winds gusting in excess of 45 mph combined with a fresh snowpack to create blizzard conditions the following day, New Year's Eve. This created dangerous travel conditions throughout much of the day within the affected areas. Blizzard conditions were largely confined to an area within the Red River Valley in far eastern North Dakota and northwestern Minnesota extending into far northeastern South Dakota. While snow did fall over some areas leading up to the blizzard, no snow was actually falling during blizzard conditions. This became what is known as a ground blizzard. Gusty winds also combined with temperatures behind the arctic cold front into the teens below zero creating dangerous wind chills near -50 degrees Fahrenheit.



Pictured Left: Wind and blowing snow shown via satellite.

...HIGHEST WIND GUSTS...

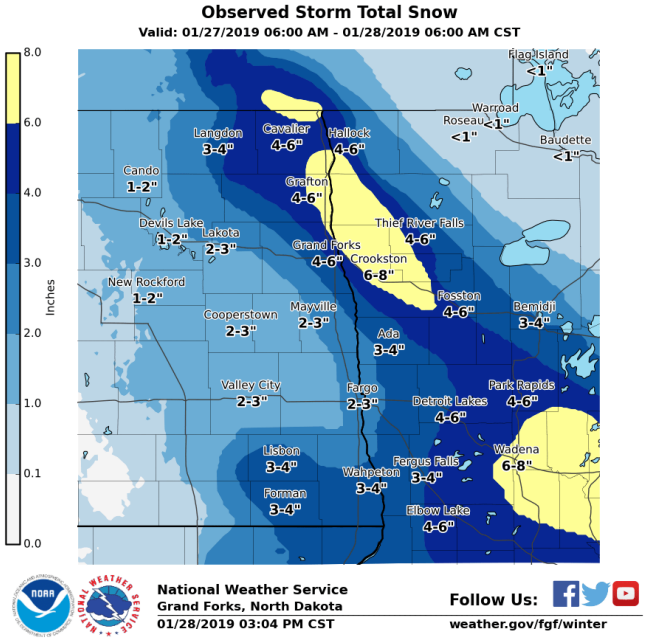
LOCATION	SPEED	TIME/DATE	PROVIDER
CAVALIER ND	38 MPH	0435 AM 12/31	ASOS
WALHALLA ND	35 MPH	0955 PM 12/30	ASOS

...LOWEST WIND CHILLS...

LOCATION	TEMP	TIME/DATE	PROVIDER
CAVALIER ND	-45 F	1155 AM 12/31	ASOS
WALHALLA ND	-44 F	1015 AM 12/31	ASOS

January 27, 2019

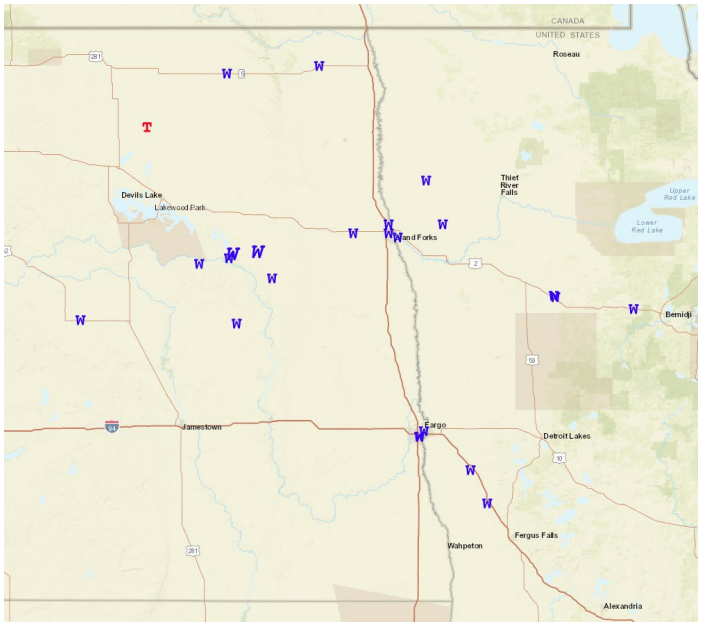
A particularly strong clipper system moved out of Canada through the Dakotas and produced heavy snow upwards of 8 inches and gusty southeast winds exceeding 30 mph. The combination of heavy snow rates and gusty winds produced blizzard conditions the afternoon and evening of Sunday January 27, 2019.




```
...PRELIMINARY SNOWFALL REPORTS AS OF 11 AM MONDAY...
LOCATION                    AMOUNT    TIME/DATE        PROVIDER
PEMBINA                     7.0 IN    0700 AM 01/28    PUBLIC
CAVALIER ND                 4.0 IN    1100 AM 01/28    COOP
```

July 8, 2019

During the afternoon and evening of July 8, 2019, strong to severe thunderstorms produced heavy rain and wind damage across portions of eastern North Dakota and west central Minnesota. Damaging wind gusts were the main threats with strong to severe thunderstorms in this event (in addition to heavy rainfall), although isolated hail was reported with some storms. Thunderstorm wind gusts damaged trees and structures across parts of the region.

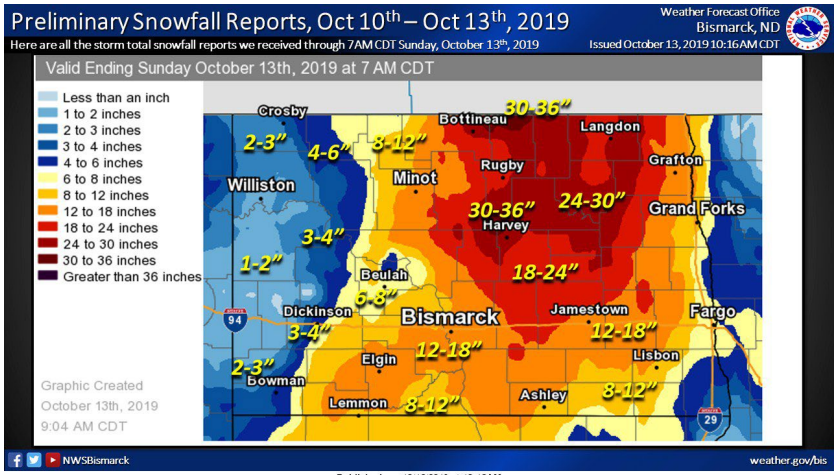


Pictured Left: Wind (blue W) and tornado (red T) reports for July 8, 2019 storm.

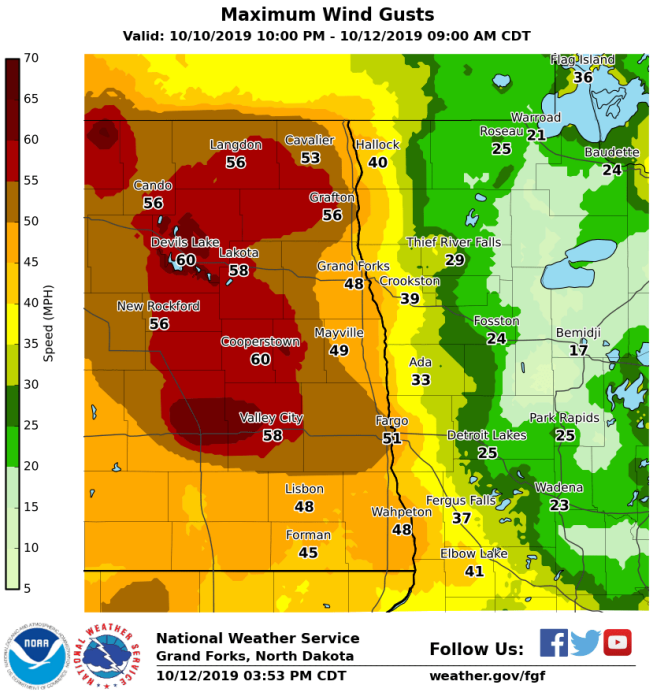
0615 PM TSTM WND GST CAVALIER 48.80N 97.62W
07/08/2019 M61.00 MPH Pembina ND AWOS
GUST TO 61 MPH AT CAVALIER AIRPORT SITE K2C8
0625 PM TSTM WND DMG HAMILTON 48.81N 97.45W
07/08/2019 Pembina ND COUNTY OFFICIAL
SEVERAL LARGE TREE BRANCHES BROKEN DOWN IN TOWN.

October 10-12, 2019

A crippling blizzard impacted central and eastern North Dakota and the Red River Valley from Thursday October 10th to Saturday October 12th, 2019. The storm began with rain and drizzle, and this gradually transitioned to snow. Snow persisted for the longest over the Devils Lake basin, James River Valley, and portions of northeast North Dakota, where snowfall totals of up to 3 feet and drifts up to 5 feet were observed. Further east in the Red River Valley and northwest and west central Minnesota, a longer period of rain and wintry mix occurred with a slower transition to snowfall.



Published on: 10/13/2019 at 10:18AM


Maximum Wind Gusts
Valid: 10/10/2019 10:00 PM - 10/12/2019 09:00 AM CDT
Speed (MPH)
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Flag Island
36
Warroad
Roseau
21
25
Baudette
24
Langdon
56
Cavalier
53
Hallock
40
Cando
56
Grafton
56
Devils Lake
60
Lakota
58
Thief River Falls
29
Grand Forks
48
Crookston
39
New Rockford
56
Fosston
24
Bemidji
17
Mayville
49
Cooperstown
60
Ada
33
Valley City
58
Fargo
51
Park Rapids
25
Detroit Lakes
25
Wadena
23
Lisbon
48
Fergus Falls
37
Wahpeton
48
Forman
45
Elbow Lake
41
National Weather Service
Grand Forks, North Dakota
10/12/2019 03:53 PM CDT
Follow Us:
weather.gov/fgf

Public Information Statement
National Weather Service Grand Forks ND
1019 AM CDT Sat Oct 12 2019

...PRELIMINARY 72-HOUR SNOWFALL REPORTS AS OF 10 AM 10/12/19...

Location	Amount	Time/Date	Provider
Langdon	27.0 in	0304 PM 10/11	Public
Lankin ND 6 E	25.0 in	0700 AM 10/12	UCOOP
5 ESE Penn	24.0 in	0430 PM 10/11	Broadcast Media
Adams	20.0 in	0519 PM 10/11	Public
Maza	20.0 in	0342 PM 10/11	Public
3 S Veseleyville	19.0 in	0630 AM 10/12	Public
3 W Adams	18.5 in	0350 PM 10/11	Public
3 E Devils Lake	18.0 in	0137 PM 10/11	Public
4 S Brocket	18.0 in	0258 PM 10/11	Public
Park River	17.0 in	0523 PM 10/11	Public
Hannaford	17.0 in	0900 PM 10/11	Broadcast Media
Northwood	17.0 in	0357 AM 10/12	Public
Mccanna	17.0 in	0522 PM 10/11	Public
5 NNE Luverne	16.0 in	0930 PM 10/11	Trained Spotter
5 S Wales	15.0 in	1110 AM 10/11	Emergency Mngr
6 NW Devils Lake	14.0 in	1230 PM 10/11	CO-OP Observer
8 SSE Logan Center	14.0 in	0518 PM 10/11	Public
6 NW Golden Lake	13.4 in	1258 PM 10/11	Public
Minto	13.0 in	0847 PM 10/11	Public
6 SW Nash	13.0 in	0521 PM 10/11	Trained Spotter
4 WNW Pisek	13.0 in	0700 AM 10/11	CO-OP Observer
2 W Larimore	13.0 in	0112 PM 10/11	Public
3 WNW Glasston	12.1 in	1000 AM 10/11	Public
Fordville	12.0 in	0523 PM 10/11	Public
Voss	12.0 in	1037 AM 10/11	Public
Crystal	12.0 in	1200 PM 10/11	Public
Hensel	12.0 in	1110 AM 10/11	Public
Lakota	12.0 in	0948 AM 10/11	Public
6 E Kempton	12.0 in	0626 PM 10/11	Public
Grand Forks AFB	12.0 in	0625 PM 10/11	Trained Spotter
Larimore	12.0 in	0511 PM 10/11	Public
2 N Northwood	12.0 in	0309 PM 10/11	Public
8 SSE Logan Center	12.0 in	0107 PM 10/11	Public
Niagara	12.0 in	1200 PM 10/11	Public
3 N Arvilla	12.0 in	0600 AM 10/11	NWS Employee
5 ESE Valley City	11.5 in	0900 PM 10/11	Public
Hillsboro	10.0 in	0954 PM 10/11	Trained Spotter
Hatton	10.0 in	0203 PM 10/11	Public
7 NW Golden Lake	10.0 in	0700 AM 10/11	Cocorahs
2 NNE Backoo	10.0 in	0700 AM 10/11	CO-OP Observer
5 ESE Valley City	9.8 in	0243 PM 10/11	Public
1 S Grand Forks	9.2 in	0856 AM 10/12	NWS Employee
5 NNE Luverne	9.0 in	0831 AM 10/11	Trained Spotter
Cavalier ND 7.9 WNW	8.0 in	1023 AM 10/11	COCORAHS
3 W Leroy	8.0 in	1022 AM 10/11	Public
Grand Forks NWS	7.3 in	0809 AM 10/12	Official NWS Obs
Golden Lake	7.0 in	0700 AM 10/11	Cocorahs
4 NNE Holmes	7.0 in	0900 PM 10/11	Public
3 WNW Backoo	6.0 in	0846 AM 10/11	Cocorahs
Arthur	6.0 in	0800 PM 10/11	Public
Mcleod ND 3 E	5.9 in	0830 AM 10/12	COOP
1 N Moorhead	5.0 in	0841 AM 10/12	Cocorahs
Hawley 5.2 WNW	4.8 in	0700 AM 10/12	COCORAHS
1 SE Moorhead	4.3 in	0841 AM 10/12	Broadcast Media
Fargo	4.0 in	0501 PM 10/11	Broadcast Media
Lidgerwood ND	3.5 in	0700 AM 10/12	COOP
1 E Lisbon	3.5 in	0800 AM 10/11	Cocorahs
Fargo	3.3 in	0700 PM 10/11	CO-OP Observer
3 E Mcleod	3.0 in	0850 AM 10/11	CO-OP Observer
2 SSW Casselton	2.8 in	0800 AM 10/11	CO-OP Observer
Lancaster MN	2.4 in	0700 AM 10/11	UCOOP
Detroit Lakes	2.4 in	1009 AM 10/12	Public
4 SSE Grand Forks	2.0 in	0700 AM 10/11	Cocorahs
4 N Argyle	2.0 in	1229 PM 10/11	Public
Bagley	2.0 in	0827 AM 10/12	Dept of Highways
Sebeka MN	1.8 in	0700 AM 10/12	UCOOP
Grand Forks ND 3.4 SSE	1.5 in	0700 AM 10/11	COCORAHS
3 SE Grand Forks	1.4 in	0700 AM 10/11	Cocorahs
1 WSW Lidgerwood	1.0 in	0700 AM 10/11	CO-OP Observer
Greenbush MN	1.0 in	0700 AM 10/12	UCOOP
3 E Plummer	1.0 in	0400 AM 10/12	Public
Park Rapids	1.0 in	0826 AM 10/12	Public

Observations are collected from a variety of sources with varying
equipment and exposures. We thank all volunteer weather observers
for their dedication. Not all data listed are considered official.

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Public Information Statement
National Weather Service Grand Forks ND
1036 AM CDT Sat Oct 12 2019

...HIGH WIND REPORTS OVER THE PAST 48 HOURS AS OF 10 AM 10/12/19...

Location	Speed	Time/Date	Provider
Hampden ND 3 SE	61 MPH	0658 PM 10/11	RAWS
Devils Lake ND Airport	61 MPH	0749 PM 10/11	AWOS
Pekin ND 2 NE	60 MPH	0805 PM 10/11	NDAWN
Cando ND Airport	58 MPH	0855 PM 10/11	AWOS
Grafton ND Airport	58 MPH	0855 AM 10/11	AWOS
Cooperstown ND Airport	58 MPH	0535 PM 10/11	AWOS
McHenry ND 8 N	56 MPH	0640 PM 10/11	NDAWN
Valley City ND Airport	56 MPH	0835 PM 10/11	AWOS
Edmore ND 3 NW	55 MPH	0805 PM 10/11	NDAWN
Langdon ND Airport	54 MPH	0555 PM 10/11	AWOS
Baker ND 1 N	53 MPH	0815 PM 10/11	NDAWN
Crary ND 1 E	53 MPH	0755 PM 10/11	NDAWN
Webster ND 2 N	53 MPH	0840 PM 10/11	NDAWN
Bowesmont ND 2 NNW	53 MPH	0613 AM 10/11	NDDOT
Leeds ND 7 E (US 2)	53 MPH	1058 PM 10/11	NDDOT
Walhalla ND Airport	52 MPH	0655 PM 10/11	AWOS
Fargo ND Airport	52 MPH	0627 PM 10/11	ASOS
St Vincent MN 1 E	52 MPH	0635 AM 10/11	MNDOT
Maddock ND 2 N	51 MPH	0905 PM 10/11	NDAWN
Dazey ND 2 E	50 MPH	0225 PM 10/11	NDAWN
Logan Center ND 2 E	50 MPH	0855 PM 10/11	NDAWN
Buxton ND 4 S (I-29)	50 MPH	0829 PM 10/11	NDDOT
Buffalo ND 7 N (Hwy 38)	50 MPH	0928 PM 10/11	NDDOT
Fort Totten ND 5 ENE	48 MPH	0951 PM 10/11	RAWS
Grand Forks ND Airport	48 MPH	0809 PM 10/11	ASOS
Wahpeton ND 6 W (Hwy 13)	48 MPH	0313 PM 10/11	NDDOT
Cooperstown ND 3 W	47 MPH	0540 PM 10/11	NDAWN
Michigan ND 2 W	47 MPH	0855 PM 10/11	NDAWN
Grand Forks ND AFB	47 MPH	0905 PM 10/11	ASOS
E Grand Forks MN 6 SE	47 MPH	0700 PM 10/11	MNDOT
Adams ND 5 N	46 MPH	1005 AM 10/11	NDAWN
Cando ND 2 SE	46 MPH	0755 PM 10/11	NDAWN
St Thomas ND 2 WSW	46 MPH	0455 AM 10/11	NDAWN
Hope ND 5 NE	45 MPH	0755 PM 10/11	NDAWN
Forest River ND 7 WNW	45 MPH	0855 PM 10/11	NDAWN
Kempton ND 6 SE	45 MPH	0805 PM 10/11	NDAWN
Pillsbury ND 1 N	45 MPH	0855 PM 10/11	NDAWN
Gwinner ND Airport	45 MPH	0735 PM 10/11	AWOS
Finley ND 1 NNW	44 MPH	0940 PM 10/11	NDAWN
Munich ND	44 MPH	0800 PM 10/11	AWS
Humboldt MN 4 SW	43 MPH	0625 AM 10/11	NDAWN
Cavalier ND 4 NNW	43 MPH	0625 AM 10/11	NDAWN
Inkster ND 3 W	43 MPH	0205 PM 10/11	NDAWN
Wahpeton ND Airport	43 MPH	0755 PM 10/11	AWOS
Moorhead MN Airport	43 MPH	0855 PM 10/11	AWOS
Dilworth MN 2 S	43 MPH	0945 PM 10/11	MNDOT
Stephen MN 1 NE	42 MPH	0905 AM 10/11	NDAWN
Niles ND 3 SE	42 MPH	1055 PM 10/11	NDAWN
Hendrum MN 4 ENE	42 MPH	1036 PM 10/11	MNDOT
Lisbon ND 18 E	42 MPH	0949 PM 10/11	RAWS
Elbow Lake MN Airport	41 MPH	0316 PM 10/11	AWOS
Donaldson MN 1 W	41 MPH	0920 AM 10/11	MNDOT
Kennedy MN 6 W	40 MPH	0705 AM 10/11	NDAWN
Langdon ND 1 E	40 MPH	0440 PM 10/11	NDAWN
Lisbon ND 2 W	40 MPH	0340 PM 10/11	NDAWN
Flag Island MN	40 MPH	0423 PM 10/11	AWOS
Brampton ND 2 WSW	39 MPH	1225 PM 10/11	NDAWN
Wahpeton ND 6 N	39 MPH	0855 PM 10/11	NDAWN
Crookston MN Airport	39 MPH	0735 PM 10/11	AWOS
Fergus Falls MN Airport	39 MPH	0856 PM 10/11	AWOS
Tenney MN 2 W	39 MPH	0820 PM 10/11	MNDOT
Lake Park MN 0.5 W	39 MPH	1130 PM 10/11	MNDOT
Moorhead MN	39 MPH	0845 PM 10/11	MNDOT
Fingal ND 4 W	38 MPH	0525 PM 10/11	NDAWN
Wendell MN 2 WSW	38 MPH	0229 PM 10/11	CWOP
Hallock MN Airport	38 MPH	0936 AM 10/11	AWOS
Barrie ND 2 SW (Ekre)	37 MPH	0220 PM 10/11	NDAWN
Galesburg ND 4 SW	37 MPH	0440 PM 10/11	NDAWN
Prosper ND 5 NW	37 MPH	0720 PM 10/11	NDAWN
Mooreton ND 3 SW	37 MPH	0220 PM 10/11	NDAWN
Sabin MN 2 NE	36 MPH	0640 PM 10/11	NDAWN
Eldred MN 2 W	35 MPH	1005 PM 10/11	NDAWN
Fargo ND 1 NNW	35 MPH	1200 AM 10/12	NDAWN

Observations are collected from a variety of sources with varying
equipment and exposures. We thank all volunteer weather observers
for their dedication. Not all data listed are considered official.

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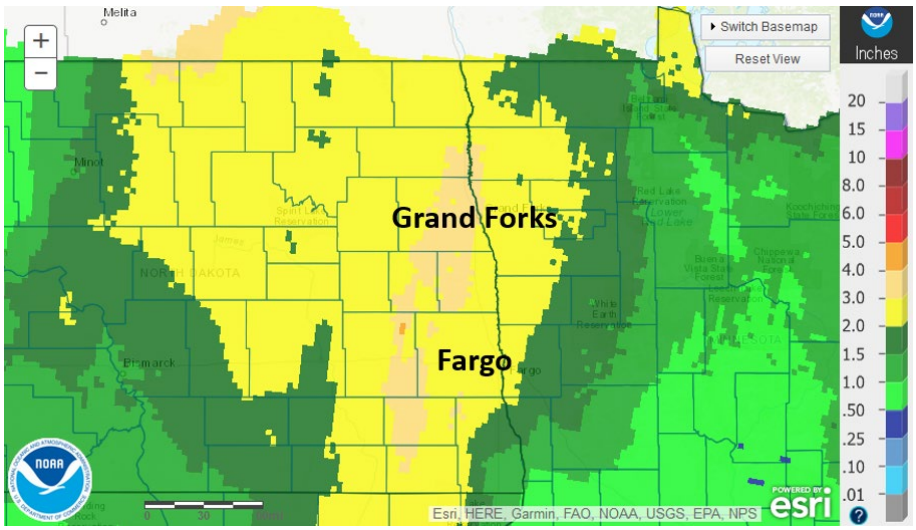
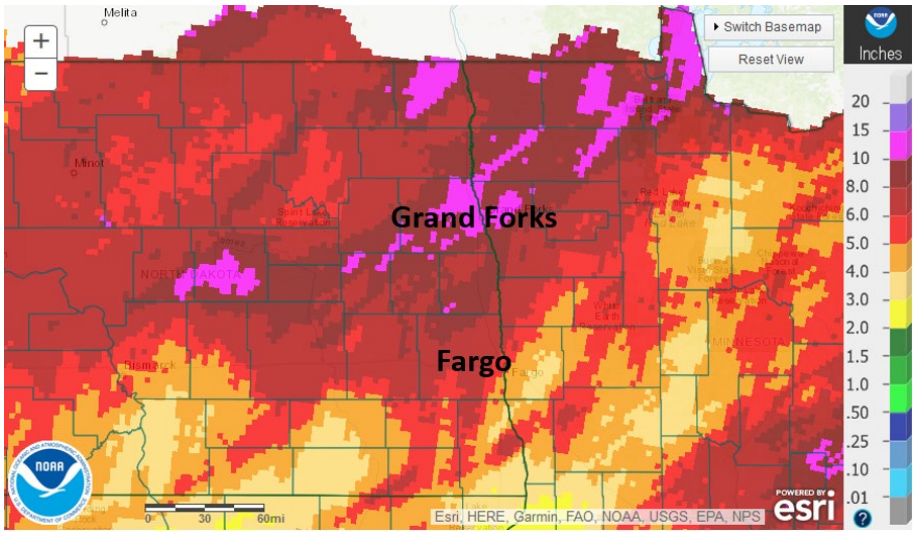
Fall 2019 will go down as the wettest fall period (Sept, Oct, Nov) on record (as of Oct 13, 2019). Between October 5-12, the region has received widespread precipitation amounts between 1-3 inches.



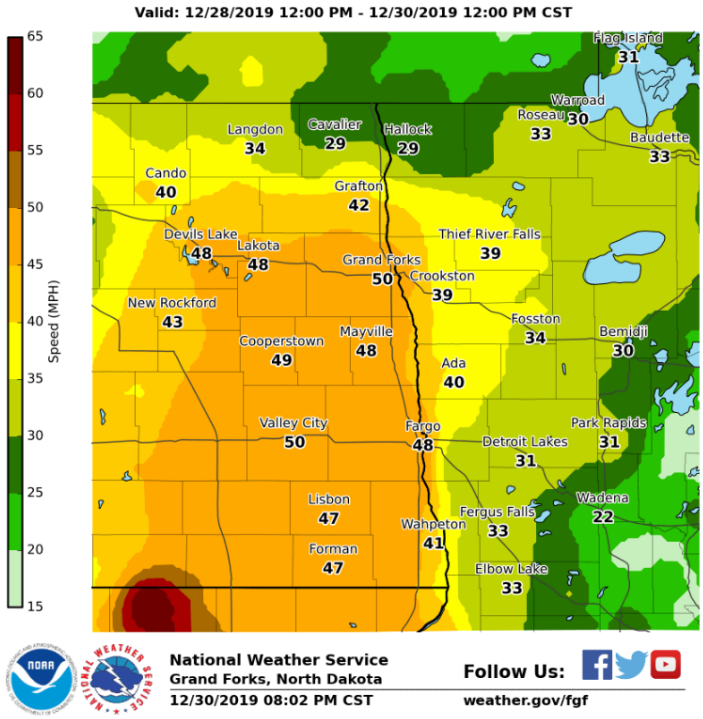
Over the past month, locations have received anywhere from 5 to 15 inches of precipitation!

This has been highly detrimental to area farmers as this heavy precipitation has come in the middle of the harvest season.



December 28-30, 2019

A powerful Colorado Low moved into the Northern Plains and Upper Midwest on the weekend of December 28 and 29, 2019, leading to widespread heavy snow and blizzard conditions. The heavy snow and blowing snow shut down most roads across eastern North Dakota, roads in the Red River Valley in Minnesota, and the Grand Forks and Fargo International Airports. Unlike some blizzard events, this storm led to bad conditions in both rural and urban areas from the heavy amounts of snow. The City of Fargo had to close some roads within the city and issue a city wide travel alert.

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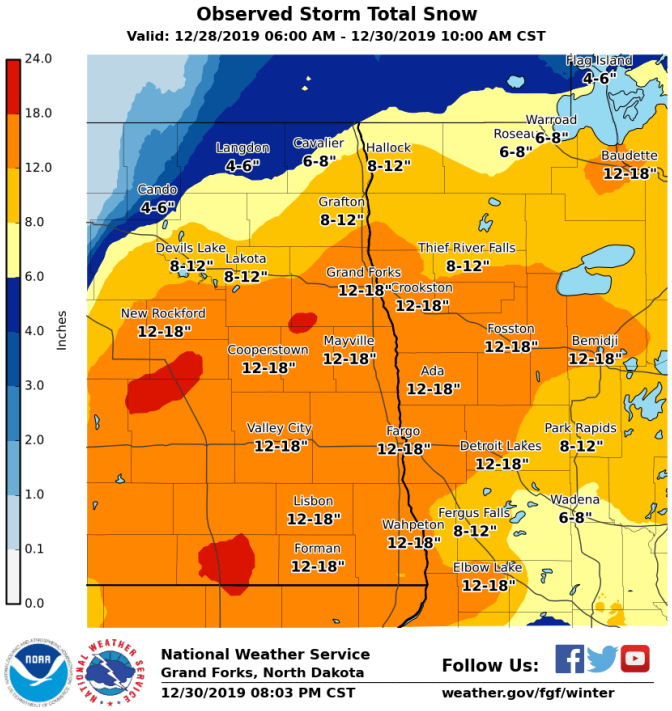
...HIGHEST WIND REPORTS...
Location                    Speed     Time/Date       Lat/Lon
Cavalier ND Airport         40 MPH    1255 PM 12/29   48.78N/97.63W
St Thomas ND 2 WSW          36 MPH    0540 PM 12/29   48.60N/97.49W
Walhalla ND Airport         35 MPH    0415 PM 12/29   48.93N/97.90W
Cavalier ND 4 NNW           31 MPH    0305 PM 12/29   48.84N/97.64W
```


Observed Storm Total Snow
Valid: 12/28/2019 06:00 AM - 12/30/2019 10:00 AM CST
Inches
24.0
18.0
12.0
8.0
6.0
4.0
3.0
2.0
1.0
0.1
0.0
Flag Island 4-6"
Warroad 6-8"
Roseau 6-8"
Baudette 12-18"
Langdon 4-6"
Cavalier 6-8"
Hallock 8-12"
Cando 4-6"
Grafton 8-12"
Devils Lake 8-12"
Lakota 8-12"
Thief River Falls 8-12"
Grand Forks 12-18"
Crookston 12-18"
New Rockford 12-18"
Fosston 12-18"
Bemidji 12-18"
Cooperstown 12-18"
Mayville 12-18"
Ada 12-18"
Valley City 12-18"
Fargo 12-18"
Park Rapids 8-12"
Detroit Lakes 12-18"
Wadena 6-8"
Lisbon 12-18"
Fergus Falls 8-12"
Wahpeton 12-18"
Forman 12-18"
Elbow Lake 12-18"
National Weather Service
Grand Forks, North Dakota
12/30/2019 08:03 PM CST
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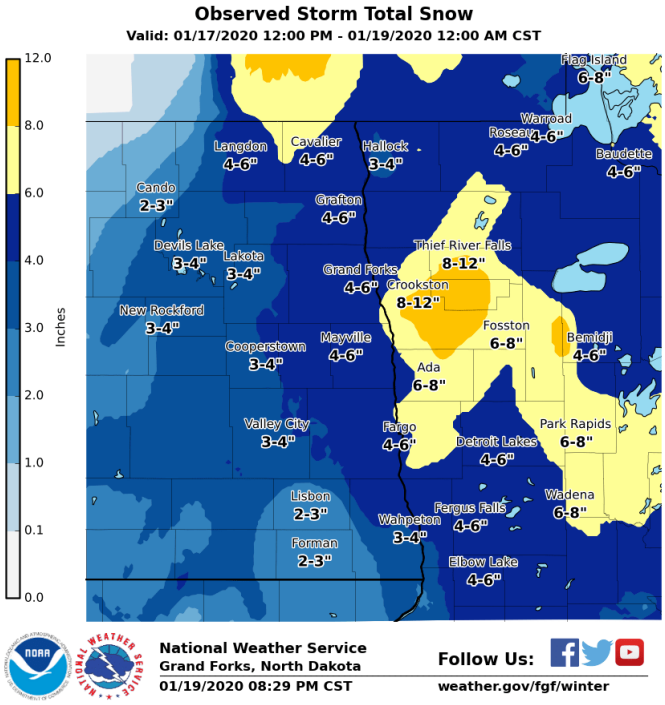
January 18, 2020

A strong winter storm developed as a upper level trough moved across the Northern Plains. Initially light freezing rain and snow caused dangerous travel conditions as this system was approaching Friday January 17. Strong southeast winds gusting as high as 60 mph resulted in blowing snow and even whiteout conditions across southeast North Dakota and the Red River Valley in Minnesota through the day on the 17th. Eventually heavy snow spread across the region from the south to the north late afternoon through the night, with several bands resulting in higher totals in excess of 8 inches. While there was a lull in winds as they shifted, strong northwest winds arrived during the nighttime period and blizzard conditions developed across the entire Red River Valley into the Devils Lake Basin. These blizzard conditions continued through the afternoon Saturday January 18th mainly in the open country.



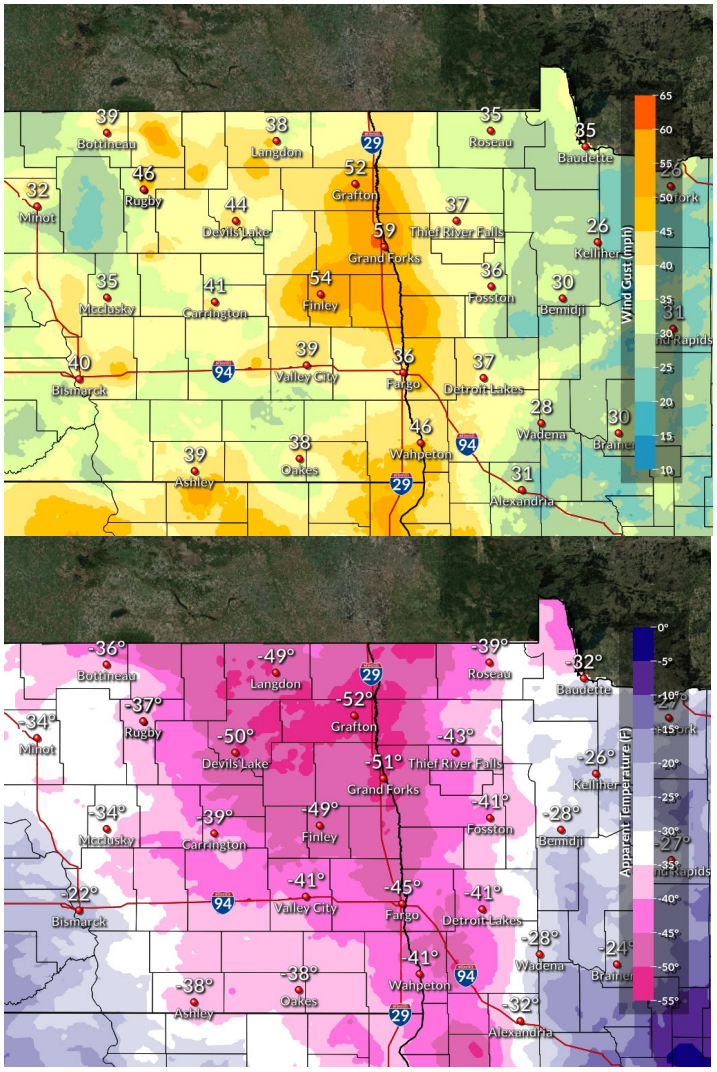
LOCATION	SPEED	TIME/DATE
FARGO ND AIRPORT	60 MPH	0846 AM 01/17
FERGUS FALLS MN AIRPORT	51 MPH	1215 PM 01/17
ROTHSAY MN 0.5 NW	50 MPH	0310 PM 01/17
WAHPETON ND 6 N	49 MPH	1055 AM 01/17
DILWORTH MN 2 S	48 MPH	1220 PM 01/17
TENNEY MN 2 W	48 MPH	0720 AM 01/17
MAHNOMEN MN 3 SSE	47 MPH	0816 AM 01/17
WAHPETON ND AIRPORT	46 MPH	1015 AM 01/17
GRAND FORKS ND AIRPORT	46 MPH	1135 AM 01/17
BUXTON ND 4 S	46 MPH	0239 PM 01/17
WAHPETON ND 6 W	46 MPH	1139 AM 01/17
SABIN MN 2 NE	43 MPH	0640 AM 01/17
PROSPER ND 5 NW	43 MPH	1135 AM 01/17
HENDRUM MN 4 ENE	43 MPH	0909 AM 01/17
PERLEY MN 6 E	42 MPH	1210 PM 01/17
LAKE PARK MN 0.5 W	42 MPH	0320 PM 01/17
CAMPBELL MN 3 SE	41 MPH	1200 PM 01/17
FARGO ND 1 NNW	41 MPH	1135 AM 01/17
MOORETON ND 3 SW	41 MPH	0735 AM 01/17
MOORHEAD MN 1 NE	41 MPH	1120 AM 01/17
ELBOW LAKE MN AIRPORT	41 MPH	1135 AM 01/17
GRAND FORKS ND 5 N	41 MPH	1139 AM 01/17
LISBON ND 18 E	40 MPH	0149 PM 01/17
HILLSBORO ND 7 SE	39 MPH	0130 PM 01/17
FOSSTON MN AIRPORT	39 MPH	0755 AM 01/17
GRAND FORKS ND AFB	39 MPH	1226 PM 01/17
MOORHEAD MN	39 MPH	0645 AM 01/17
KEMPTON ND 6 SE	38 MPH	0155 PM 01/17
MENTOR MN 2 SW	38 MPH	0953 AM 01/17
WENDELL MN 2 WSW	38 MPH	0143 PM 01/17
GRAFTON ND AIRPORT	38 MPH	0415 PM 01/17
GWINNER ND AIRPORT	38 MPH	0135 PM 01/17
COOPERSTOWN ND AIRPORT	38 MPH	0755 AM 01/17
BROOKS MN 3 S	38 MPH	0800 AM 01/17
EMERADO ND 3 W	38 MPH	1154 AM 01/17
BARRIE ND 2 SW	37 MPH	0640 AM 01/17
BRAMPTON ND 2 WSW	37 MPH	0100 PM 01/17
GALESBURG ND 4 SW	37 MPH	0955 AM 01/17
DETROIT LAKES MN 1 N	37 MPH	0420 PM 01/17
BUFFALO ND 7 N	37 MPH	0109 PM 01/17
PINE POINT MN 2 N	36 MPH	0135 PM 01/17
LEONARD ND 5 N	36 MPH	0310 PM 01/17
MAYVILLE ND 2 E	36 MPH	0305 PM 01/17
DETROIT LAKES MN AIRPORT	36 MPH	0255 PM 01/17
THIEF RIVER FALLS MN AIRPORT	36 MPH	0110 PM 01/17
ELDRED MN 2 W	35 MPH	1040 AM 01/17
WAUKON MN 3 S	35 MPH	0735 AM 01/17
ULEN MN 7 SSE	35 MPH	1255 PM 01/17
GRAND FORKS ND 3 S	35 MPH	0215 PM 01/17
MAHNOMEN MN AIRPORT	35 MPH	0756 AM 01/17
LANGDON ND AIRPORT	35 MPH	0935 AM 01/17
PARK RAPIDS MN AIRPORT	35 MPH	1240 PM 01/17
GATZKE MN 3 ENE	35 MPH	1045 AM 01/17
E GRAND FORKS MN 6 SE	35 MPH	0210 PM 01/17
SHOOKS MN 0.5 E	34 MPH	1235 PM 01/17
BOWESMONT ND 2 NNW	34 MPH	0124 PM 01/17
LISBON ND 2 W	33 MPH	0210 PM 01/17
HAMPDEN ND 3 SE	33 MPH	0958 AM 01/17
ADA MN 1 N	32 MPH	0810 AM 01/17
WAHPETON ND 6 N	32 MPH	1050 AM 01/17
KENNEDY MN 6 W	32 MPH	1250 PM 01/17
PERHAM MN 2 NW	32 MPH	0135 PM 01/17
DAZEY ND 2 E	32 MPH	0635 AM 01/17
LOGAN CENTER ND 2 E	32 MPH	1200 PM 01/17
ST THOMAS ND 2 WSW	32 MPH	0130 PM 01/17
BAGLEY MN 5 N	32 MPH	1218 PM 01/17
ARGYLE MN 8 SW	32 MPH	1108 AM 01/17
WALHALLA ND AIRPORT	32 MPH	1015 AM 01/17
CROOKSTON MN AIRPORT	32 MPH	0735 AM 01/17
ST VINCENT MN 1 E	32 MPH	0135 PM 01/17
HOPE ND 5 NE	31 MPH	1110 AM 01/17
HALLOCK MN AIRPORT	31 MPH	0216 PM 01/17
VERNDALE MN 2 NW	31 MPH	1035 AM 01/17
ROSEAU MN 2 E	31 MPH	0808 AM 01/17
RED LAKE MN	31 MPH	0809 AM 01/17

OBSERVATIONS ARE COLLECTED FROM A VARIETY OF SOURCES WITH VARYING EQUIPMENT AND EXPOSURES. WE THANK ALL VOLUNTEER WEATHER OBSERVERS FOR THEIR DEDICATION. NOT ALL DATA LISTED ARE CONSIDERED OFFICIAL.

LOCATION	AMOUNT	TIME/DATE
THIEF RIVER FALLS	11.0 IN	0930 PM 01/18
2 S WYLIE	10.0 IN	0828 PM 01/18
SOLWAY MN 2.1 S	9.8 IN	0900 AM 01/19
1 ENE CROOKSTON	9.5 IN	0630 AM 01/19
4 SW ERSKINE	9.0 IN	1109 PM 01/18
ERSKINE	9.0 IN	0817 PM 01/18
WALHALLA	8.0 IN	0828 PM 01/18
PARK RAPIDS	8.0 IN	0824 PM 01/18
THIEF RIVER FALLS	8.0 IN	0817 PM 01/18
SABIN	7.2 IN	0845 AM 01/19
SHEVLIN	7.0 IN	1020 PM 01/18
3 W THIEF RIVER FALLS	7.0 IN	0816 PM 01/18
1 N THIEF RIVER FALLS	7.0 IN	0815 PM 01/18
4 N MUSKODA	6.9 IN	0700 AM 01/19
4 NW LAKE ITASCA	6.8 IN	0758 PM 01/19
BEMIDJI MN 7.8 ENE	6.1 IN	0700 AM 01/19
FERGUS FALLS	6.0 IN	0759 PM 01/19
2 ESE LAKE BRONSON	6.0 IN	0800 AM 01/19
1 SSW NEW YORK MILLS	6.0 IN	0730 AM 01/19
SEBEKA	6.0 IN	0700 AM 01/19
2 NNE BACKOO	6.0 IN	0700 AM 01/19
FARGO ND 3.6 NNE	6.0 IN	0700 AM 01/19
4 S WADENA	6.0 IN	0725 PM 01/18
4 WSW OYLEN	6.0 IN	0300 PM 01/18
WINGER	6.0 IN	0618 AM 01/18
WEST FARGO ND 3.8 SSE	5.8 IN	0700 AM 01/19
NORCROSS	5.8 IN	0300 PM 01/18
1 NW PRAIRIE ROSE	5.8 IN	0700 AM 01/18
MAYVILLE	5.4 IN	0700 AM 01/18
4 W DUNVILLA	5.3 IN	0614 AM 01/19
4 WSW HOFFMAN	5.2 IN	0758 PM 01/19
WARROAD MN 4 W	5.1 IN	1000 PM 01/18
GRAND FORKS AFB	5.0 IN	1014 PM 01/19
4 SSE GRAND FORKS	5.0 IN	1012 PM 01/19
PEMBINA	5.0 IN	0800 AM 01/19
DEER CREEK	5.0 IN	0301 PM 01/18
BORUP	5.0 IN	0300 PM 01/18
VERGAS	5.0 IN	0300 PM 01/18
FERGUS FALLS	5.0 IN	0300 PM 01/18
BATTLE LAKE	5.0 IN	0300 PM 01/18
NEW YORK MILLS	5.0 IN	1024 AM 01/18
2 WSW MALUNG	5.0 IN	0841 AM 01/18
5 NNW CORMORANT	4.8 IN	0700 AM 01/19
FARGO	4.8 IN	0107 PM 01/18
4 ESE WESTBURY	4.5 IN	0615 AM 01/19
FARGO ND 2.1 N	4.5 IN	0800 AM 01/18
OTTERTAIL MN	4.5 IN	0540 AM 01/18
KARLSTAD MN 0.2 SSW	4.3 IN	0945 AM 01/19
3 NW LAVINIA	4.1 IN	0700 AM 01/19
FARGO	4.1 IN	0445 PM 01/18
GRAND FORKS	4.1 IN	0430 PM 01/18
ABERCROMBIE	4.0 IN	0759 PM 01/19
GRANDIN ND 7.1 ENE	4.0 IN	0700 AM 01/19
ASHBY	4.0 IN	0815 PM 01/18
LIDGERWOOD	4.0 IN	0719 AM 01/18
1 SE LUCCA	3.8 IN	1018 PM 01/17
GOODRIDGE MN 7.4 SW	3.7 IN	0700 AM 01/19
DEVILS LAKE	3.5 IN	1009 PM 01/19
MICHIGAN	3.5 IN	0547 AM 01/18
4 E TURTLE RIVER	3.2 IN	0700 AM 01/19
3 SW FILLMORE	2.7 IN	0804 PM 01/19
LISBON ND 0.5 ENE	2.7 IN	0503 PM 01/18
MCLEOD ND 3 E	2.6 IN	0810 AM 01/19

February 12, 2020

A strong arctic cold front rushed through the eastern Dakotas and western Minnesota during the early morning hours on Wednesday, February 12th. The front brought light snow, strong winds, and frigid temperatures that combined to create blizzard conditions through the Red River Valley. Blizzard conditions began during the pre-dawn hours and lasted well into the early afternoon causing impacts along the I-29 corridor for the morning commute. Numerous vehicle accidents were reported across eastern North Dakota and northwest Minnesota.



...HIGHEST WIND REPORTS...

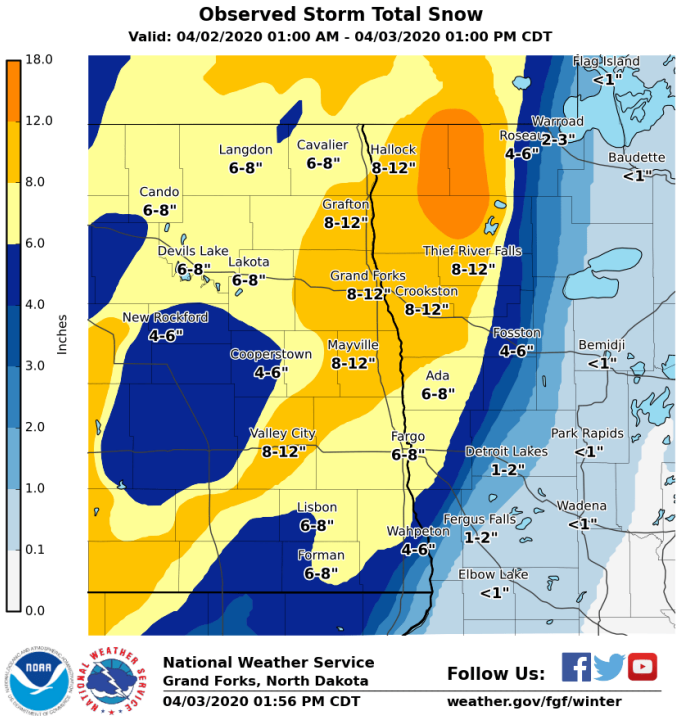
Location	Speed	Time/Date	Provider
Grand Forks ND Airport	61 MPH	0404 AM 02/12	ASOS
Hendrum MN 4 ENE	54 MPH	0456 AM 02/12	MNDOT
Fargo ND Airport	53 MPH	0744 AM 02/12	ASOS
Grafton ND Airport	53 MPH	0415 AM 02/12	AWOS
Donaldson MN 1 W	53 MPH	0345 AM 02/12	MNDOT
Bowesmont ND 2 NNW	53 MPH	0301 AM 02/12	NDDOT
Buxton ND 4 S	53 MPH	0216 AM 02/12	NDDOT
Grand Forks ND AFB	52 MPH	0511 AM 02/12	ASOS
Cando ND Airport	49 MPH	0135 AM 02/12	AWOS
Moorhead MN Airport	49 MPH	0735 AM 02/12	AWOS
Cooperstown ND Airport	49 MPH	0435 AM 02/12	AWOS
Eldred MN 2 W	48 MPH	0440 AM 02/12	NDAWN
Warren MN 6 SW	48 MPH	0300 AM 02/12	NDAWN
Wahpeton ND Airport	48 MPH	0815 AM 02/12	AWOS
Dilworth MN 2 S	48 MPH	0815 AM 02/12	MNDOT
Leeds ND 7 E	48 MPH	0131 AM 02/12	NDDOT
Kennedy MN 6 W	47 MPH	0440 AM 02/12	NDAWN
Sabin MN 2 NE	47 MPH	0940 AM 02/12	NDAWN
Baker ND 1 N	47 MPH	1255 AM 02/12	NDAWN
Mayville ND 2 E	47 MPH	0445 AM 02/12	NDAWN
Hampden ND 3 SE	47 MPH	0358 AM 02/12	RAWS
Emerado ND 3 W	47 MPH	0331 AM 02/12	NDDOT
Grand Forks ND 5 N	47 MPH	0346 AM 02/12	NDDOT
Gwinner ND Airport	46 MPH	0935 AM 02/12	AWOS
St Vincent MN 1 E	46 MPH	0230 AM 02/12	MNDOT
St Thomas ND 2 WSW	45 MPH	0255 AM 02/12	NDAWN
Langdon ND Airport	45 MPH	0315 AM 02/12	AWOS
Hallock MN Airport	45 MPH	0515 AM 02/12	AWOS
Buffalo ND 7 N	45 MPH	0646 AM 02/12	NDDOT
Devils Lake ND 4 S	45 MPH	1246 AM 02/12	NDDOT
Wahpeton ND 6 W	45 MPH	0946 AM 02/12	NDDOT
Campbell MN 3 SE	44 MPH	0940 AM 02/12	NDAWN
McHenry ND 8 N	44 MPH	0410 AM 02/12	NDAWN
Prosper ND 5 NW	44 MPH	0520 AM 02/12	NDAWN
Valley City ND Airport	44 MPH	0315 AM 02/12	AWOS
Detroit Lakes MN Airport	44 MPH	1036 AM 02/12	AWOS
Humboldt MN 4 SW	43 MPH	0310 AM 02/12	NDAWN
Edmore ND 3 NW	43 MPH	0255 AM 02/12	NDAWN
Hillsboro ND 7 SE	43 MPH	0740 AM 02/12	NDAWN
Kempton ND 6 SE	43 MPH	0410 AM 02/12	NDAWN
Walhalla ND Airport	43 MPH	1115 PM 02/11	AWOS

...LOW TEMPERATURE REPORTS...

Location	Temp	Time/Date	Provider
Waukon MN 3 S	-37 F	0420 AM 02/13	NDAWN
Fosston MN Airport	-35 F	0536 AM 02/13	AWOS
Ada MN 1 N	-33 F	0650 AM 02/13	NDAWN
Ulen MN 7 SSE	-33 F	0650 AM 02/13	NDAWN
Shooks MN 0.5 E	-33 F	0505 AM 02/13	MNDOT
Waskish MN 3 NW	-33 F	0750 AM 02/13	MNDOT
Warren MN	-33 F	0800 AM 02/13	COOP
Mahnomen MN 3 SSE	-32 F	0621 AM 02/13	MNDOT
Perley MN 6 E	-31 F	0825 AM 02/13	NDAWN
Stephen MN 1 NE	-31 F	0335 AM 02/13	NDAWN
Pine Point MN 2 N	-31 F	0415 AM 02/13	NDAWN
Kelliher MN 1 W	-31 F	0407 AM 02/13	RAWS
Gatzke MN 3 ENE	-31 F	0345 AM 02/13	MNDOT
Mentor MN 2 SW	-30 F	0123 AM 02/13	CWOP
Bagley MN 5 N	-30 F	0704 AM 02/13	CWOP
Dilworth MN 2 S	-30 F	0745 AM 02/13	MNDOT
Hendrum MN 4 ENE	-30 F	0806 AM 02/13	MNDOT
Eldred MN 2 W	-29 F	0525 AM 02/13	NDAWN
Greenbush MN 7 W	-29 F	0110 AM 02/13	NDAWN
Sabin MN 2 NE	-29 F	0615 AM 02/13	NDAWN
Hillsboro ND 7 SE	-29 F	0630 AM 02/13	NDAWN
Prosper ND 5 NW	-29 F	0710 AM 02/13	NDAWN
Holt MN 15 E	-29 F	0120 AM 02/13	RAWS
Bemidji MN 8 N	-29 F	0735 AM 02/13	CWOP
Mahnomen MN Airport	-29 F	0735 AM 02/13	AWOS
Park Rapids MN Airport	-29 F	0653 AM 02/13	ASOS
Brooks MN 3 S	-29 F	0305 AM 02/13	MNDOT
Ross MN	-29 F	0345 AM 02/13	HADS
Hubbard MN 1 SE	-28 F	0810 AM 02/13	NDAWN
Roseau MN 11 S	-28 F	1240 AM 02/13	NDAWN
Warren MN 6 SW	-28 F	0420 AM 02/13	NDAWN
Badoura MN 2 E	-28 F	0706 AM 02/13	RAWS
Argyle MN 8 SW	-28 F	0419 AM 02/13	CWOP
Grand Forks ND Airport	-28 F	0600 AM 02/13	ASOS
Roosevelt MN 1 SE	-28 F	0330 AM 02/13	MNDOT
Osage MN 5 NW	-28 F	0700 AM 02/13	HADS
Sabin MN	-28 F	0830 AM 02/13	COOP
Williams MN 6 N	-27 F	0335 AM 02/13	NDAWN
Fox MN 4 NE	-27 F	0940 PM 02/12	NDAWN
Langdon ND Airport	-27 F	0815 AM 02/13	AWOS
Staples MN Airport	-27 F	0755 AM 02/13	AWOS
Thief River Falls MN Airport	-27 F	0156 AM 02/13	AWOS

April 1-3, 2020

After a prolonged quiet period, a strong spring storm system developed as a upper level trough moved across the Northern Plains. Initially rain showers spread across the area Wednesday night April 1st. As cold air began to undercut the moisture laden airmass, rain turned to freezing rain and sleet in portions of eastern North Dakota and northwest Minnesota Thursday morning, and eventually snow. In southeast North Dakota and west central Minnesota, freezing rain and sleet persisted into the afternoon before turning to snowfall. Heavy snowfall rates starting lifting out of South Dakota into the Red River valley Thursday afternoon, with thunder snow even reported in a few locations. These heavy snowfall rates continued to spread to the north and east Thursday evening into Friday morning. The highest snowfall was 16 inches at multiple locations in northwest Minnesota, with a band stretching back to the southwest of 8 to 12 inches from Grand Forks to Valley City. Areas east of this heavier band saw more ice and sleet accumulations.

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0956 AM     HEAVY SNOW        3 WNW BACKOO              48.85N 97.78W
04/03/2020  M7.0 INCH         PEMBINA             ND    COCORAHS
            COCORAHS STATION ND-PM-1 CAVALIER ND 7.9 WNW.
0700 AM     HEAVY SNOW        1 NE PEMBINA              48.97N 97.24W
04/03/2020  M6.5 INCH         PEMBINA             ND    CO-OP OBSERVER
            CO-OP OBSERVER STATION PBAN8 PEMBINA ND.
0700 AM     SNOW              4 SSE WALHALLA            48.87N 97.89W
04/03/2020  M5.5 INCH         PEMBINA             ND    COCORAHS
            COCORAHS STATION ND-PM-3 WALHALLA 3.6 SSE.
0700 AM     SNOW              2 NNE BACKOO              48.86N 97.70W
```
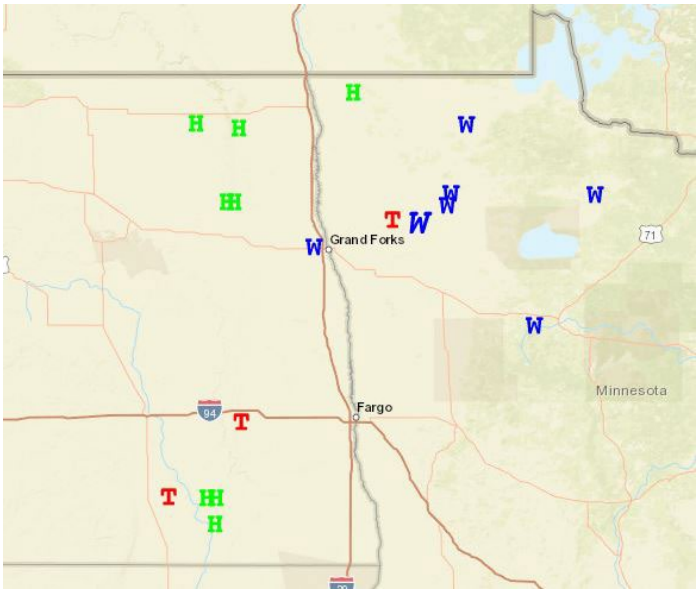
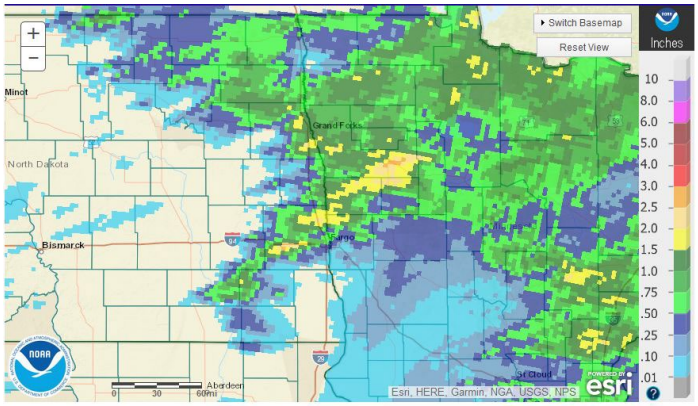

04/03/2020 M4.0 INCH PEMBINA ND CO-OP OBSERVER
CO-OP OBSERVER STATION CVLN8 CAVALIER ND 7 NW.

August 9, 2020

On August 9, 2020, severe thunderstorms moved through portions of the region, with a variety of hail, strong winds, and even tornadoes.



Pictured Left: Wind (blue W), hail (green H) and tornado (red T) reports for August 9, 2020 storm.



Pictured Left: Rainfall amounts for the August 9, 2020 storm.

1205 PM HAIL 1 S MOUNTAIN 48.67N 97.86W
08/09/2020 E1.25 INCH PEMBINA ND TRAINED SPOTTER
A FEW HAIL LARGER THAN QUARTERS. MOST WERE
DIME TO NICKEL SIZED.

Commented [DKB26]: Andrew, Realizing Pembina wasn't in the June 29-July 1 disaster declaration, did you all have any impacts otherwise. You may want to include a section. Here's the description from the dec letter. tate Climatologist Adnan Akyüz, Ph.D., North Dakota State University, determined this impactful storm ranked between a 500- to 1,000-year event. As much as 52 times the average amount of rain fell, flooding basements and overflowing infrastructure far beyond designed capacities. Overland floodwaters swamped fields and pastures, already saturated from three flood events in 2019 and 2020. Wetlands and sloughs swelled, inundating nearby infrastructure. Subsequent flash flooding resulted in washed out roads, damaged bridges and railroad tracks, destroyed water control structures, and inundated lift stations. Basements filled with water as neighbors and volunteers helped with cleanup and debris removal efforts. Lightning strikes and high winds caused extensive damage to regional Rural Electric Cooperatives, destroying electrical equipment and downing miles of power lines, leaving thousands of residents temporarily without power. Damages to local infrastructure systems exceeded $2.25 million, and damages to the state's Federal Aid System highways amounted to an estimated $2,894,000.

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Overall Vulnerability

As shown above, a severe winter storm has the ability to cripple the region. Primary vulnerabilities can be summarized by the following:

Transportation

While prolonged inability to travel will cause damage to the economy and commerce, the primary concern is motorists becoming stranded on the road. Unprepared stranded motorists face a life-threatening situation in minutes in extreme temperatures and it can be difficult for responders to 1) be aware of stranded motorists; 2) locate stranded motorists; and 3) reach motorists in a reasonable time due to poor road and visibility conditions.

It is also notable that the inability to travel may also be detrimental to the health and wellbeing of individuals who must travel to purchase food or medications, as well as anyone experiencing an emergency and is unreachable by first responders.

Utilities

While it has been the practice for some time now to bury utilities such as power supply and communication lines, there remain many miles in Pembina County where these utilities are exposed to weather extremes. Damage to these utilities could limit communication to residents as well as first responders and/or cause loss of power to homes and business in the region.

Generally, the rural water supply remains functional while protected below the frost line, a lack of insulation by snow could cause frost to penetrate unusually deep causing freezeups or burst pipes leaving locations without fresh water. This is especially dire as the equipment necessary to make these repairs is limited and multiple bursts may leave residents without water for an extended period of time.

Structural Damage

Heavy accumulations of snow or ice may stress roofs of structures beyond their designed limits resulting in collapse or other damage to the structure or protective surfaces (roofs, shingles, etc). While insurance may help rectify the matter financially, short and mid term needs will still need to be met. and mid term needs will still need to be met.

Fire

Broadly, fires can fit in two categories: structural and wildland.

All fire departments in Pembina County are trained for and respond to fires in and out of city limits for anything from crass and brush fires to home and apartment fires. The risk in any part of the county tends to follow precipitation patterns and practices of the population.

Wildfire

For the purposes of this document, a "wildfire" is any fire that uses grasses, brush or trees as the primary fuel source and does not involve a burning structure (though structures may start on fire or be damaged as the result of a wildfire). Generally, damage done by fires rarely impacts county infrastructure, and losses are usually regulated to crops or natural resources.

Severity of a fire is generally determined by the time of year of the incident. Fires in the early spring, before crops are planted, tend only to effect air quality and visibilities with little economic loss. It is likely that these fires often end up leaving the land better after the incident than before as much of the old and dead plant matter in the area is burned off and makes room for new growth. The secondary effects of a wildfire cannot be overlooked though, as seen in an April 15, 2015 fire that was spread by embers falling from a semi-trailer. High winds and a high volume of smoke reduced visibility causing at least one auto accident and respiratory distress for several residents. The chief strategy for wildfires is to contain the burn and snuff any hot spots out.

Late season fires are of significant concern as fire in a dry crop field or hay field has the potential to quickly destroy hundreds of thousands or millions of dollars in minutes. Most years, the Pembina County Commission will enact a burn ban of some kind to reduce the likelihood of wildfires starting, and we've come a long way is getting the public on our side. Individuals are taking much greater responsibility to control their fires, clear excess dead plant matter and to call in prescribed burns ahead of time. With help from the state's attorney's office and sheriff's department, the threat of heavy fine and misdemeanor sentence has greatly reduced the number of accidental ignitions.

As mentioned prior, fire rarely poses a threat to county infrastructure, though in some instances there has been damage done to electrical and telephone poles. While no damage to lines have been reported, significant fire damage to the structure of these high lines reduces integrity and excessive damage may mean loss of the line, or an unsafe situation for responders working around downed high-voltage lines.

Other utility stations are not immune to this risk as well, including electrical substations, pump stations, valve sites, railroads and subsurface drain tile pumps. Most sites mention reduce their level of risk by incorporating a gravel or cement pad, or some standoff from flammable materials to prevent fire from spreading to the asset.

PHOTO 1: FIRE DAMAGE TO UTILITIES

Structural Fire

Structural fires are any fires that involve the burning of a structure, either a home, business or public building.

Like most modern construction, many homes and buildings in Pembina County are stick buildings (construction lumber) sided with wood, vinyl or streel, and roofed with asphalt shingles or steel panels. While newer buildings are at a lower risk of catching fire, once ignited burn quite readily.

Older parts of some towns contain historic buildings or homes that may or may not be occupied that carry the additional risk of not being well-supervised, well-kept, or having inadequate modern utilities. These buildings carry additional risk for the owner.

Due to its rural nature, there are few multi-unit housing buildings that could result in total loss for all occupants. While this reduces the need to have large scale housing plans for displaced, social service resources are quickly overwhelmed with the loss of a single apartment or condominium complex. Recent restructuring in social services from local to regional and state based have increased the availability of resources to the displaced, and gaps are filled with the help of the American Red Cross. Generally, the small-town nature of the county is apparent and almost any displaced can find someplace to stay with friends or family in the area.

Automotive Fires

Local fire departments are also tasked to respond to car accidents that may involve fire due to combustible materials. Generally, this tends to be a support function to EMS or law enforcement and involves cutting battery cables, providing extinguishing foam, and necessary extrication. This section is expanded further under transportation incidents.

Preparedness and Mitigation

Much like severe weather, there is a "season" and forecasting available for high fire conditions. Tools through the National Weather Service (NWS) provide up to the minute predictions for extreme fire conditions, known as Red Flag Warnings. NWS also provides long- and mid-range tools as well that can help anticipate fire danger weeks and months out. *Graphics 1-3* demonstrate some of the tools used to determine risk. Drought monitoring courtesy of droughtmonitor.unl.edu also helps determine fuel availability in conjunction with the ND Fire Danger Index, an example shown in *Graphic 4.*

Pembina County is also heavily supported by North Dakota Department of Emergency Services (NDDES) with fire danger documents and social media tools to help educate the public. An example of these publications can be found in *Graphic 5.*

Fire
Location – full extent of Pembina County.
Extent – varying severity, with seasonal wildfires.
Probability – low likelihood of large-scale fires.
History – 2015, widespread fire from a smoking semi-trailer; 2018, wildfire that destroyed a critical rail bridge.
Impacts – property and crop damage.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning

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Level of Impact	B	B	D	C	D	B	C	D	C	A	A	D	D	D	C	A	A	c

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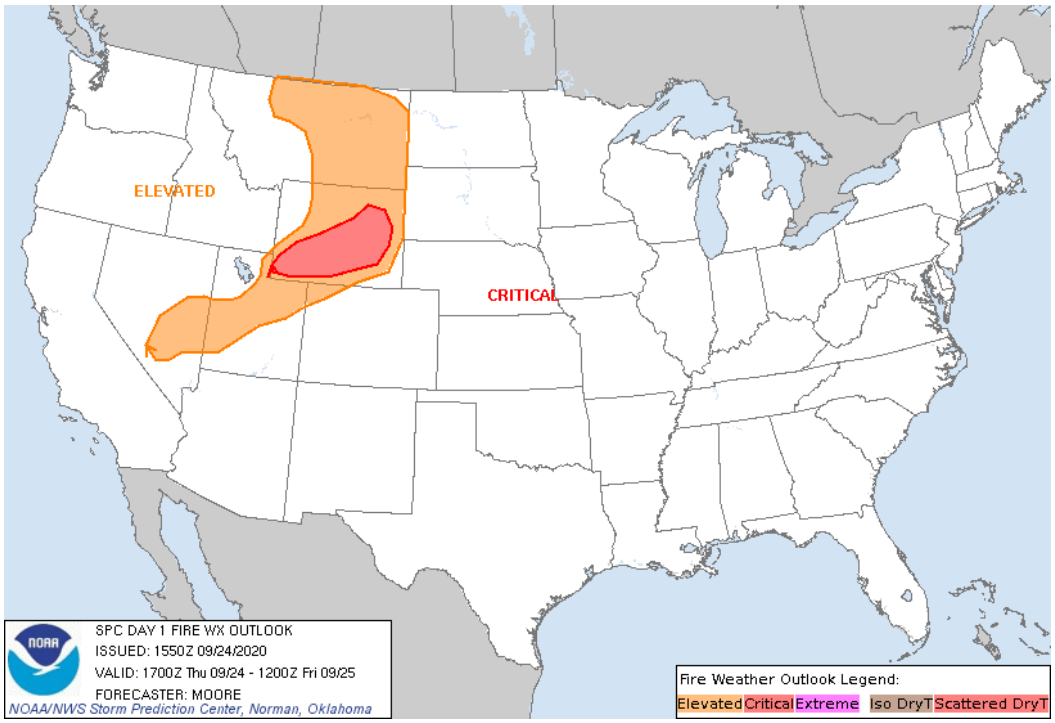
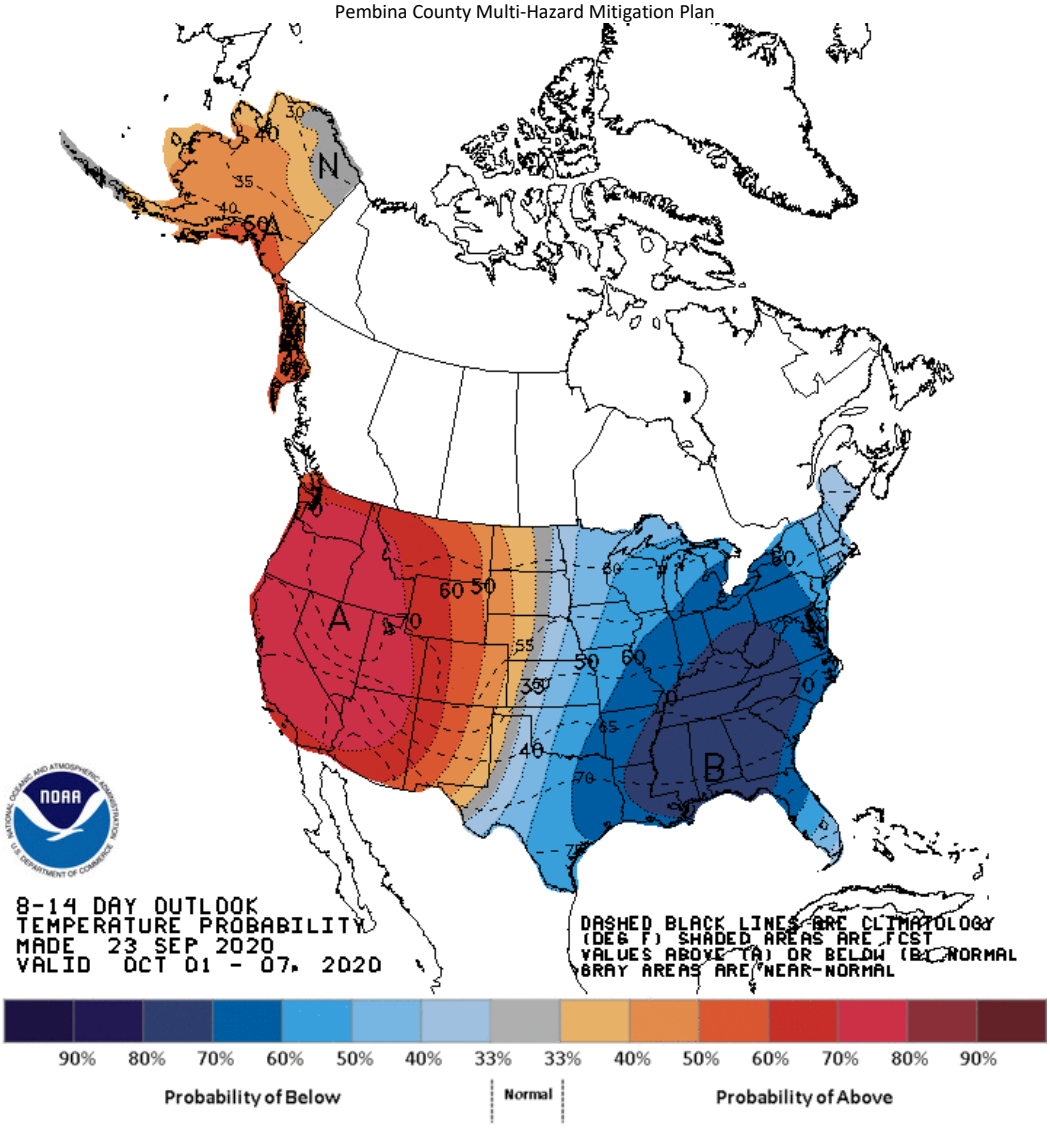
Rationale

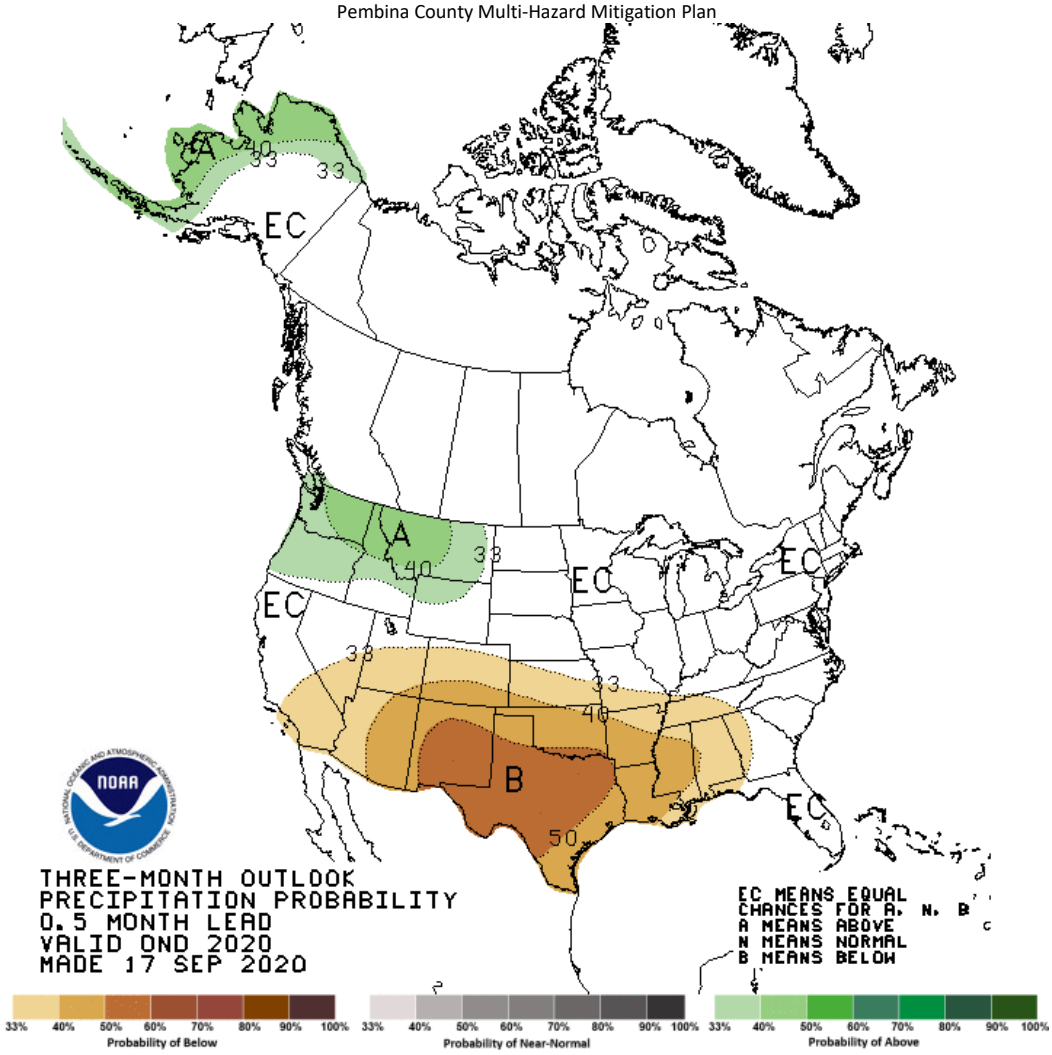
- Infrastructure Systems: damage to utility lines and disruption to utilities in fire suppression activities.
- Critical Transportation: damage to infrastructure, detours around emergency vehicles, reduced visibility due to smoke.
- Mass Care Services: housing of displaced individuals and support care of firefighters.
- Housing: damage to homes or loss of critical utilities.
- Fire Management: of course.
- Law Enforcement: support of fire suppression activities.
- Planning: preparations for large buildings such as schools, or unique facilities housing hazardous materials.
- Operational Coordination: especially critical when several departments working together, or working with partner agencies.
- Situational Assessment: constant vigilance as the fire scene changes, especially critical in wildfires where changes in weather may increase spread.
- Public Information and Warning: how the public can reduce risk in dry conditions.



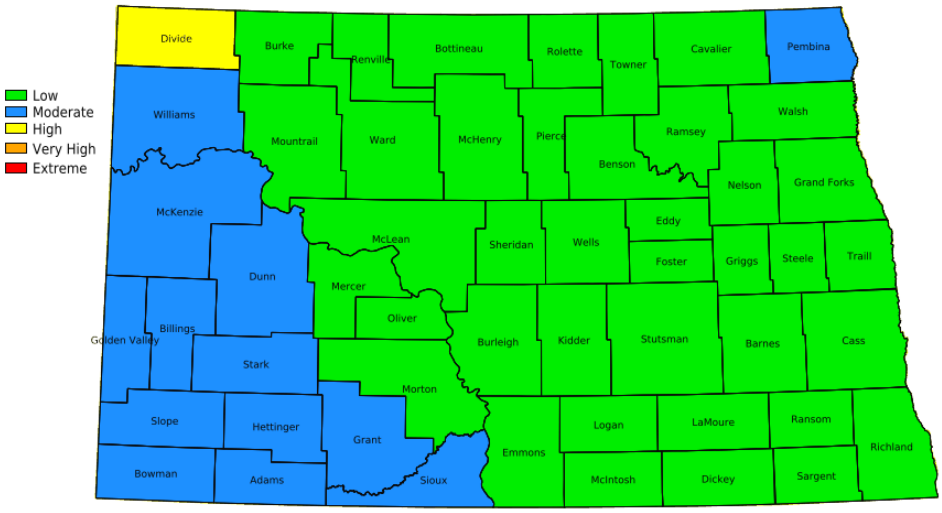
GRAPHIC 1: FIRE WEATHER OUTLOOK



GRAPHIC 2: LONG-RANGE TEMPERATURE OUTLOOK



GRAPHIC 3: LONG-RANGE PRECIPITATION OUTLOOK



0100 PM Thu Sep 24 2020
Wildland Fire Assessment System (WFAS)

GRAPHIC 4: FIRE DANGER MAP

Fire Danger Guide Suggestions and Restrictions

During severe, extended dry conditions, or drought the Governor may issue a proclamation mandating these restrictions. Fines and other penalties may be assessed for failing to comply. Local governments may institute burn bans and reference these restrictions regardless of fire danger and independent of a Governor's proclamation. Local bans may be more restrictive but not less than what is identified in the state proclamation for the same area.

It is critical that you verify the current rating and local burn bans/restrictions BEFORE burning and participating in outdoor activities. Many counties have reporting requirements prior to burning. Information about current fire danger ratings is available through county sheriff offices, the National Weather Service (www.weather.gov/bis/fire or www.weather.gov/fgf/fire), or the ND Department of Emergency Services (www.nd.gov/des).

Restrictions are mandatory when a proclamation is active and highly advised when not.

Fire Danger / Activity Category	Open Burning	Recreation Fire	Fireworks	Device Controlled	Smoking	Equipment/Vehicles
Low	S1	S1	S1	S 1	S 1	S 1
Moderate	S 1 S 2	S 1 S 4	S 1	S 1	S 1	S 1
High		S 1 S 2 S 3 S 4	S 2 S 3	S 1 S 2 S 3	S 1	S 2 S 3
Very High				R 1 S 1	R 2	R 3
Extreme				R 1 S 1 S 3	R 2	R 4
Red Flag Warning				R 1 S 1 S 3	R 2	S 2 S 3 R 4

The US Forest Service issues the North Dakota Fire Danger Rating each morning (6:45 CST) during fire season; typically from April 1 to October 31. The USFS calculates the Fire Danger Rating using grassland fuel moisture, forecast temperature, humidity, and wind speed.

Suggested Actions - Consider these precautions when a fire proclamation or burn ban is active.

S 1 - Monitor activity.
S 2 - Have basic hand tools available for quick response.
S 3 - Have extinguisher or water available on site.
S 4 - Fire should be contained in fire ring or organic material removed from immediate area.

Restrictions - The restrictions below apply to the area identified in proclamation issued by the governor or local authority.

R 1 - Allowed when device is on a hard non-organic surface 15 feet away from dry vegetation.
R 2 - Restricted to inside of vehicles, hard surface areas, homes, or in approved buildings.
R 3 - All recreational off road travel is restricted
R 4 - Off road travel is restricted to land owners and facility owners or their employees who need to maintain property, crops, and livestock.

Definitions

Open Burning - Any burning that takes place in an unenclosed space. Includes burning of leaves, grass clippings, garbage pits, construction debris, fallen trees, crop residue or hay land, sloughs and bonfires.

Recreation Fire - Fires associated with recreational activities like camping, fishing, or hunting where the purpose for the fire may be cooking, warmth, or ambiance and are under observation until extinguished.

Device Controlled - Manufactured device that controls or confines the fire to a degree it is safe when not under continued observation. This category includes gas, charcoal, or wood fired grills, patio fireplaces and chimineas, gas camp stoves, and smokers.

Smoking - Practice in which a substance is burned and the resulting smoke is breathed in. Includes cigarettes, cigars, pipes, and bongs for which tobacco or other substances is smoked.

Fireworks - A class of explosive pyrotechnic devices used for aesthetic, cultural, and religious purposes that are generally lit to explode or travel, emit sparks, or smoke. Includes, firecrackers, rockets, shells, smoke bombs, and sparklers.

Equipment/Vehicles - Heavy-duty vehicles wheeled or tracked and all other vehicles made to traverse land. Includes farm, construction, mining, oil extraction, cars, trucks, utility vehicles (4 wheelers), motorcycles, and motor homes.

Note: Definitions above were developed in part from the 2012 International Fire Code

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Vulnerability

Threats to Pembina County due to fire can be categorized broadly several ways:

Utility Destruction

Structural and wildland fires have the ability to spread and engulf utility features such as power line and telephone poles, electrical substations, and other means of utility distribution. The can create secondary hazards – and in the form of electric wires, potential start additional fires – and may make containment much more difficult, as well as leaving residents without the utility.

Reduced Air Quality

Fuels and combustibles, especially those man-made and manufactured, produce combustion byproducts that are toxic to humans. In even small doses, they can cause irritation and swelling to eyes and airways of bystanders and responders alike. Particularly thick smoke under proper weather conditions can cause near blackout conditions to motorists and residents near the area.

Damage to Crops and Livestock

Fires spreading into fields or pastures have the ability to destroy large amounts of crops or trees in the case of tree farms or stands. Animals or livestock unable to escape fire may also be injured by fire or smoke inhalation.

Destruction of Natural Resources and Wildlife Habitat

Pembina County is home to several nature preserves and wildlife habitats. Fire spreading into these areas can cause damage to habitats that may take several years or decades to totally recover from. Damage to parks or recreation areas could mean loss of revenue and extreme labor and financial costs to restore.

Flooding

The primary threat to residents and infrastructure in Pembina County is overland and riverine flooding. Flooding is generally a seasonal event, occurring to some extent each spring, but small-scale “flash” flooding has also been seen during heavy precipitation events at any time in the year. Emergency management and response personnel rely on several tools to anticipate and observe flooding conditions.

Flood Insurance and Floodplain Management

The primary means of reducing flood vulnerability is coordination with floodplain management at the local and state levels. Communities currently participating in the National Flood Insurance Program (NFIP) and pledge to continue to do so are:

- Bathgate
- Cavalier
- Crystal
- Drayton
- Hamilton
- Neche
- City of Pembina

All communities not mentioned and all townships are overseen by Pembina County Floodplain Administration except for the following who operate independently:

- Cavalier Township
- Drayton Township
- Joliette Township

Additionally, floodplain management will work closely with elected leaders, insurance companies and property owners to help identify the benefits of flood insurance.

River Gauges

The United States Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) have river and stream gauges in watersheds nationwide. There are 4 permanent gauges in Pembina County and one semi-permanent gauge that provide real-time river levels during flooding events. Additionally, there are 3 gauges north of the border in Manitoba along the Upper Pembina River that help forecast flooding in the Lower Pembina River stateside. Advanced information on the Red River of the North is obtained by gauges up and down the Red, including Wahpeton, Fargo, Grand Forks and Oslo, to name a few.

Together, these gauges provide a current view and an estimated forecast of what river levels are to come. This information is invaluable to city governments and the LEPC to help plan flood prevention measures.

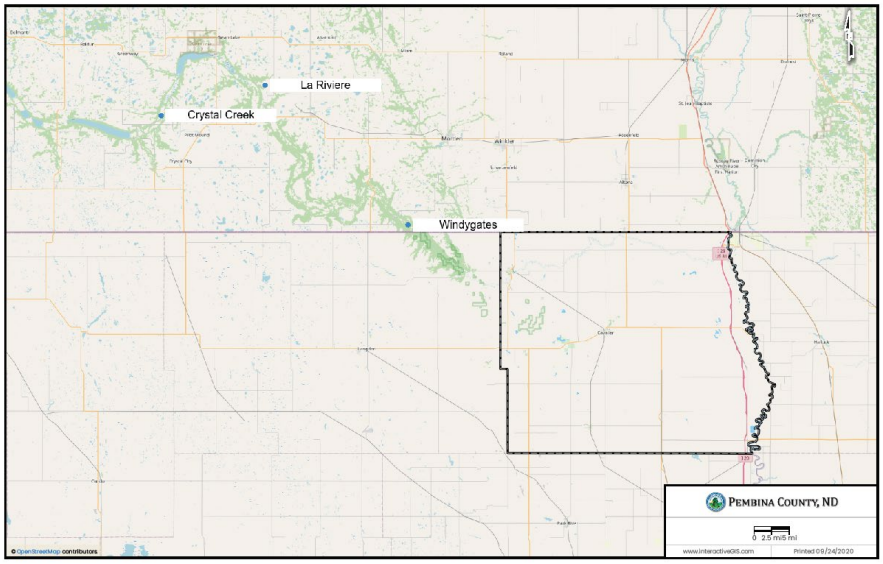

FIGURE 5: CANADIAN GAUGES ALONG THE UPPER PEMBINA RIVER

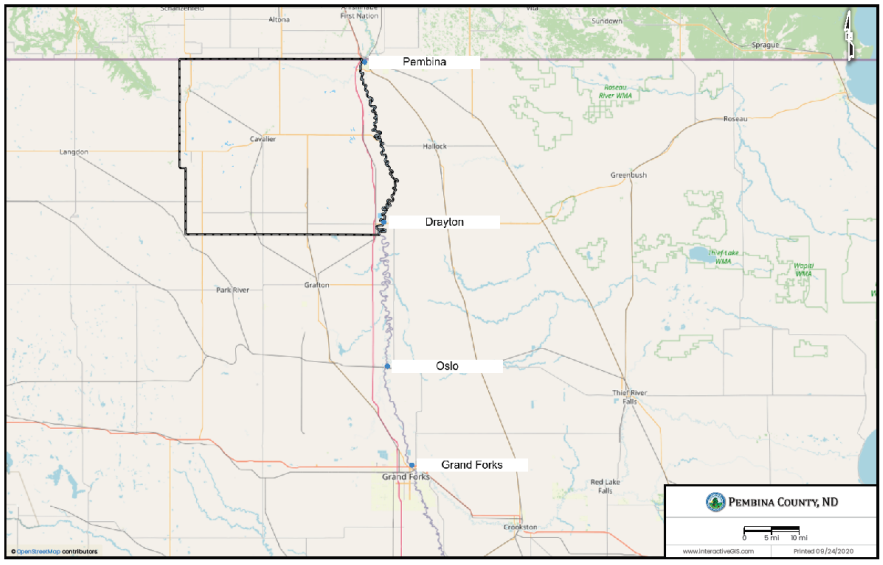

FIGURE 6: RIVER GAUGE ALONG THE RED RIVER FROM GRAND FORKS NORTH


Walhalla
Delano Avenue
5th Street
CR 55
CR 9
ND 32
WLHN8
PEMBINA RIVER
State Highway 32
PEMBINA COUNTY, ND
Walhalla Stream Gauge
0 500 ft 1000 ft
www.interactiveGIS.com
Printed 09/24/2020
© OpenStreetMap contributors

FIGURE 7: RIVER GAUGE AT WALHALLA, PEMBINA RIVER

Figure 8: River Gauge at Neche, Pembina River

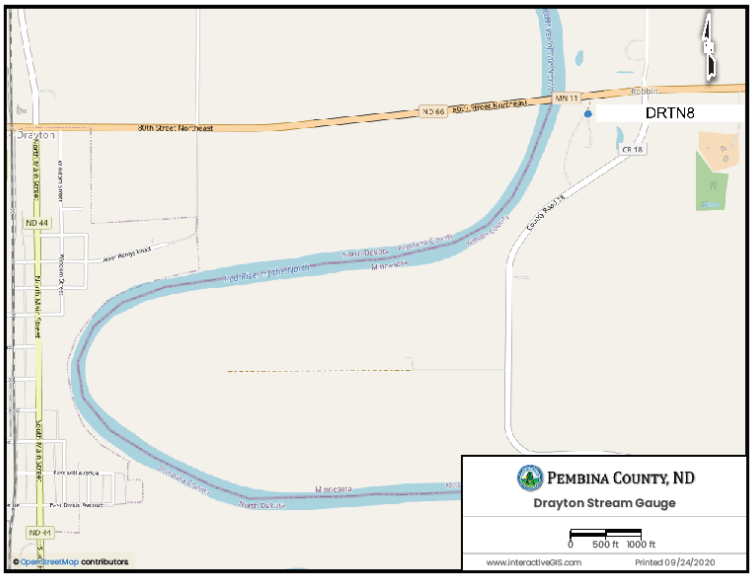

FIGURE 9: RIVER GAUGE AT DRAYTON, RED RIVER

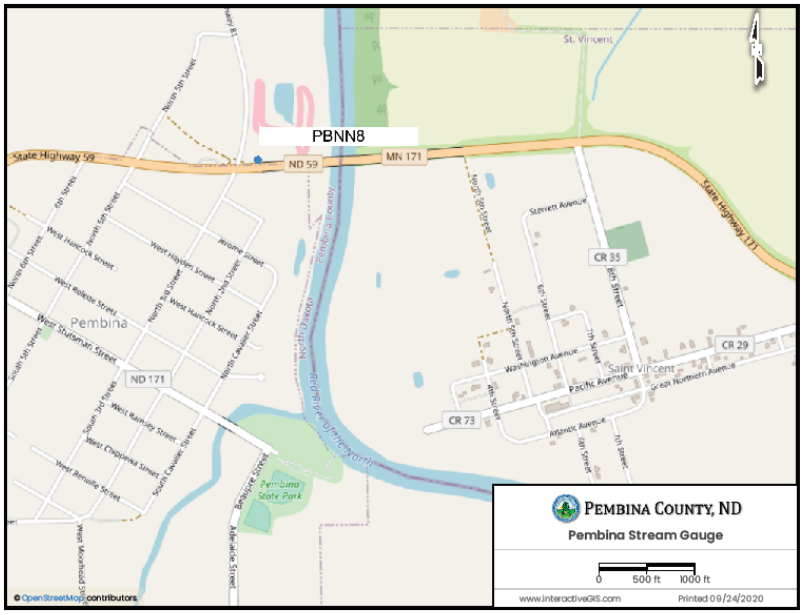

Figure 10: River Gauge at Pembina, Red River

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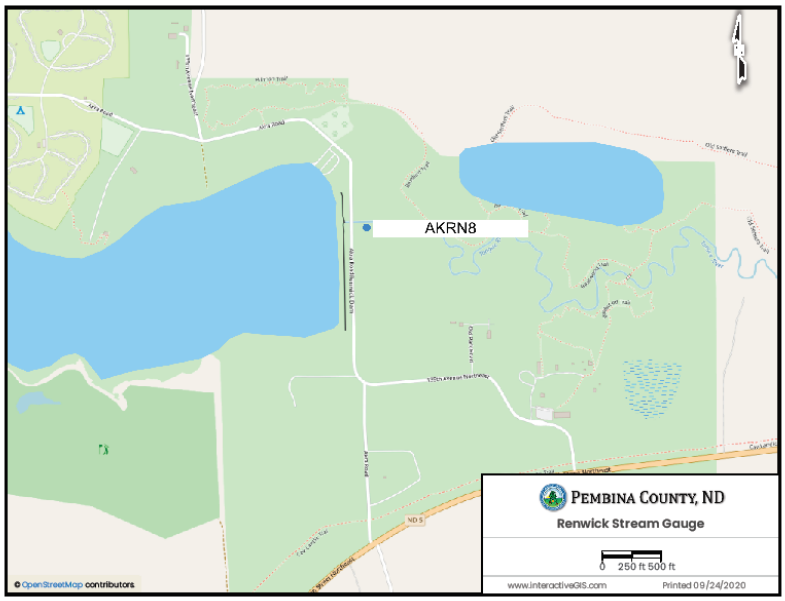


FIGURE 11: RIVER GAUGE AT RENWICK DAM, TONGUE RIVER WATERSHED

National Weather Service

The National Weather Service office in Grand Forks provides highly detailed short term weather forecasts and long-range climate information that helps inform policy makers well in advance of floods to help make immediate prevention measures. It is understood that the information is using only best available data (BAD) and it is understood by PCDES that forecasts tend to be a worst case scenario. This fits into the principle that it is better to be over prepared than under.

Flood Prevention Measures

Many communities and residents in Pembina County have lived with the threat of flooding for years. The risk is understood, so they have grown to adapt to the challenges and threat.

City of Walhalla, Pembina River

Walhalla has developed a progressive zoning and development strategy of limiting building in the floodplain to only green space and park projects. Utilities in greenspace have been raised and hardened against flooding in order to greatly reduce losses.

City of Neche, Pembina River

Neche developed a ring dike around their town using city and private funds. The city has sought engineering aid from the Army Corps of Engineers for some time, but having been unsuccessful so far, assume the risk upon themselves with good luck so far. The levee is patrolled during flood time and the few entrances into town not protected by levee are sandbagged. Pump stations and temporary pumps are used to move water from low areas to protect homes and infrastructure within.

With recent improvements to North Dakota Highway 18, DOT engineers have worked with community leaders to help reduce strain on city levees by installing culverts along the highway – a road that has historically funneled water towards the town. While the system has not yet been tested, it is optimistic to think these changes will help reduce risk to the city.

City of Drayton, Red River

In flood years, Drayton constructs temporary levees to protect the city. These levees have always been cost shared by FEMA and NDDES to construct and remove, however in 2009, the city made the decision to leave the levees up in order to save time and labor of the install and demolition each year. Doing so was considered an incursion into the floodplain and the levees were ordered to be removed. After battling for some time, the levees were permitted to stay with the understanding that they would not be considered permanent flood protection

In 2016, a revision of the floodplain by the National Flood Insurance Program (NFIP) placed much of the City of Drayton into a high flood hazard area. This move was unsurprising, due to the city's proximity to the Red River, but caused considerable stress to residents who would take a significant economic hit, especially in the real estate market. After an appeal to Senators Hoeven and then Senator Heitkamp, the maps were revised again in 2017 to show a reduced risk to the community as no flooding had occurred, due to preventative measures.

Presently, despite the risk of the river, Drayton has a robust damage prevention plan including construction of temporary levees, a network a pump stations, and a proactive community to sandbag critical buildings.

City of Pembina, Tongue River, Red River

The primary threat to the City of Pembina is the Red River, which tends to be slowest to drain and whose waters encroach further out of the floodway than the Pembina. However, a swollen Red River can restrict the Tongue River's ability to train, also causing a hazard to the city. Pembina has worked closely with the Army Corps to install a robust flood barrier around the city, including "invisible" flood walls which can be erected over city entrances to keep water out. A robust system of culvert gates can also be opened and closed depending on the situation in order to protect the city. Lastly, city leaders and residents

have a great depth of experience to draw from for fighting floods and community involvement with sandbagging and dike patrols help to protect the city.

Pembina also has the disadvantage of a dispute with the Municipality of Rhineland over a boarder roadway that has the unfortunate feature of acting as a levee, preventing flood water from draining north. An international committee is currently working through this issue.

Summary

Pembina County has received 6 presidential disaster declarations in the past 11 years, a higher frequency than decades before that. While it is unclear what is causing the uptick in disasters, whether the climate, unsustainable draining practices or poor zoning practices, it is a fact of life in a county with three rivers that flooding will continue to be a great threat and something that must continually be reassessed for years to come.

Hydrological

Dam Failure

A dam failure is the partial or complete collapse of an impoundment, with the associated downstream flooding. Flooding of the area below the dam may occur as the result of structural failure of the dam. Dam failures are caused by natural and manmade conditions. The list of causes includes: erosion of the face or foundation, improper siting, structural/design flaws, and prolonged rainfall and flooding. The primary danger associated with a dam failure is the swift, unpredictable flooding of those areas immediately downstream of the dam.

There are three general types of dams: earth and rock fill, concrete arch or hydraulic fill, and concrete gravity. Each of these types of dams has different failure characteristics. The earth and rock fill dam will fail gradually due to erosion of the breach; a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete arch or hydraulic fill dam will fail almost instantaneously; with a very rapid build-up to a peak and then a gradual decline. A concrete gravity dam will fail somewhere in between instantaneous and gradual, with corresponding build- up of flood wave.

A majority of these dams are earth fill embankments. The remaining dams can be categorized as follows: three gravity concrete dams, three variable radius concrete arch dams, two rock embankment dams, and one hydraulic fill dam. These dams function in a ~~variety of~~variety of service capacities for the County, including irrigation, recreation, stock watering, power production, and municipal water supply. The following table depicts the dams under State jurisdiction in Pembina County.

The Mount Carmel Dam is located in Cavalier County on the Pembina River Watershed, but would impact our county if it should fail. The Senator Young Dam is located in Cavalier County in the Tongue River Watershed, and would impact our county if failure occurs.

There are nine “significant” or “high hazard” dams in the county, two in the adjacent Cavalier County. If a high hazard dam fails, there is a potential for the loss of many lives. All federal dams in the state are required to have emergency action plans. In addition, emergency action plans (EAP) are required for the nonfederal dams greater than 1,000 acre-feet of storage in North Dakota. Renwick Dam, Olson Dam, and Senator Young Dam are the dams with greater than 1,000 acre-feet in Pembina County and have EAP’s in place.

As of the writing of this document, the Natural Resource Conservation Service based out of Bismarck is beginning discussions to rehabilitate Senator Young Dam, Olson Dam, and Bourbanis Dam to reduce dam threat. Pembina County Emergency Management intends to participate in the planning meetings taking place between 2020 and 2022.

Dams or any retention structures’ failure can generally be categorized three ways:

Hydraulic Failures - Hydraulic failures result from the uncontrolled flow of water, over, around, and adjacent to the dam, the erosion action of the water on the dam and its foundation. Earthen dams are particularly susceptible to hydraulic failure since earthen material erodes at relatively low velocities. Hydraulic failures account for approximately 30 percent of all dam failures. A hydraulic failure may occur due to wave action, toe erosion, and excessive spillway erosion, and overtopping as a result of insufficient reservoir storage and insufficient spillway capacity.

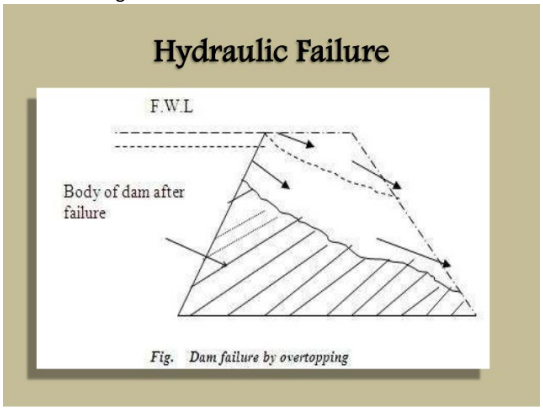


FIGURE 12: HYDRAULIC FRACTURE

Seepage Failure - All dams do have some seepage. This seepage occurs through the structure and its foundation. Seepage, if uncontrolled, can erode material from the downstream slope or foundation and work backward toward the upstream slope to form a "scour hole" which often leads to a complete failure of the structure. Seepage accounts for approximately 40 percent of all dam failures. Piping is a special seepage problem where soil particles are transported by a flow of water from one area to another. As soil particles are transported, the flow becomes larger and the soil particles move faster until a tunnel of flowing water is created.

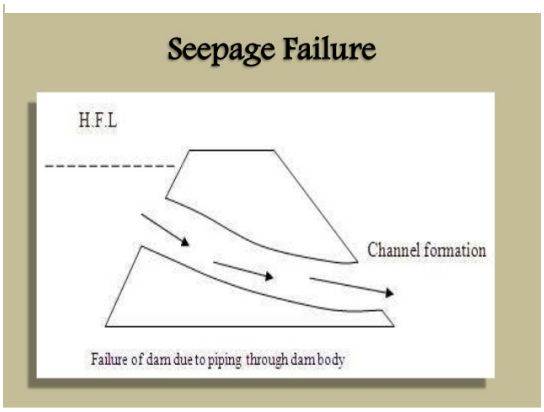


FIGURE 13: SEEPAGE FAILURE

Structural Failure - Structural failures involve the rupture or movement of monolithic components of the dam and/or its foundation. This is a particularly important hazard on large earthen dams and on dams built of low strength material such as silts. Structural failure accounts for approximately 30 percent of all dam failures.

Generally speaking, these types of failures are interrelated and complex. For example, uncontrolled seepage may weaken the soil of an earthen dam and lead to an embankment failure.

A structural failure may shorten the seepage path and lead to a "piping" failure. Surface erosion may lead to embankment failures.

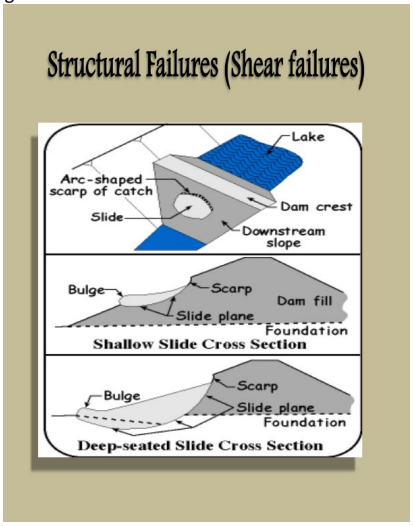


FIGURE 14: STRUCTURAL FAILURE

Time itself can also have an impact on dam integrity. Such things as weathering, mechanical changes, and the influence of chemical agents can affect a dam in the following ways:

- Engineering properties of the foundation and materials composing the dam may change;
- Chemical properties of the contents may change;
- Concrete can gradually deteriorate and weaken from leaching and frost, and the amount of sulfate present in the surrounding soil;
- Cracking to a significant depth can endanger stability;
- Monolithic behavior is affected, causing high stress concentrations and water pressure which has free access to the interior of the structure. Freeze/thaw damage is accelerated by these cracks;
- Metal components can corrode unless continually maintained; and
- Timber structures such as cribbing will eventually decay from the change of water content as well as infestation by insects or attack by other organisms.

Few man-made facilities pose a greater potential for the loss of life and property than the failure of a dam. Pent-up waters suddenly unleashed can have catastrophic effects on life and property downstream. Homes, bridges, and roads can be demolished in minutes.

Dams are categorized according to the potential hazard for loss of life and property damage, should the dam suddenly fail. Existing development must be considered when categorizing a dam. The hazard category is based on potential hazard from failure and not on the selected design criteria or storage capacity.

Although it is recognized that loss of life is possible with any dam failure, the following hazard categories of dams have been established for North Dakota:

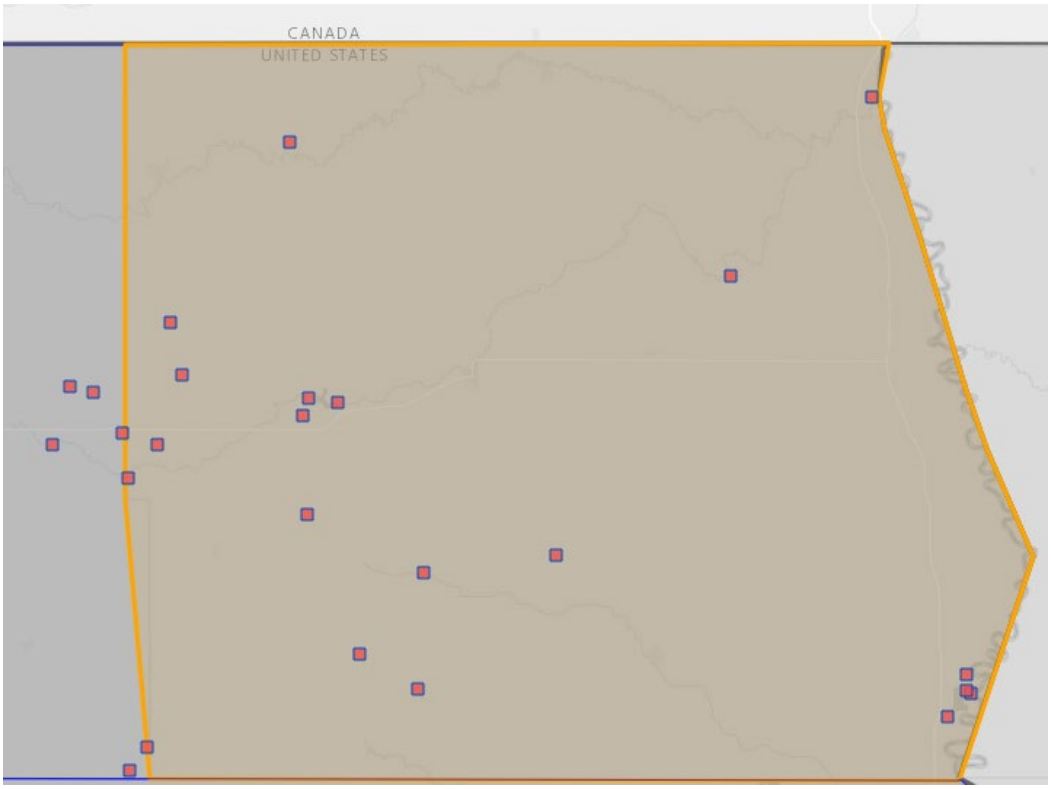
> **Low Hazard:** Dams located in rural or agricultural areas where there is little possibility of future development. Failure of low hazard dams may result in damage to agricultural land, township and county roads, and farm buildings other than residences. No loss of life is expected if the dam fails.

Medium Hazard: Dams located in predominantly 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 may be expected if the dam fails.

High Hazard: 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.

Liability - English common law, still the basis for non-statutory law in the United States, traditionally has held that the capture or collection of large amounts of water on one's land constitutes a hazardous activity, and that the collector operates at the risk of all subsequent occurrences related to that capture. Thus, to this day, most states hold the dam owners liable for damages that result from the failure of their dams.

The U.S. Government assumes liability for federally owned dams. However, it disclaims liability for nonfederal dams, including those regulated or inspected by federal agencies. Several dam failures in the United States created public concerns and stimulated congress to quickly enact legislation on dam safety.



GRAPHIC 5: DAMS AFFECTING PEMBINA COUNTY

Dam Name	Owner	Purpose	County	River	Latitude	Longitude	Hazard
Bourbanis Dam	**Pembina Water Board**	**Flood Control**	**Cavalier**	**Tongue**	**48.785000**	**-97.980000**	**Significant**
Carlisle Dairy LLP	*Carlisle Dairy LLP*	*Agriculture*	*Pembina*	*N/A*	*48.858340*	*-97.362210*	*Low*
Crystal Water Supply	**City of Crystal**	**Water Supply**	**Pembina**	**Park**	**48.601667**	**-97.670000**	**Significant**
Drayton Dam	**Pembina Water Board**	**Water Supply**	**Pembina**	**Red**	**48.59856**	**-9715567**	**Significant**
Goschke Dam	**Pembina Water Board**	**Flood Control**	**Pembina**	**Busse Coulee**	**48.795000**	**-97.893333**	**Significant**
Herzog Dam	**Pembina Water Board**	**Flood Control**	**Pembina**	**Tongue**	**48.751667**	**-97.918333**	**Significant**
Mount Carmel Dam	**Cavalier Water Board**	**Recreation**	**Cavalier**	**South Pembina**	**48.90768**	**-98.28019**	**Significant**
Morrison Dam	Pembina Water Board	Flood Control	Pembina	Tongue	48.780000	-97.778333	Low
ND00653	*GLD Farms*	*Irrigation*	*Pembina*	*N/A*	*48.681019*	*-97.546349*	*Low*
ND00638	*Loren Estad*	*Irrigation*	*Pembina*	*N/A*	*48.621503*	*-97.730291*	*Low*
ND00967	*Don & Neil Heuchert*	*Irrigation*	*Pembina*	*N/A*	*48.672465*	*-97.668032*	*Low*
ND00973	*Robert Vivatson*	*Irrigation*	*Pembina*	*N/A*	*48.769967*	*-97.782233*	*Low*
ND01009	*American Crystal Sugar*	*Other*	*Pembina*	*N/A*	*48.607402*	*-97.156967*	*Low*
ND01076	**City of Drayton**	**Other**	**Pembina**	**N/A**	**48.581518**	**-97.171710**	**Undetermined**
ND Natural Reserve Trust	*ND Natural Reserve Trust*	*Agriculture*	*Pembina*	*N/A*	*48.939932*	*-97.794039*	*Low*
Olson Dam	Pembina Water Board	Flood Control	Cavalier	Tongue	48.723333	-97.955000	High
Pembina City Dam	City of Pembina	Water Supply	Pembina	Pembina	48.956667	-97.236667	Medium
Renwick Dam	Pembina Water Board	Flood Control	Pembina	Tongue	48.780000	-97.741667	High
Senator Young Dam	Pembina Water Board	Flood Control	Cavalier	Tongue	48.75204	-98.01825	High
Wieler Dam	**Pembina Water Board**	**Flood Control**	**Pembina**	**Smith Coulee**	**48.825000**	**-97.910000**	**Significant**
Willow Creek Dam	**Pembina Water Board**	**Flood Control**	**Pembina**	**Willow**	**48.70811**	**-97.77804**	**Significant**

TABLE 1: DAMS AFFECTING PEMBINA COUNTY (ARMY CORPS OF ENGINEERS, 2020)

Since the last update of this plan (2015), several dams have been categorized into the "**Significant**" risk category. This is due in part the age of the structures. The Pembina County Water Resource District is aware of these conditions and is slated to repair Wieler Dam in 2020-2021 and produce rehabilitation plans for Olson, Senator Young and Bourbanis Dams in 2021-2022.

Additional data has been provided for several agricultural and irrigation dams in the county being utilized by landowners. The "low" risk categorization are in part to the low pool volume and limited infrastructure in the region. It is possible there could be second or third order effects to these dams, including but not limited to: concentration of agricultural products, such as fertilizer; changes to the natural flow rate of water runoff; impacts to wildlife patterns.

Identified Impacts for Dam Failure

- Blocked Roads
- Building Collapse
- Business Interruptions
- Delayed Emergency Response
- Downed Power Lines
- Downed Trees
- Evacuation (full)
- Evacuation (localized)
- Increased Fire Potential
- Increased Public Safety Runs
- Loss of Potable Water
- Loss of Medical Facilities
- Loss of Power
- Mass Casualties
- Property Damage
- School Closure
- Explosion
- Flooding (street)
- Flooding (structure)
- HAZMAT Release
- School Closure
- Sewer Backup
- Bridge Collapse

History

Pembina County has not seen severe damage from a dam breach due to the flat nature of the land and the lack of dams retaining vast amounts of water.

However, in May 2013, heavy rainfall coupled with spring melt water raised water levels in retention dams above acceptable levels, threatening the Renwick Dam that was under renovation at the time. Renwick Dam holds back approximately 1,500 acre feet during normal seasonal conditions, but during the heavy rain, its max pool of nearly 12,000 acre feet was topped. In order to protect the aged emergency spillway from catastrophic erosion, a temporary levee was erected. Due to the efforts of local construction crews, the North Dakota National Guard, and state and local officials, the dam was persevered, despite being weakened from construction.

Floods
Location – along rivers and low-lying areas beneath the Pembina Gorge escarpment.
Extent – varying severity, seasonal.
Probability – high probability with low impact. Low probability of severe threat.
History – an annual event of some magnitude, but floods of record are 1197, 2009, 2013, 2015, 2017, 2019, 2020.
Impacts – severe damage to infrastructure and travel.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A

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Likely	C	C	B	A
Possible	D	C	B	B
Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning
Level of Impact	A	A	D	C	A	C	C	D	D	D	D	B	D	D	A	A	A	A

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Rationale

- Infrastructure Systems: erosion of roads and debris left on roadways.
- Critical Transportation: significant detours for road traffic, and some impassible roads, especially detrimental to farmers attempting to reach fields.
- Mass Care Services: emergency housing of displaced individuals.
- Logistics and Supply Chain: disruption of critical goods due to reduced transportation.
- Housing: damage to homes or inaccessibility.
- Environmental Health and Safety: anything in contact with floodwater is considered "contaminated" and must be properly disposed of or cleaned.
- Economic Recovery: often the roads impacted are those leading to fields and farmers are unable to reach their land in time for planting. Additionally, fields may remain too wet to be planted in the first place.
- Planning: significant planning of community groups takes place to discuss action items, resource requests and needs from the county and state.
- Operational Coordination: ensuring resources are utilized to the best of their ability.
- Situational Assessment: a common operating picture among all pertinent parties and continual updates of flood levels and areas in danger.
- Public Information and Warning: continual updates of threatened areas. Specific to recovery, when aid will be available.

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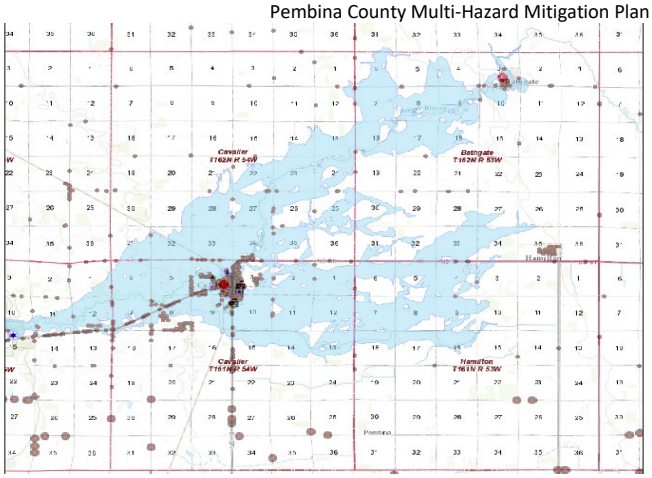
Vulnerabilities

A sudden release from a retention dam at its highest or "emergency" level has the potential to cause widespread property and infrastructure damage and even result in injury or loss of life. Unlike flooding, dam failures generally inundate less land and the land may not be underwater as long. Dam failures are obviously restricted to dam locations which are listed above.

An additional vulnerability exists at Goshke and Renwick dams where recreational actives are undertaken and without a dam to retain water, those opportunities would be lost. Projections on a release have been calculated for Renwick as it has the largest pool and greatest ability for injury and damage.


Cavalier
T162N R 54W
Bathgate
T162N R 53W
Cavalier
T161N R 54W
Hamilton
T161N R 53W
Pembina

Drought

Hazard Description

Drought is a condition of climatic dryness severe enough to reduce soil moisture below the minimum necessary for sustaining plant, animal, and human life systems. Drought characteristics usually include precipitation levels well below normal and temperatures higher than normal. Under these conditions, topsoil crumbles and is lost due to erosion. Streams, ponds, and wells often dry up and water levels in lakes and rivers drastically fall, creating severe strain on vegetation, wildlife, and livestock. Although the agricultural economy may be more negatively impacted, urban economies are also constrained when the amount of domestic and industrial water is in short supply.

Although drought has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity (University of Nebraska, Lincoln, 2014).

Scientifically, drought can mean many things to many people, depending on the discipline and perspective of the individual. Operational definitions are used to help quantify the beginning, end, and degree of severity of a drought. The following definitions were provided by the National Drought Mitigation Center.

> *Meteorological drought* is usually an expression of precipitation's departure from normal over some period of time. These definitions are usually region-specific, and presumably based on a thorough understanding of regional climatology.
>
> *Agricultural drought* occurs when there isn't enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.
>
> *Hydrological drought* refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, this shortage will be reflected in declining surface and subsurface water levels.
>
> *Socioeconomic drought* occurs when physical water shortage starts to affect people, individually and collectively. Or, in more abstract terms, most socioeconomic definitions of drought associate it with the supply and demand of an economic good (University of Nebraska, Lincoln, 2014).

Drought effects regarding 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 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 injury and

death to plants and animals. Stagnant pools along rivers provide favorable habitat for insects, particularly mosquitoes. When normal rain patterns develop, the dry, unstable topsoil becomes vulnerable to gullies and flooding.

A wide range of possible social and economic consequences normally occurs during a prolonged drought. The effects of drought first strike individual farmers and ranchers, who suffer loss of income, increased indebtedness, possible bankruptcy, and dislocation. Regionally, drought can cause increased unemployment, economic disruption, migration intensity, and regional instability. A nation may be affected by increased government payments to the agricultural sector, foreign trade losses, rising prices, food shortages, and health problems. Worldwide effects include severe health problems, disruption of world social systems, international conflict, starvation, and famine.

Effects of drought accumulate slowly but tend to persist over long periods. Determining whether conditions warrant drought status versus an extended dry spell is difficult and experts often disagree. However, a typical drought in North Dakota would most likely begin with limited winter snowfall, deficient 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. Spring planting plans 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 reduced and hydroelectric power production is affected.

Several drought indices are used to measure a drought's severity and any combination of these indices and others may be used to trigger a wide variety of response activities by governments, individuals, and organizations. The following table shows the common indices and their use.

Index	Use
Percent of Normal	The percent of normal is a simple calculation well suited to the needs of television weathercasters and general audiences.
Standardized Precipitation Index (SPI)	The SPI is an index based on the probability of precipitation for any timescale.
Palmer Drought Severity Index (PDSI)	The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions.
Crop Moisture Index (CMI)	A PDSI derivative, the CMI reflects moisture supply in the short-term across major crop-producing regions and is not intended to assess long-term droughts.
Surface Water Supply Index (SWSI)	The SWSI was originally designed to complement the PDSI in the State of Colorado, where mountain snowpack is a key element of water supply. The SWSI is calculated by river basin, based on snowpack, streamflow, precipitation, and reservoir storage. Other states have modified the SWSI for their areas.
Reclamation Drought Index (RDI)	Like the SWSI, the RDI is calculated at the river basin level, incorporating temperatures as well as precipitation, snowpack, streamflow, and reservoir levels as input.
Deciles	Groups monthly precipitation occurrences into deciles so that, by definition, "much lower than normal" weather cannot occur more often than 20% of the time.

FIGURE 15: DROUGHT INDEX

(NORTH DAKOTA STATE CLIMATE OFFICE, 2014)

Identified Impacts for Drought

- Business Interruptions
- Delayed Emergency Response
- Explosion
- Increased Public Safety Runs
- Loss of Potable Water
- Mass Casualties
- Increased Fire Potential
- Property Damage

History

Although there have been several historical instances of drought in Pembina County and in the Midwest, including the Dust Bowl of the 1930's, more recent drought events have put a strain on residents and farmers in the area.

A drought set in on the region in 1988 and its effects, though not as severe, lasted 4 years, putting stress on farmers and ranchers. A 1994 report by the U.S. Geological Survey places 1988 as one of the most severe years in nearly 100 years of record-keeping in the area. The following passage from the article lists challenges faced by Pembina County, and by the state of North Dakota as a whole:

> North Dakota's economy depends on agricultural activities, Federal activities, energy, manufacturing, and tourism, including recreational activities on area rivers and lakes. If precipitation is inadequate, many resources in North Dakota may be adversely affected. Agricultural activities and recreation, in particular, are dependent on timely and sufficient amounts of precipitation. Less-than-normal precipitation can result in low soil-moisture conditions that are detrimental to crop production, pastureland development, and water supplies. Less-than-normal precipitation results in lower lake levels and lower streamflow levels. The lower levels have an effect on the water supplies, recreational activities, and fish and wildlife in North Dakota (U.S. Geological Survey, 1994).

Other notable instances of drought include 2002 where drought caused Pembina County to participate in the $223 million lost statewide due to crop loss, and to the $32 million in livestock lost in 2006 (National Conference of State Legislatures, 2008).

Drought
Location – county-wide, but most affecting agricultural land.
Extent – long-term trends, generally ebbing and flowing severity.
Probability – cyclical.
History – none of note in the past 25 years.
Impacts – severe economical impacts.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected

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Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

Frequency	Severity: *Negligible*	*Limited*	*Critical*	*Catastrophic*
Highly Likely	C	B	A	A
Likely	C	C	B	A
Possible	D	C	B	B
Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Infrastructure Systems	Critical Transportation	Mass Search and Rescue	Mass Care Services	Logistics and Supply Chain	Housing	Environmental Health/Safety	Fatality Management	Public Health, Healthcare	Fire Management	Law Enforcement	Economic Recovery	Health and Social Services	Natural and Cultural Resources	Planning	Operational Coordination	Situational Assessment	Public Info. and Warning
Level of Impact	D	D	D	D	D	D	C	D	D	B	D	A	D	D	D	D	C	C

Rationale

- Environmental Health and Safety: dry conditons can create poor air quality with blowing dust and soil.
- Fire Management: draughts create dry conditions that make wildfires much more likely.
- Economic Recovery: long-lasting draught conditions can severely harm the agricultural economy, forcing farmers out of business entirely in some cases.
- Situational Assessment: awareness of especially dry areas and possible wildfire conditions.
- Public Information and Warning: public information campains to educate resdients to reduce fire risk.

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Vulnerabilities

The immediate threat to life from a drought is lack of clean, readily accessible drinking water. Since the last update of this plan, all of Pembina County has access to clean, potable water provided by a rural water district – Northeast Regional Water. For the purposes of draught and potable water, this vulnerability section is applicable to all communities. Some communities may have additional information.

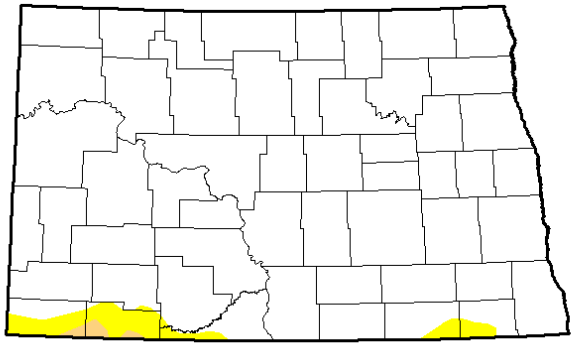
Northeast Regional Water (NRW) draws water out of below ground natural aquafers to be filtered, treated and pumped to Pembina and the surrounding counties. Despite being a single point of failure, NRW provides reliable and clean potable water any time of the year. The system is redundant enough with multiple pumping stations that even in the event of failure of several wells, water can still be provided. However, loss of enough wells, or contamination the water could mean outages county and region-wide.

Additionally - and pertaining specifically to drought - sustained drought conditions could reduce the amount of accessible water in aquafers. The system is resilient thanks to wells over a massive area that would require acute, long-term drought over a large region. To further reduce vulnerability, NRW has negotiated with additional districts in the area that can be tapped into to provide water in the event of emergency. While water use may need to be reduced, live-sustaining amounts may still be accessed.

Cities connected to rural water also have the system tapped into their fire hydrants so water can be provided during those emergencies as well. NRW can “boost” pumps to provide additional pressure to sustain long-lasting fire events.

U.S. Drought Monitor

North Dakota



September 27, 2016

(Released Thursday, Sep. 29, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	96.70	2.90	0.41	0.00	0.00	0.00
Last Week 9/20/2016	92.29	6.34	1.37	0.00	0.00	0.00
3 Months Ago 6/28/2016	82.42	13.97	3.41	0.19	0.00	0.00
Start of Calendar Year 12/29/2015	61.32	33.21	5.47	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.57	20.43	0.00	0.00	0.00	0.00
One Year Ago 9/29/2015	79.57	20.43	0.00	0.00	0.00	0.00

Intensity:

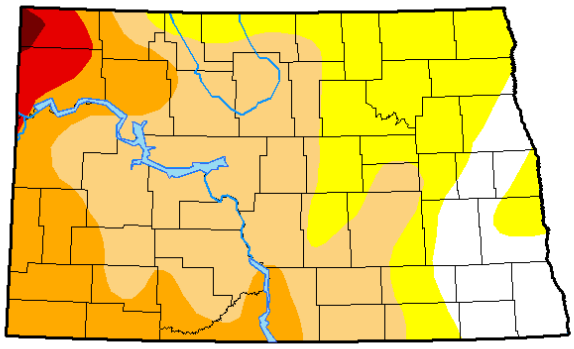
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Chris Fenimore
NCEI/NESDIS/NOAA

U.S. Drought Monitor

North Dakota



September 26, 2017

(Released Thursday, Sep. 28, 2017)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	11.07	26.08	39.36	20.13	2.94	0.41
Last Week 09-19-2017	0.13	12.52	54.48	29.41	3.05	0.41
3 Months Ago 06-27-2017	0.02	33.22	19.86	21.84	25.06	0.00
Start of Calendar Year 01-03-2017	93.87	6.13	0.00	0.00	0.00	0.00
Start of Water Year 09-27-2016	96.70	2.90	0.41	0.00	0.00	0.00
One Year Ago 09-27-2016	96.70	2.90	0.41	0.00	0.00	0.00

Intensity:

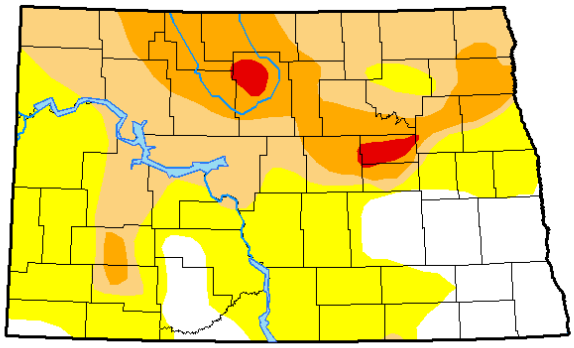
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brad Rippey
U.S. Department of Agriculture

U.S. Drought Monitor

North Dakota



September 25, 2018

(Released Thursday, Sep. 27, 2018)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	16.36	39.26	27.59	15.49	1.29	0.00
Last Week 09-18-2018	16.36	39.46	27.66	15.92	0.60	0.00
3 Months Ago 06-26-2018	39.25	51.69	7.21	1.85	0.00	0.00
Start of Calendar Year 01-02-2018	7.74	31.70	56.09	4.47	0.00	0.00
Start of Water Year 09-26-2017	11.07	26.08	39.36	20.13	2.94	0.41
One Year Ago 09-26-2017	11.07	26.08	39.36	20.13	2.94	0.41

Intensity:

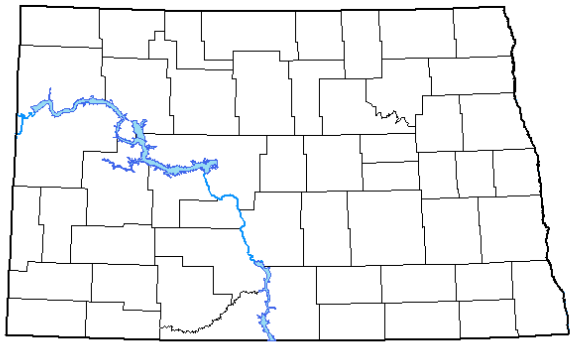
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Jessica Blunden
NCEI/NOAA

U.S. Drought Monitor

North Dakota



September 24, 2019

(Released Thursday, Sep. 26, 2019)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week 09-17-2019	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 06-25-2019	58.32	27.13	10.78	3.77	0.00	0.00
Start of Calendar Year 01-01-2019	66.21	18.31	15.48	0.00	0.00	0.00
Start of Water Year 09-25-2018	16.36	39.26	27.59	15.49	1.29	0.00
One Year Ago 09-25-2018	16.36	39.26	27.59	15.49	1.29	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Eric Luebehusen
U.S. Department of Agriculture

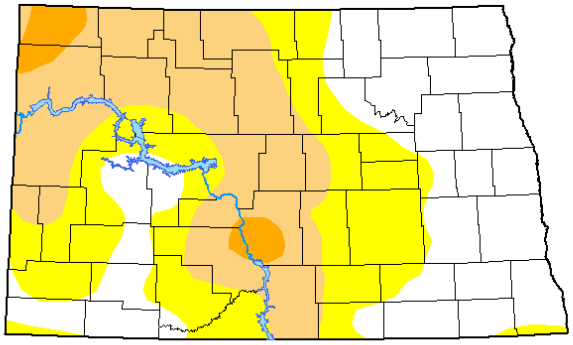
U.S. Drought Monitor

North Dakota

September 15, 2020

(Released Thursday, Sep. 17, 2020)

Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	36.94	29.73	30.32	3.01	0.00	0.00
Last Week *09-08-2020*	38.57	37.33	22.90	1.20	0.00	0.00
3 Months Ago *06-16-2020*	36.81	27.01	36.18	0.00	0.00	0.00
Start of Calendar Year *12-31-2019*	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year *10-01-2019*	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago *09-17-2019*	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

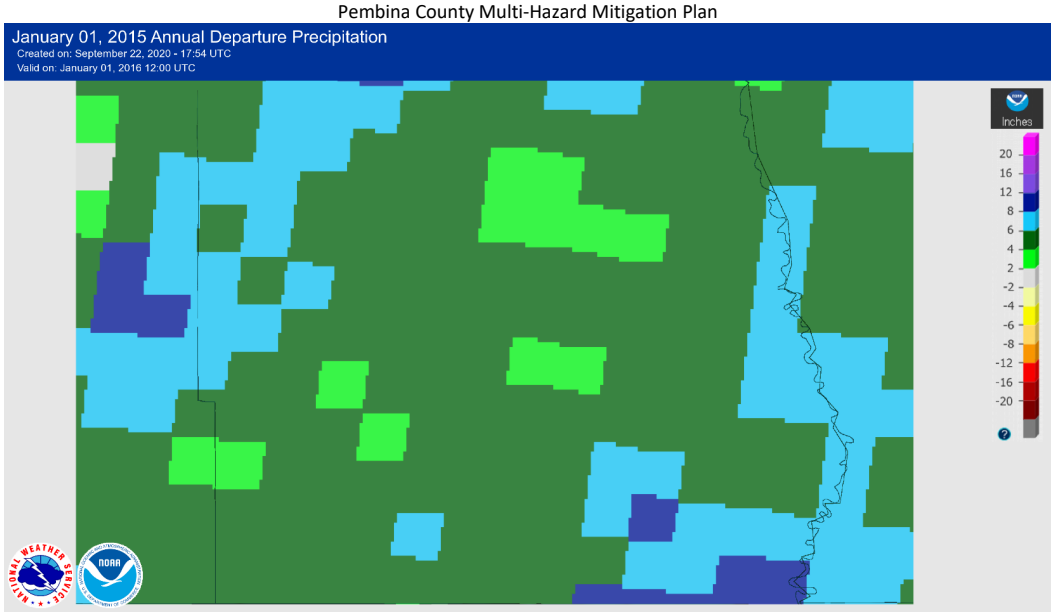
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

Brad Rippey

U.S. Department of Agriculture

Pembina County was briefly in a drought in the past 5 years which was moderate to severe, though very little agricultural losses were reported. Since then, precipitation amounts have returned to normal or slightly above normal, as shown below.


January 01, 2015 Annual Departure Precipitation
Created on: September 22, 2020 - 17:54 UTC
Valid on: January 01, 2016 12:00 UTC
Inches
20
16
12
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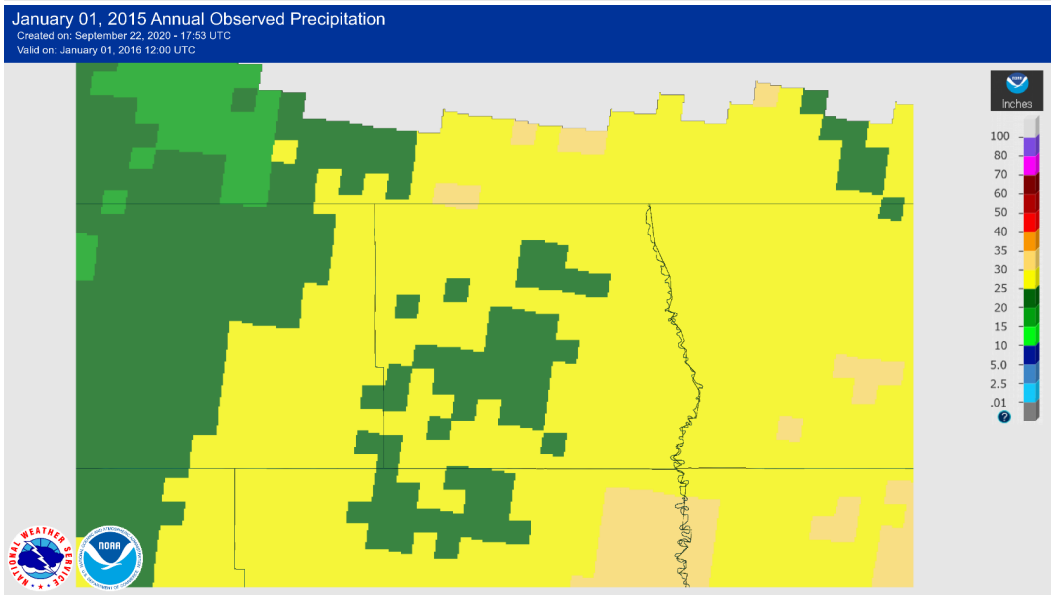
January 01, 2015 Annual Observed Precipitation
Created on: September 22, 2020 - 17:53 UTC
Valid on: January 01, 2016 12:00 UTC
Inches
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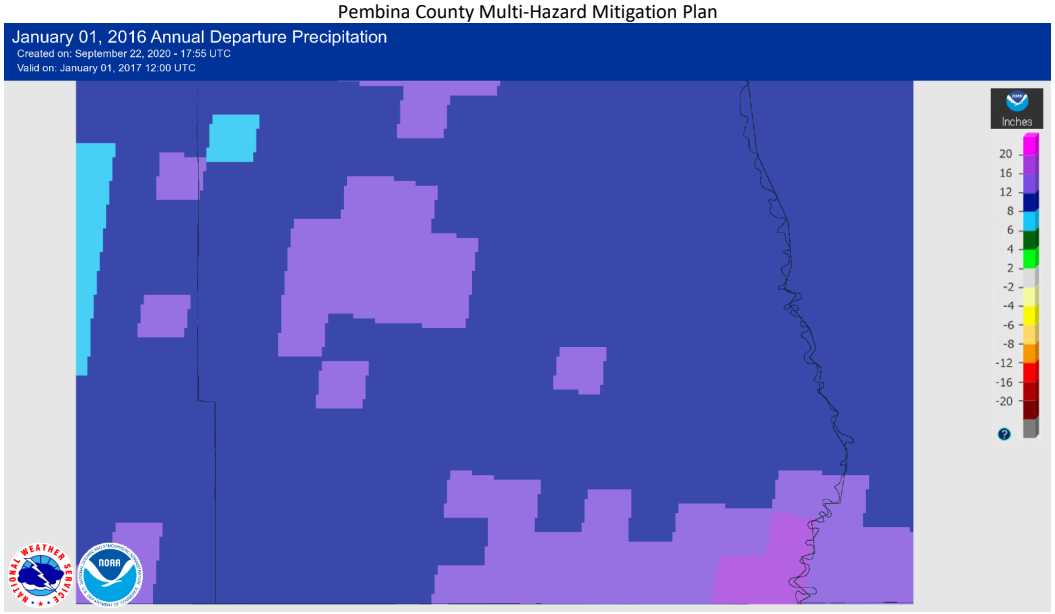
2.5
.01


January 01, 2016 Annual Departure Precipitation
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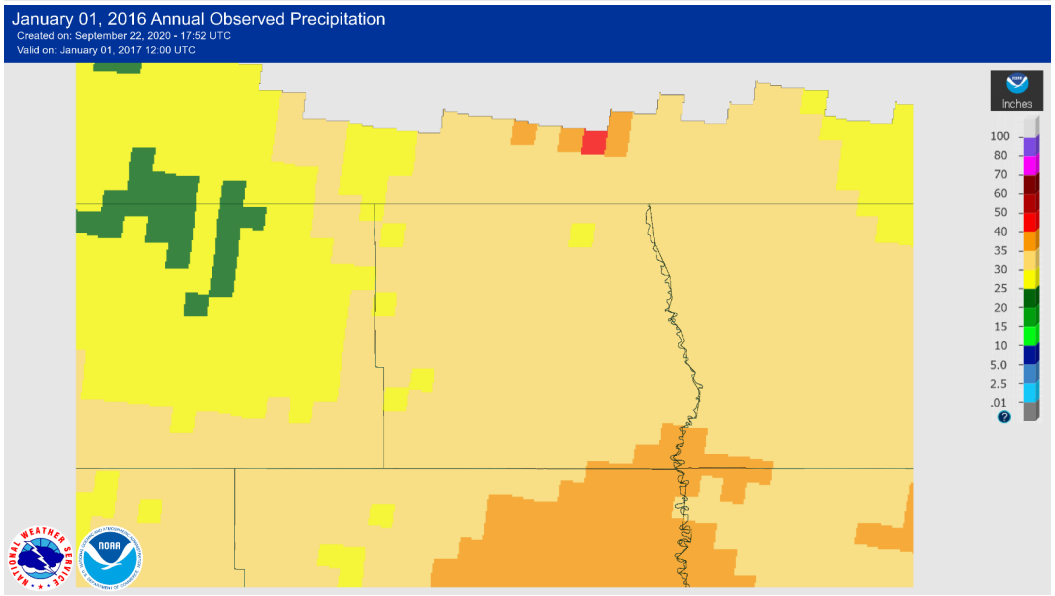
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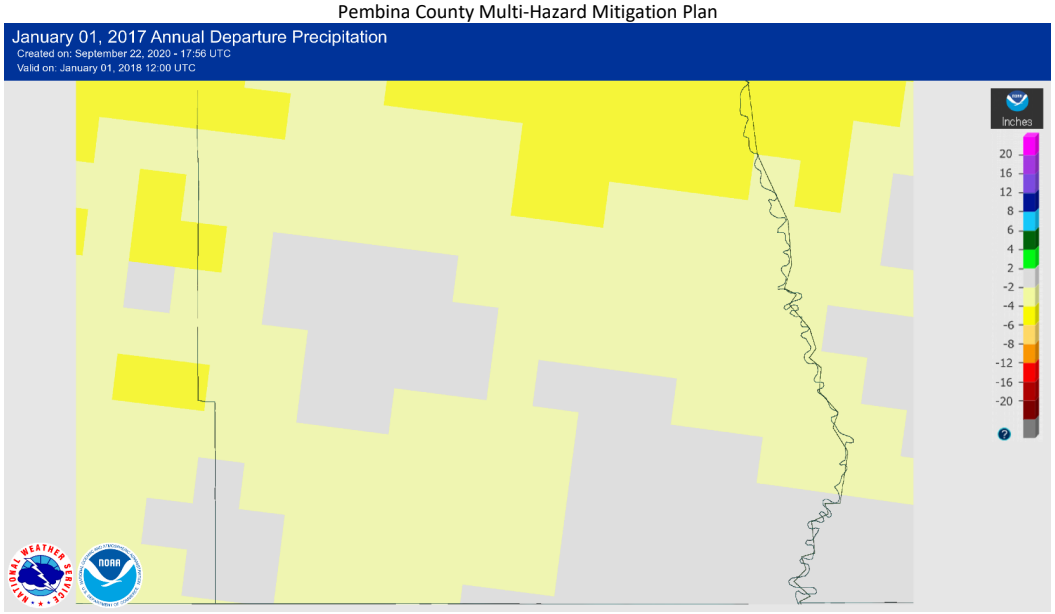
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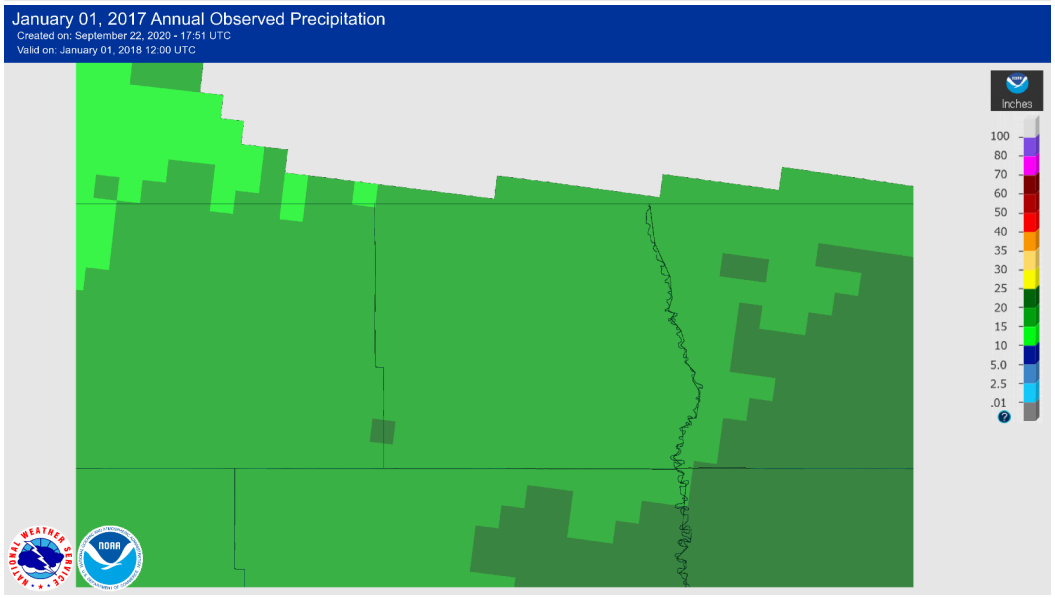
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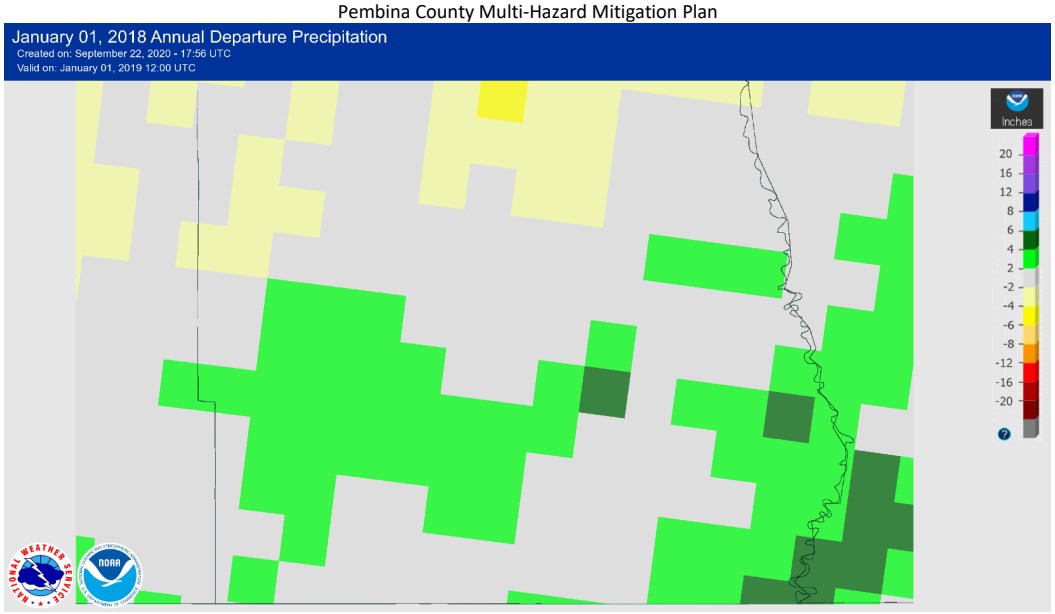
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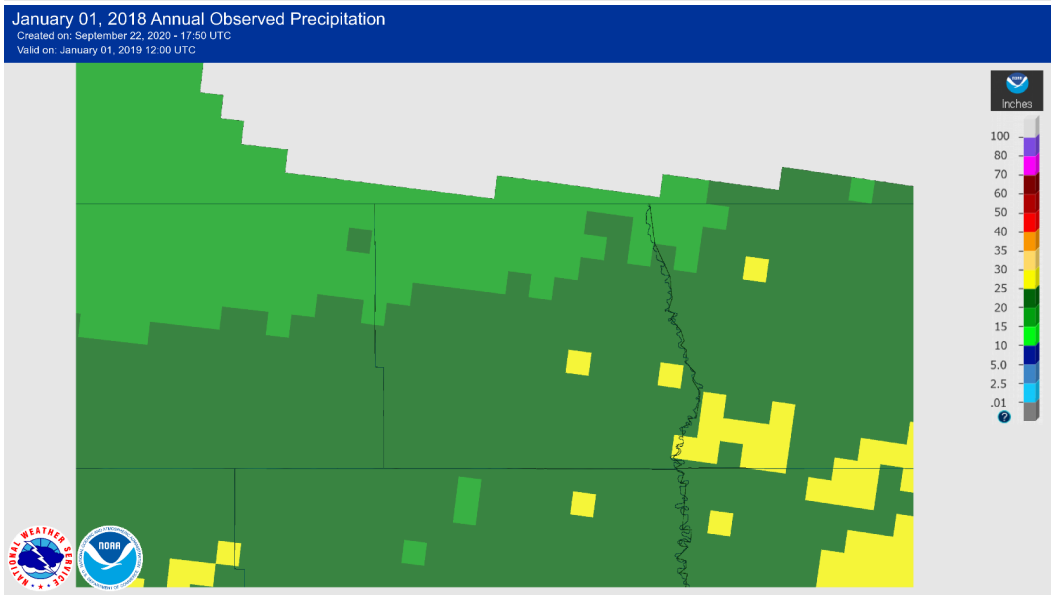
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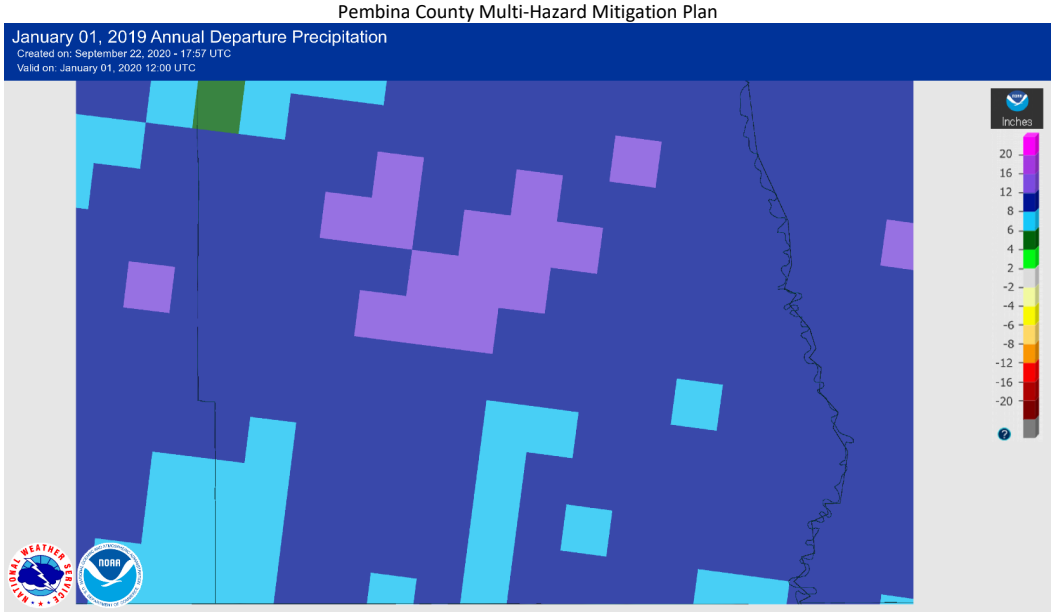
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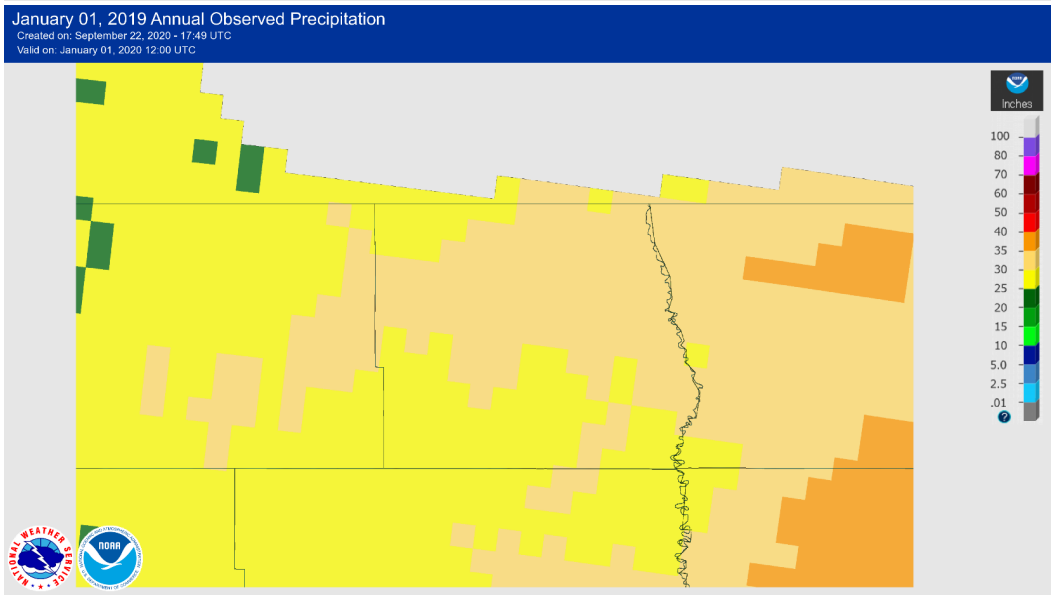
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Flood

Hazard Description

A flood is defined as an overflowing of water onto an area of land that is normally dry. Floods generally occur from natural causes, usually weather-related, such as a sudden snow melt, often in conjunction with a wet or rainy spring or with sudden and very heavy rainfalls. Floods can, however, result from human causes as a dam impoundment bursting. Dam break floods are usually associated with intense rainfall or prolonged flood conditions.

Floods are generally classed as either slow-rise or flash floods. Slow-rise floods may be preceded by a warning time lasting from hours to days, or possibly weeks. Evacuation and sandbagging for a slow rise flood may lessen flood-related damage. Conversely, flash floods are the most difficult for which to prepare due to the extremely short warning time, if there is any at all. Flash flood warnings usually require immediate evacuation.

For floodplain management purposes, the following discussion describes the Federal Emergency Management Agency (FEMA) definition of 100-year flood. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on a map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

Pembina County will continue to comply with the regulations by identifying flood plains on new subdivision proposals and final plans. Building permit requirements mandate Flood Plain permits where identified on the Flood Insurance Rate Maps (FIRM). Sanitation permits also require compliance with the ordinance. As an ongoing program the Pembina County Emergency Manager will educate the community and encourage participation of jurisdictions not participating. A list of previously damaged properties can be found in the appendices.

Riverine Flooding

Riverine flooding originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. The riverine hazard areas may be mapped as part of the National Flood Insurance Program (NFIP). Under this program, an area is broken into zones to depict the level of flood hazard. Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain is that area of the floodplain that has a 1 percent 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 flood conditions during greater magnitude floods, localized events, flash flooding, or along unmapped creeks, streams, and ditches.

Most riverine floods are slow developing events with a natural, predictable source of water or moisture, such as snowmelt, slow rain, or a controlled dam release. This type of flood can often be forecast based on the amount of moisture or water available. The timing and location of flood conditions can often be calculated to a reasonable degree. If implemented in a timely manner, protective measures can sometimes mitigate the potential damage and loss. The State Emergency Operations Center (SEOC) works with the local and tribal jurisdictions to conduct advance planning; staff also issues an Event Specific Operations Plan that outlines areas of responsibility and protocols for coordination as well as guides efforts to preposition resources.

Levee Failure

Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, 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, the environment, and the economy. In 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, such as the 100-year and 500-year flood events. For purposes of this plan, the levee failure hazard will refer to both overtopping and breach of a levee as defined in FEMA's publication — So You Live Behind a Levee‖ (http://content.asce.org/ASCELeveeGuide.html)

- Overtopping: When a Flood Is Too Big—Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.
- Breaching: When a Levee Gives Way—A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Levees are usually engineered to withstand a flood with a computed risk of occurrence. Many flood control dikes and levees in North Dakota have been constructed over the years in attempts to contain floodwaters within the channel and protect development. Some of these structures have not been built to current standards. 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, have not been maintained properly, or other problems may exist. The presence of levees that are not built in accordance with current standards and/or are not intended to protect against larger floods such as the 100-year or 500-year flood can, in some cases, generate a false sense of security.

Closed Basin

Flooding in a closed basin occurs when surface water cannot flow naturally out of the basin as a river does (until a certain elevation is reached), and therefore, during wet periods, normally dry locations can fill in with water. The Devils Lake Basin in North Dakota is a closed basin.

Ice Jams

Flooding can also result from ice jamming or blockage along streams. Ice breaking up into pieces, called floes, moves along with the flowing rivers or streams. The ice floes can jam at curves, narrow places in the channel, structures, river/stream confluences, or where there is a sharp decrease in river bed gradient, creating an effective dam that produces water 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.

Flash Flood

Another source of flooding, called flash flooding, occurs when heavy rain falls in such a short time that the soil cannot absorb it and/or drainage systems (natural or mad made) cannot carry the volume of water away as quickly as it accumulates. Flash flooding also occurs when heavy rain falls over a prolonged period of time and the ground becomes saturated and cannot absorb the additional moisture fast enough.

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. Flash floods can occur anywhere when a large volume of water inundates an area over a short time period. 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. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep, can lift people off their feet, and only a depth of a foot or two, is needed to sweep cars away. Most flood deaths result from flash floods.

Urban flooding is a type of flash flooding that is the result of development and the ground‘s decreased ability to absorb excess water without adequate drainage systems in place. Typically, this type of flooding occurs when land uses change from fields or woodlands to roads and parking lots. According to the National Oceanic and Atmospheric Administration, urbanization increases runoff two to six times more than natural terrain. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

Groundwater levels fluctuate from season to season and from year to year. Excessive groundwater may flood basements and crawlspaces but never reach the Earth‘s surface. Often this type of flooding occurs during or following periods of heavy rainfall or snowmelt.

Hundreds of significant floods occur in the United States each year and kill an average of 93 people annually. Most injuries and deaths occur when people are swept away by flood currents, and most property damage results from inundation by sediment-laden water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can also cause extensive damage.

A tremendous amount of soil erosion takes place by water movement and its pressures on land surfaces. Runoff from the eroded areas is swift, thus contributing to flood magnitude. Additionally, when the flood-flow slackens, the suspended materials will settle to the bottom of the channel, reducing the space that was previously available to keep the river within its banks. This sedimentation increases flood potential.

Excessive rainfall and heavy snows associated with riverine, closed basin, flash, ice jam, and groundwater flooding can be related to other hazards. Landslides and mudslides are often attributed to saturated soils and flooding. During the summer, severe thunderstorms can bring heavy rain along with the wind, hail, and tornadoes.

The National Weather Service issues flood warnings, watches and advisories when flood conditions are forecast.

- Advanced Hydrologic Prediction Services (AHPS) Long Range Probabilistic Outlook: The outlook shows the probability of a river rising above and falling below various stages over the next ninety days. The probabilities are called “exceedance” and “non-exceedance” probabilities, respectively.
- Spring Flood and Water Resources Outlook: Issued each spring, the spring flood and water resources outlook outlines the potential for snowmelt and spring flooding.
- Significant River Flood Outlook: The flood outlook provides a general assessment of the potential significant river flooding over the next five days.

- Flood Watch: Flood watches inform the public of conditions which may cause flooding within the next thirty-six hours, but the flooding is neither certain now imminent. Flood watches are also issued for potential dam failure.
- Flood Warning: Flood warnings are issued when flooding is expected to occur more than six hours after the causative event (i.e. heavy precipitation, snow melt, ice jams. Or reservoir releases).
- Flash Flood Warning: Flash flood warnings are issued when flooding is imminent during short term events requiring immediate action. Flash flooding occurs when the water level rises rapidly to inundation within six hours of a causative event (i.e. heavy precipitation, snow melt, dam failure, or ice jams).
- Urban and Small Stream Flood Advisory: Small stream flood advisories are issued when flooding of small streams, streets, and low-lying areas is occurring or imminent. (National Weather Service, 2014).

Flooding, as a natural hazard, has been a part of the county's conflict with nature throughout history. High runoff produced by excessive rainfall and/or sudden spring thaws after periods of heavy snowfall will cause a river or other bodies of water to overflow and inundate areas, causing or threatening damage. The loss of life and severe damages may result when floodwaters strike cities, industries, and farms located in or near river valleys. Usually the damaged area is in a floodplain, which is a strip of relatively level land bordering a stream. The spring flood danger period generally occurs during March and April. A wet fall, early freeze up with saturated ground at the time of freezing, heavy winter precipitation, and warm rains during and after spring thaw add to the seriousness of the spring flooding situation.

Identified Impacts for Flooding

- Blocked Roads
- Building Collapse
- Business Interruptions
- Delayed Emergency Response
- Downed Power Lines
- Downed Trees
- Evacuation (localized)
- HAZMAT Release
- Increased Fire Potential
- Increased Public Safety Runs
- Loss of Potable Water
- Loss of Medical Facilities
- Loss of Power
- Mass Casualties
- Explosion
- Flooding (street)
- Flooding (structure)
- Property Damage
- School Closure
- Sewer Backup

History

Pembina County has a long history of flood events. Traditionally, flooding takes place along the eastern border of the county on the Red River, due to the unusual nature of the river. The Red River is one of only a few rivers in North America that flow north, and because the downstream portion of the river remains frozen longer, water is unable to flow and breaks out of the river's banks.

In recent years, there has been increased risk of overland flooding from smaller tributaries of the Red River- the Pembina River, the Tongue River, and the Park River. Increased ditching and the practice of installing drain tile in fields has increased the flow of water rushing towards the low ground to the east. Water breaking the banks of these rivers have a tendency to wash topsoil from fields and damage county roads.

Flooding **Incident period: April 1, 2020 to April 25, 2020**	(DR-4553) Major Disaster Declaration on July 9, 2020
Flooding **Incident period: March 21, 2019 to April 28, 2019**	(DR-4444) Major Disaster Declaration on June 12, 2019
Flooding **Incident period: March 23, 2017 to April 29, 2017**	(DR-4323) Major Disaster Declaration on July 12, 2017
Severe Storms and Flooding **Incident period: May 17, 2013 to June 16, 2013**	(DR-4128) Major Disaster Declaration on July 12, 2013

Flooding **Incident period: April 22, 2013 to May 16, 2013**	(DR-4118) Major Disaster Declaration on May 29, 2013
Flooding **Incident period: April 22, 2013 to May 7, 2013**	(EM-3364) Emergency Declaration on April 26, 2013
Flooding **Incident period: February 14, 2011 to July 20, 2011**	(DR-1981) Major Disaster Declaration on May 10, 2011
Flooding **Incident period: April 5, 2011 to July 1, 2011**	(EM-3318) Emergency Declaration on April 7, 2011
Flooding **Incident period: February 26, 2010 to July 15, 2010**	(DR-1907) Major Disaster Declaration on April 30, 2010
Flooding **Incident period: February 26, 2010 to April 30, 2010**	(EM-3309) Emergency Declaration on March 14, 2010
Severe Storms and Flooding **Incident period: March 13, 2009 to August 10, 2009**	(DR-1829) Major Disaster Declaration on March 24, 2009
Severe Storms and Flooding **Incident period: June 2, 2007 to June 18, 2007**	(DR-1713) Major Disaster Declaration on July 17, 2007
Severe Storms, Flooding, and Ground Saturation **Incident period: March 30, 2006 to April 30, 2006**	(DR-1645) Major Disaster Declaration on June 5, 2006
Severe Storms, Flooding, and Ground Saturation **Incident period: June 1, 2005 to July 7, 2005**	(DR-1597) Major Disaster Declaration on July 22, 2005
Severe Storms, Flooding, and Ground Saturation **Incident period: March 26, 2004 to June 14, 2004**	(DR-1515) Major Disaster Declaration on May 5, 2004
Severe Storms, Tornadoes and Flooding **Incident period: June 8, 2002 to August 11, 2002**	(DR-1431) Major Disaster Declaration on September 10, 2002
Floods **Incident period: March 1, 2001 to August 9, 2001**	(DR-1376) Major Disaster Declaration on May 28, 2001
Severe Storms And Flooding **Incident period: April 5, 2000 to August 12, 2000**	(DR-1334) Major Disaster Declaration on June 27, 2000
Severe Storms, Tornadoes, Snow and Ice, Flooding, Ground Saturation, Landslides and Mudslides **Incident period: March 1, 1999 to July 19, 1999**	(DR-1279) Major Disaster Declaration on June 8, 1999
Flooding and Ground Saturation **Incident period: March 2, 1998 to July 18, 1998**	(DR-1220) Major Disaster Declaration on June 15, 1998
Severe Storms/Flooding **Incident period: February 28, 1997 to May 24, 1997**	(DR-1174) Major Disaster Declaration on April 7, 1997
Flooding **Incident period: March 12, 1996 to June 21, 1996**	(DR-1118) Major Disaster Declaration on June 5, 1996
Severe Storms, Flooding, Ground Saturation **Incident period: March 1, 1995 to July 5, 1995**	(DR-1050) Major Disaster Declaration on May 16, 1995
Severe Storm, Flooding **Incident period: March 5, 1994 to August 5, 1994**	(DR-1032) Major Disaster Declaration on July 1, 1994
Flooding, Severe Storms **Incident period: June 22, 1993 to September 24, 1993**	(DR-1001) Major Disaster Declaration on July 26, 1993
Flooding **Incident period: March 29, 1989 to May 8, 1989**	(DR-825) Major Disaster Declaration on May 8, 1989
Flooding **May 11, 1982**	(DR-658) Major Disaster Declaration on May 11, 1982
Storms, Snowmelt, Flooding	(DR-581)

April 26, 1979	Major Disaster Declaration on April 26, 1979
Storms, Ice Jams, Snowmelt, Flooding **April 17, 1978**	(DR-554) Major Disaster Declaration on April 17, 1978
Flooding **April 16, 1976**	(DR-501) Major Disaster Declaration on April 16, 1976
Severe Flooding **April 13, 1976**	(EM-3012) Emergency Declaration on April 13, 1976
Severe Storms, Flooding **July 11, 1975**	(DR-475) Major Disaster Declaration on July 11, 1975
Flooding from Rains, Snowmelt **May 24, 1975**	(DR-469) Major Disaster Declaration on May 24, 1975
Heavy Rains, Snowmelt, Flooding **May 14, 1974**	(DR-434) Major Disaster Declaration on May 14, 1974
Severe Storms, Flooding **June 10, 1972**	(DR-335) Major Disaster Declaration on June 10, 1972
Flooding **April 18, 1969**	(DR-256) Major Disaster Declaration on April 18, 1969
Severe Storms, Flooding **July 9, 1966**	(DR-220) Major Disaster Declaration on July 9, 1966
Flooding **March 23, 1966**	(DR-216) Major Disaster Declaration on March 23, 1966
Flooding **May 10, 1965**	(DR-195) Major Disaster Declaration on May 10, 1965

Risk Matrix

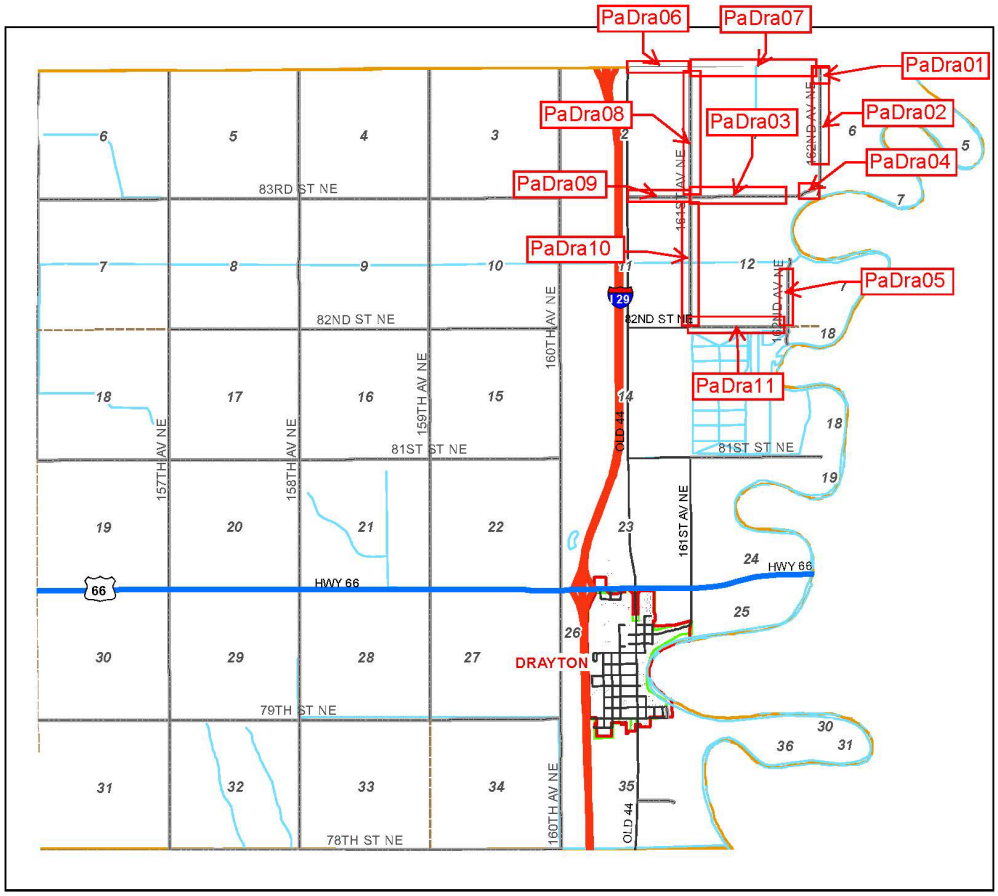
See above under “Dam Failure”.

sVulnerabilities

Pembina County is most susceptible to flooding especially along rivers, however floodwaters can expand for miles away from the river itself. Flash flooding is generally considered unlikely and damaged is generally caused by water from snowmelt. Most damage is accrued by the significant amount of time water lingers due to poor drainage.

These lingering effects of extended periods of inundated lands prevents any use of the land by farmers, hunters or hunters. The exclusion from land generally has no lasting effects, but denial of property can be detrimental to businesses.

Floodwaters have the more direct effect of causing costly damage to roads and other infrastructure. For instance, in 2020, flood waters along the Red River caused an estimated $200,000 in Pembina County alone. As floods have been growing in frequency, townships and landowners will need to make the difficult decision to relocate residents and/or decommission township roads, reducing transportation options in the area. Damage sites for 2020 are mapped below.



DRAYTON TOWNSHIP

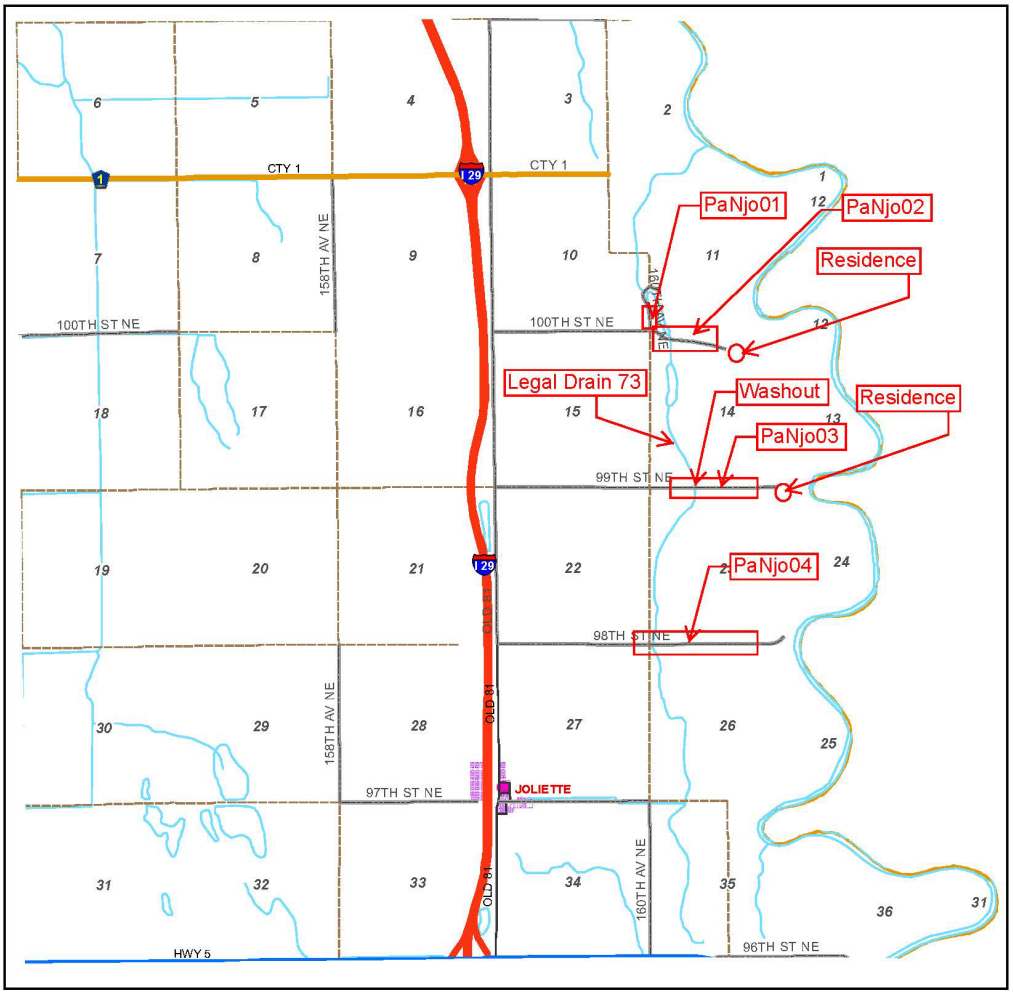
DRAYTON
159-50-51

Pembina County

N

Interstate
Highway
County
Asphalt
Gravel
Dirt

Prepared by
Pembina County
911/IT/GIS Department
May 2016



Pembina County

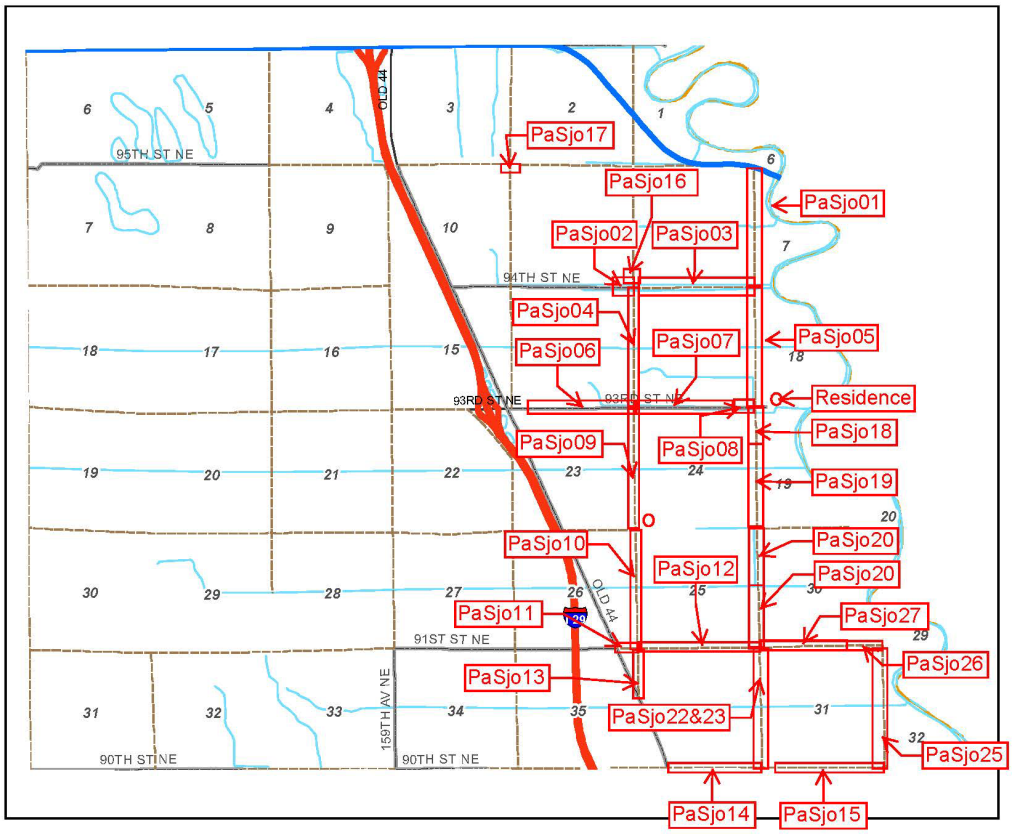
N

Interstate
Highway
County
Asphalt
Gravel
Dirt

JOLIETTE N. TOWNSHIP

JOLIETTE N.
162-50-51

Prepared by
Pembina County
911/IT/GIS Department
May 2016



JOLIETTE S. TOWNSHIP

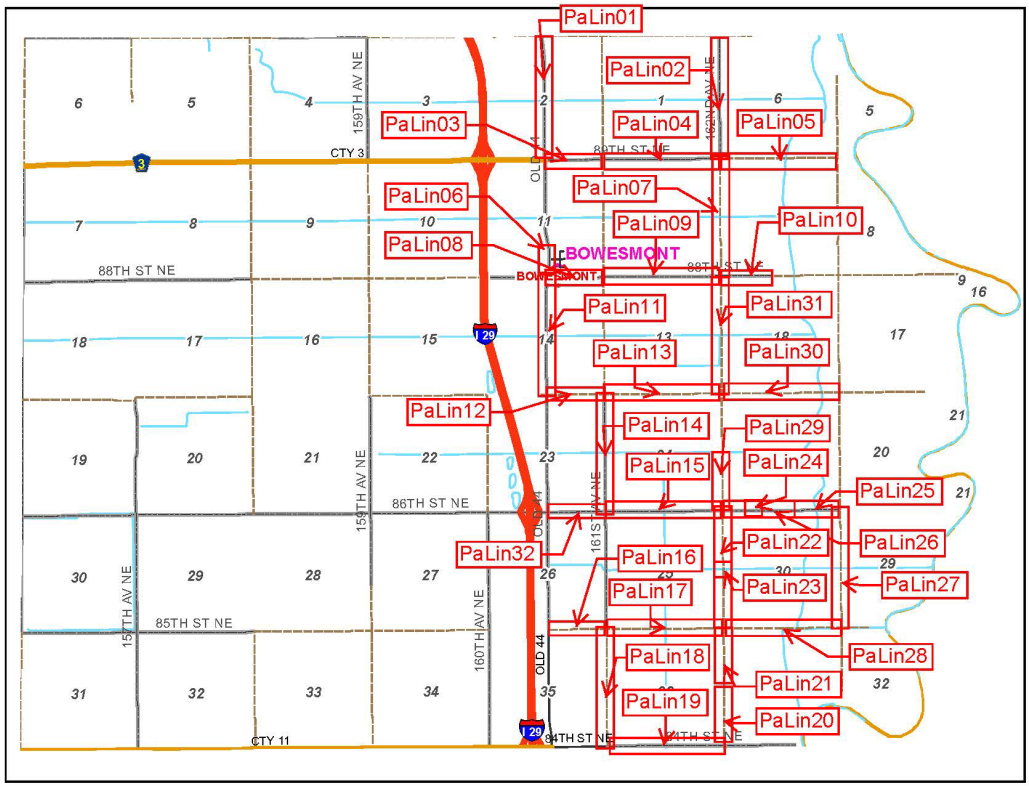
JOLIETTE S.
161-50-51

Pembina County

N

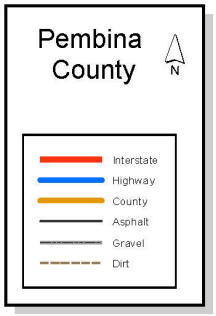
- Interstate
- Highway
- County
- Asphalt
- Gravel
- Dirt

Prepared by
Pembina County
911/IT/GIS Department
May 2016



LINCOLN TOWNSHIP

LINCOLN
160-50-51



Prepared by
Pembina County
911/IT/GIS Department
May 2016

Homeland Security Incident

Hazard Description

A homeland security incident is any intentional human-caused incident, domestic or international, that causes mass casualties, large economic losses, or widespread panic in the country. Terrorism and civil unrest are examples of human caused hazards that are intentional and often planned. Terrorism, both domestic and international, is a violent act done to try and influence government or the population of some political or social objective. Terrorist acts can come in many recognized forms or may be more subtle using untraditional methods. The primary recognized forms of terrorism are chemical, explosive, biological, radiological/nuclear, and cyber; however, terrorism's only limitation is the human imagination.

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population or animals, destroy crops or natural resources, or deny access to certain areas. Chemical agents can be broken into five different categories: nerve agents, vesicants, cyanides, pulmonary agents, and incapacitating agents. Known nerve agents include tabun, sarin, soman, GF, and VX and can cause a variety of conditions affecting the central nervous system either through vapor or liquid form. Vesicants cause blisters on the skin and can damage eyes, airways, and other tissues and organs. Vesicant agents include sulfur mustard, Lewisite, and phosgene oxime. Cyanides can be in solid salt or volatile liquid format, or when combined with acid, a vapor or gas. Their absorption can cause everything from nausea to death, depending on the amount absorbed. Pulmonary agents such as phosgene and perfluroroisobutylene cause pulmonary edema usually hours after exposure. Incapacitating agents produce reversible disturbances within the central nervous system and cognitive abilities and include the agent BZ (Sidell, 1996).

Terrorism using **explosive and incendiary devices** includes bombs and any other technique that creates an explosive, destructive effect. Bombs can take many forms from a car bomb to a mail bomb. They can be remotely detonated using a variety of devices or directly detonated in the case of a suicide bomb.

Bioterrorism is the use of biological agents, such as Anthrax, Ricin, and Smallpox, to infect the population, plants, or animals with disease. The impacts of bioterrorism could be similar to those discussed in the Communicable Disease Hazard Profile, with the primary exception that the infection of the population was intentionally caused.

Radiological/nuclear terrorism involves the use of radiological dispersal devices, nuclear weapons, or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a "dirty bomb" to attack the population. A "dirty bomb" is a low-tech, easily assembled and transported device made up of simple explosives combined with a suitable radioactive agent. As with chemical and biological events, radiological incidents present contamination challenges for first responders

Cyberterrorism is the attack or hijack of the information technology infrastructure that is critical to the US economy through financial networks, government systems, mass media, or other systems. Any cyber-attack that creates national unrest or instability would be considered cyberterrorism.

Civil unrest and violence incidents typically occur on a smaller scale than terrorism when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Violence can be small scale, such as domestic violence, or larger and require significant government response, as is profiled in this plan.

Most times, homeland security incidents, both domestic and international, are driven by a terrorist group or hate organization. Occasionally, individuals, as was the case in the Oklahoma City bombing, perform independent acts. Usually, the perpetrators have an underlying belief that drives the act. Some of the types of groups include the following:

- Anarchist Extremists: Groups or individuals who facilitate or engage in acts of violence as a means of changing the government and society in support of the belief that all forms of capitalism and corporate globalization should be opposed and that governing institutions are unnecessary and harmful to society.
- Animal Rights Extremists: Groups or individuals who facilitate or engage in acts of violence directed against people, businesses, or governmental entities perceived to be exploiting or abusing animals.
- Black Supremacist Extremists: Groups or individuals who facilitate or engage in acts of violence as a means to oppose racial integration and/or to eliminate non-black people and Jewish people.
- Domestic Terrorists: Groups or individuals who commit an act of violence that is dangerous to human life or potentially destructive of critical infrastructure or key resources. These groups or individuals are based and operating entirely within the United States or its territories without direction or inspiration from a foreign terrorist group. The act of domestic terrorism is a violation of the criminal laws of the United States or of any state or other subdivision of the United States and appears to be intended to intimidate or coerce a civilian populations, to influence the policy of a government by intimidation or coercions, or to affect the conduct of a government by mass destruction, assassination, or kidnapping. A domestic terrorist differs from a homegrown violent extremist in that the former is not inspired by and does not take direction from a foreign terrorist group or other foreign power.
- Environmental Rights Extremists: Groups or individuals who facilitate or engage in acts of violence against people, businesses, or government entities perceived to be destroying, degrading, or exploiting the natural environment.
- Homegrown Violent Extremist (HVE): A homegrown violent extremist (HVE) is a person of any citizenship who has lived and/or operated primarily in the United States or its territories who advocates, is engaged in, or is preparing to engage in ideologically-motivated terrorist activities (including providing support to terrorism) in furtherance of political or social objectives promoted by a foreign terrorist organization, but is acting independently of direction by a foreign terrorist organization. HVEs are distinct from traditional domestic terrorists who engage in unlawful acts of violence to intimidate civilian populations or attempt to influence domestic policy without direction from or influence from a foreign actor.
- Lone Offender: An individual motivated by one or more violent extremist ideologies who, operating alone, supports or engages in acts of violence in furtherance of that ideology or ideologies that may involve influence from a larger terrorist organization or a foreign actor.
- Militia Extremists: Groups or individuals who facilitate or engage is acts of violence directed at federal, state, or local government officials or infrastructure in response to their belief that the government deliberately is stripping Americans of their freedoms and is attempting to established a totalitarian regime. These individuals consequently oppose many federal and state authorities' laws and regulations, (particularly those related to firearms ownership), and often belong to armed paramilitary groups. They often conduct paramilitary training designed to violently resist perceived government oppression or to violently overthrow the US Government.
- Sovereign Citizen Extremists: Groups or individuals who facilitate or engage in acts of violence directed at public officials, financial institutions, and government facilities in support of their belief that the legitimacy of US citizenship should be rejected; who believe that all forms of established government, authority, and institutions are illegitimate and that they are immune from federal, state and local laws.
- Terrorism: Any activity that involves an act that is dangerous to human life or potentially destructive to critical infrastructure or key resources, and is a violation of the criminal laws of the United States or of any state or other subdivision of the United States and appears to be intended to intimidate or coerce a civilian population to influence the policy of a government by intimidation or coercion, or to affect the conduct of a government by mass destruction, assassination, or kidnapping.
- White Supremacist Extremists: Groups or individuals who facilitate or engage in acts of violence directed at the federal government, ethnic minorities, or Jewish persons in support of their belief that Caucasians are intellectually and morally superior to other races and their perception that the government is controlled by Jewish persons.

When notified by a government official, the National Weather Service has the ability to send alert messages through the Emergency Alert System and over NOAA Weather Radio. Examples include the following:

- Local Area Emergency Message: This message defines an event that by itself does not pose a significant threat to public safety and/or property, but the event could escalate, contribute to other more serious events, or disrupt critical public safety services. Instructions, other than public protective actions, may be provided by authorized officials. Examples of

when this message may be used include: utility disruptions, road closures, or a potential terrorist threat where the public is asked to remain alert.

- Civil Emergency Message: This message outlines a significant threat or threats to public safety and/or property that is imminent or in progress. The hazard is usually less specific or severe than those requiring a Civil Danger Warning.
- Law Enforcement Warning: This warning is issued for a bomb explosion, riot, or other criminal event. An authorized law enforcement agency may block roads, waterways, or facilities, evacuate or deny access to affected areas, and arrest violators or suspicious persons.
- Radiological Hazard Warning: This warning warns of the loss, discovery, or release of a radiological hazard such as the theft of a radiological isotope used for medical, seismic, or other purposes, discovery of radioactive materials, or a transportation accident involving nuclear weapons, nuclear fuel, or radioactive wastes. Authorized officials may recommend protective actions be taken if a radioactive hazard is discovered.
- Civil Danger Warning: This warning is issued when an event presents a danger to a significant civilian population. The message usually warns of a specific hazard and outlines specific protective actions such as evacuation or shelter in place.
- Shelter In Place Warning: This warning is issued when the public is recommended to shelter in place (go inside, close doors and windows, turn off air conditioning or heating systems, and turn on the radio or TV for more information). Examples include hazardous material releases or radioactive fallout (National Weather Service, 2011).

Risk Assessment

One of the special considerations in dealing with the terrorist threat is that it is difficult to predict. Because all terrorists are not the same, the calculation is even more difficult. Two things are clear from the perspective of hazard mitigation: the most often used weapon of terrorists is bombs and the greatest potential for loss is from WMDs.

A National Security Emergency is any occurrence that seriously degrades or severely threatens the National Security of the United States.

To reduce the risk of incident within each jurisdiction and the county will monitor the access of new critical facilities and infrastructure information through the Emergency Management Coordinator. This information is available on a need-to-know basis by application to the appropriate person(s) in the OES. Maps provided are updated through November 2008 any new information will be considered potentially sensitive in nature.

Threats

Our country's national security may be impacted by the following:

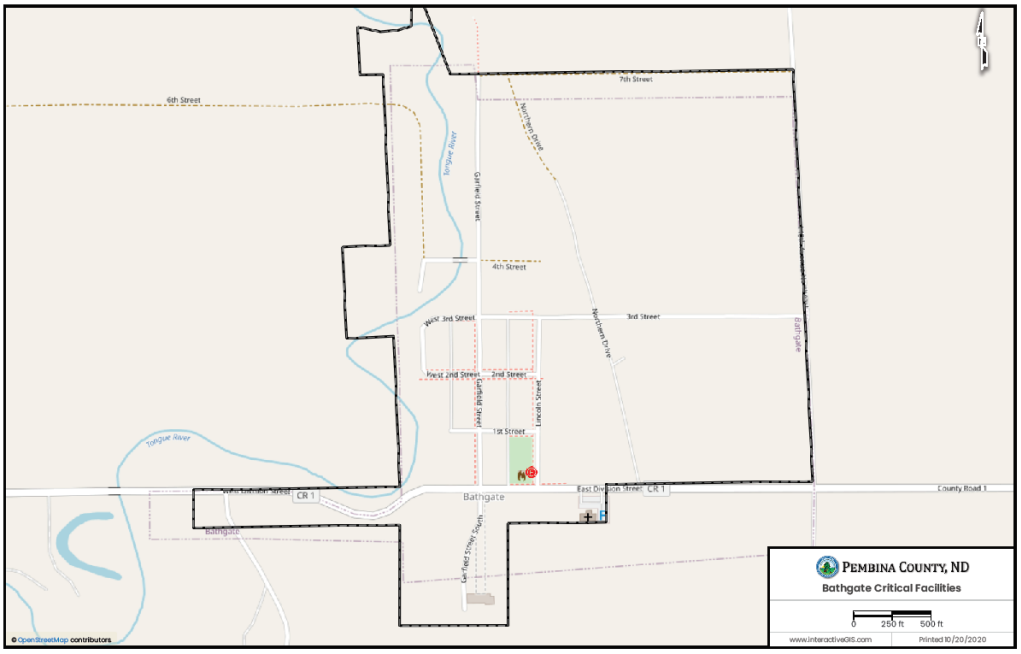
- Revolutionary changes in Eastern Europe;
- Instability and uncertainty within the Commonwealth of Independent States (former Soviet Union);
- Unrest in the Middle East;
- Proliferation of nuclear, biological, chemical, and conventional weapons, especially among third world nations;
- Terrorism;
- Drug Cartels;
- Antifa violent protests and counter protests;
- Political unrest.

Identified Impacts for Homeland Security Incidents

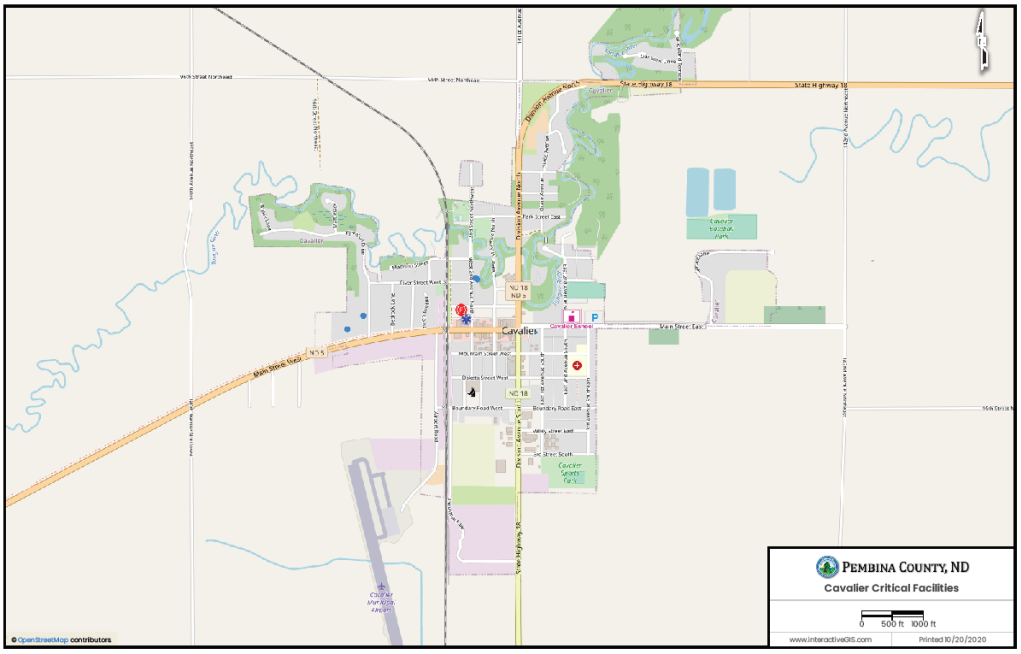
- Blocked Roads
- Building Collapse
- Business Interruptions
- HAZMAT Release
- Increased Fire Potential
- Increased Public Safety Runs
- Explosion
- Flooding (street)
- Flooding (structure)

- Delayed Emergency Response
- Downed Power Lines
- Downed Trees
- Evacuation (localized)
- Loss of Potable Water
- Loss of Medical Facilities
- Loss of Power
- Mass Casualties
- Property Damage
- School Closure
- Sewer Backup

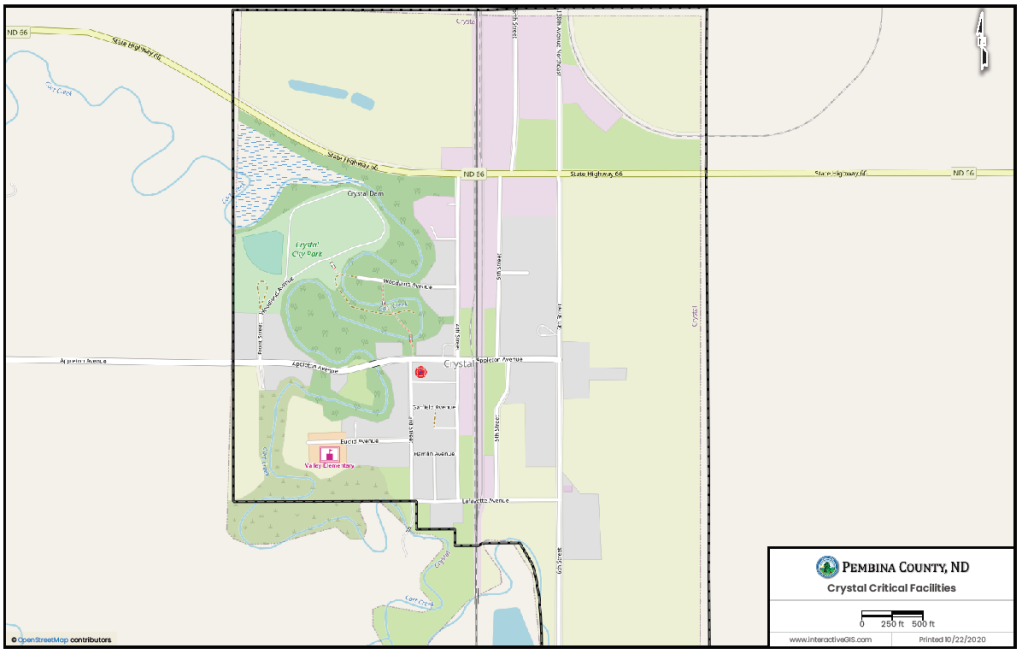
	Pembina Border Station	Neche Border Station	Walhalla Border Station	I-29	Courthouse	US Customs Office	Postal Service Office	Law Enforcement Building	Social Service Office	Hospital	Nursing Home – Cavalier	Nursing Home – Walhalla	Nursing Home – Mountain	Elevators / Grain	Public Schools
Easy Public Access	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Minimal Security				X	X		X		X	X	X	X	X	X	X
Large groups of people	X			X											X
Central Receiving					X	X	X								
Multilevel Building					X	X		X		X					X
Restricted Exits	X	X	X		X	X		X	X	X	X	X	X		X
Inadequate or Minimal HVAC System					X		X	X							
Easy Access to HVAC System or Inlets					X		X								
Visibility of Attack Results (Photogenic Target)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
On-Site Storage of Infectious Material										X					
Major Chemical Facilities Nearby											X				
Hazardous Materials Transportation Routes Nearby	X	X	X	X			X				X				
Predictable Staging Area for Responders	X	X	X			X	X								
Easy Escape via Major Rapid Transportation Routes	X	X	X							X					
History of Threats	X	X	X		X			X							
Politically Sensitive	X	X	X					X						X	
Controversial														X	
Regular/Predictable Events/Schedule	X	X	X		X	X	X	X	X	X	X	X	X	X	X



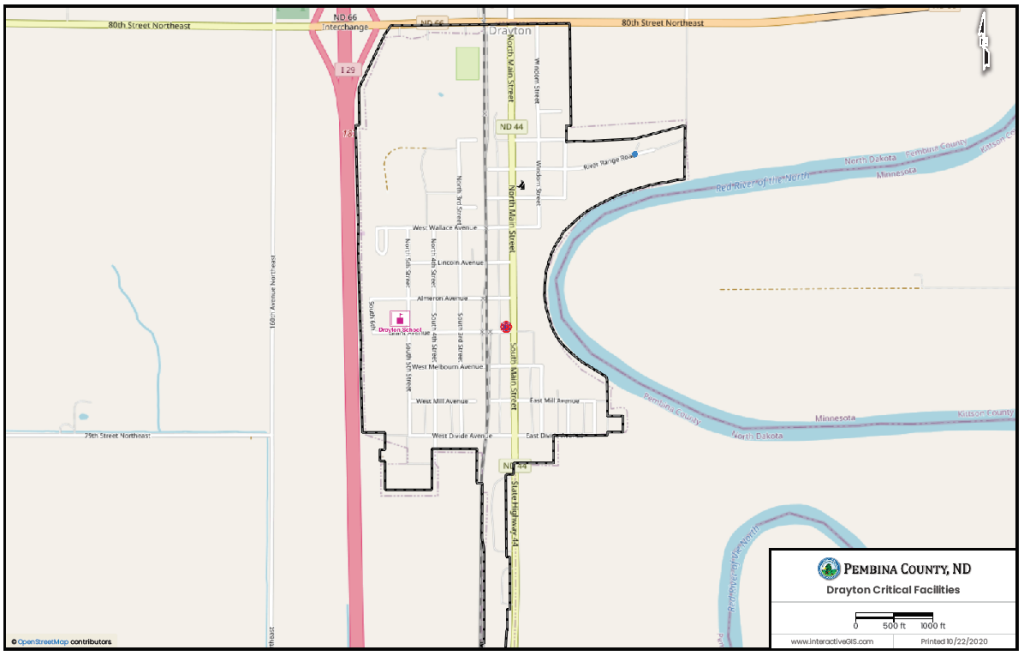
CRITICAL FACILITIES	ADDRESS	CATEGORY
Bathgate Fire Hall	12 Lincoln St	Fire Hall



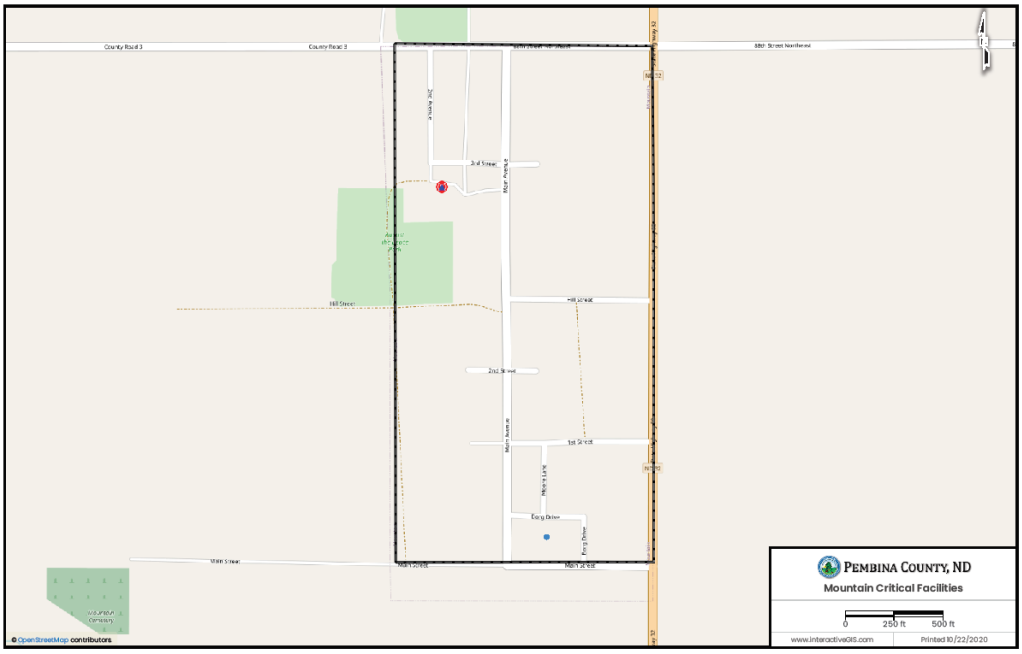
CRITICAL FACILITIES	ADDRESS	CATEGORY
County Jail	308 Court House Dr	County Jail
Law Enforcement Center/EOC	308 Court House Dr	Government
ND National Guard/City Auditorium	107 Main St E	Government
Pembina County Memorial Hospital	301 Mountain St E	Hospital
Country Estates	107 Bjornson Dr	Nursing Home
Wedgewood Manor Nursing Home	804 Main Street	Nursing Home
Cavalier Public School	300 East Main Street	Public School
Cavalier Utilities	300 W 2nd Ave N	Water Treatment
Minnkota Power	300 W 2nd Ave N	Electrical Supply
Cavalier Fire Department	305 Elizabeth St	Fire Hall
Cavalier Ambulance	105 W 2nd Ave	Ambulance Hall
Cavalier Police Department	310 Division Ave N	Police Station



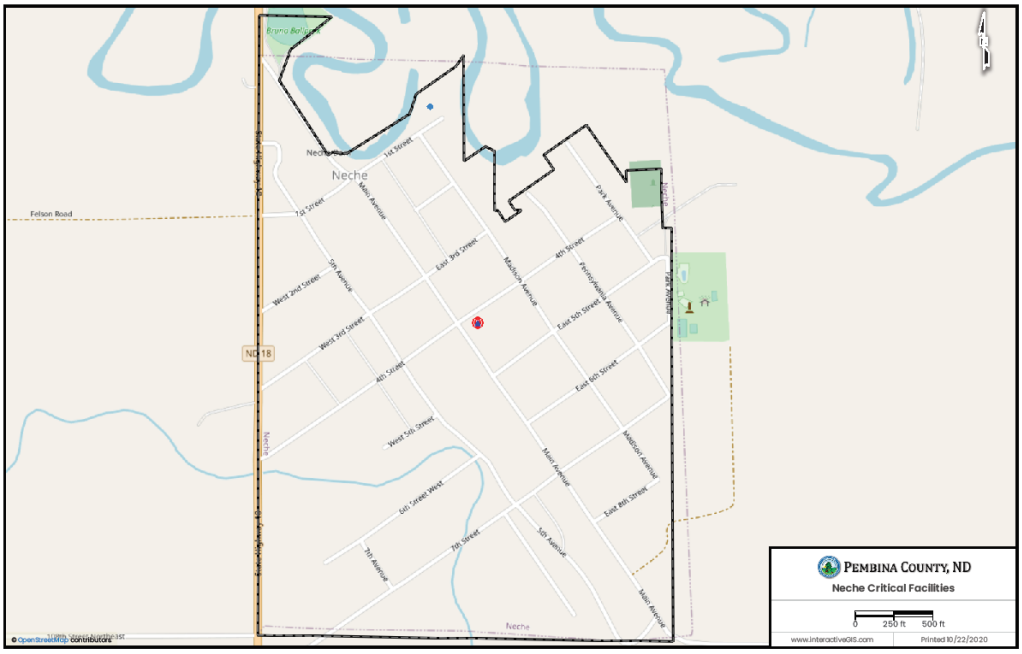
CRITICAL FACILITIES	ADDRESS	CATEGORY
Valley Elementary School	4013 Euclid Ave	Public School
Crystal Fire and Quick Response	330 3rd St	Fire/Rescue Station



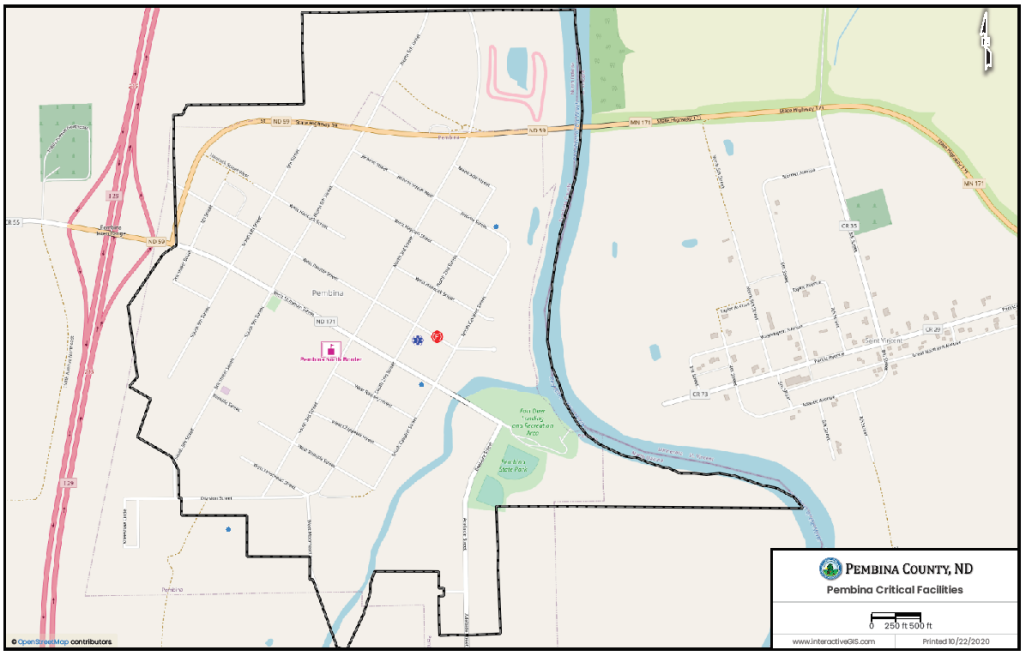
CRITICAL FACILITIES	ADDRESS	CATEGORY
Drayton Public School	108 S 5th St	Public School
Drayton Water Treatment Plant	507 River Range Rd	Water Treatment
Drayton Fire and Ambulance	105 W Grant Ave	Fire/Rescue Station



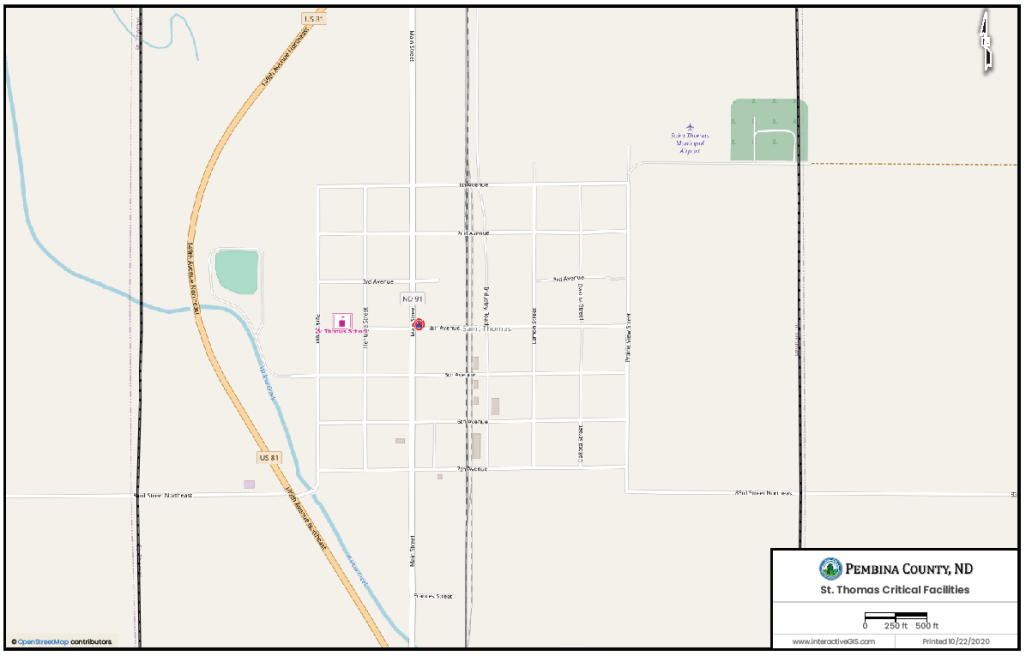
CRITICAL FACILITIES	ADDRESS	CATEGORY
Borg Pioneer Memorial Home	61 Borg Dr	Nursing Home
Mountain Fire and Quick Response	286 2nd Ave S	Fire/Rescue Station



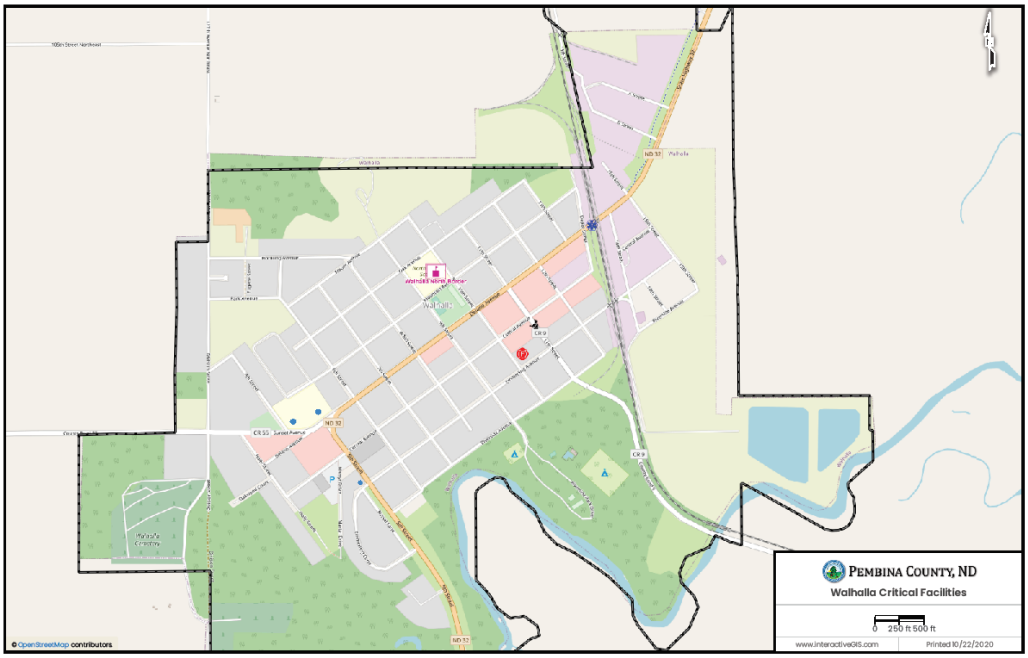
CRITICAL FACILITIES	ADDRESS	CATEGORY
Neche Fire and Quick Response	422 Main Ave	Fire/Rescue Station
Neche Water Treatment Plant	128 1st St	Water Treatment



CRITICAL FACILITIES	ADDRESS	CATEGORY
Pembina Public School	155 3rd St S	Public School
Pembina City Water Department	163 Jerome St W	Water Treatment
Pembina Fire and Ambulance	152 W Rolette St	Fire Department
US Customs and Border Protection	112 Stutsman St W	Federal Government
US Border Patrol	388 Division St	Federal Government



CRITICAL FACILITIES	ADDRESS	CATEGORY
St. Thomas Public School	375 Heritage St	Public School
St. Thomas Fire and Quick Response	335 Main St	Fire/Rescue Station



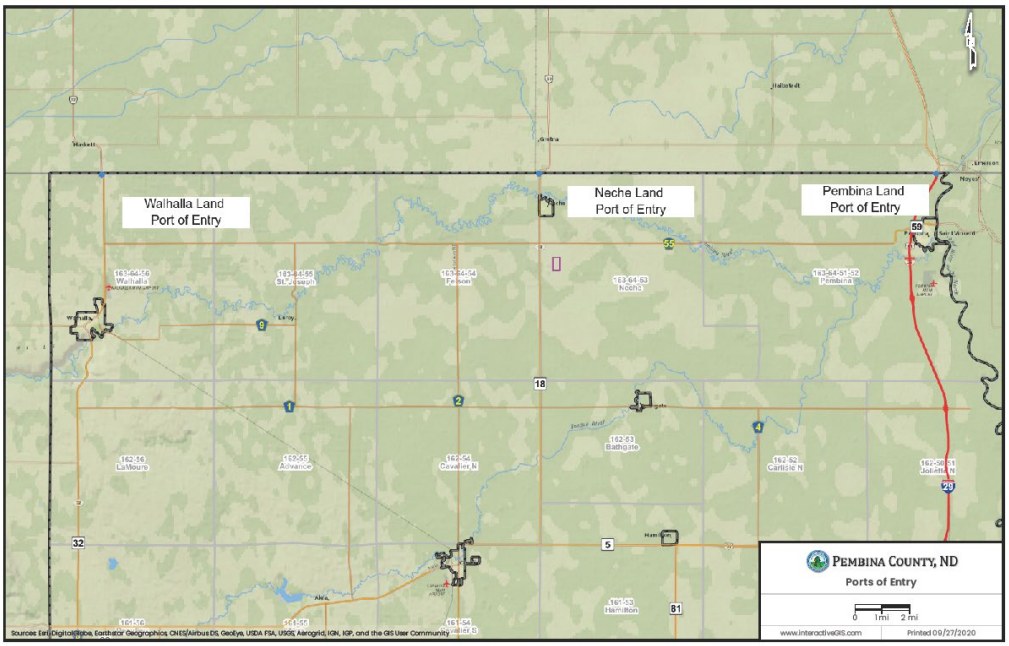
CRITICAL FACILITIES	ADDRESS	CATEGORY
North Border Estates	500 4th Ave	Nursing Home
Pembilier Nursing Center	500 Delano Ave	Nursing Home
Walhalla Public School	605 10th St	Public School
Walhalla Fire Department	304 10th St	Fire Station
Walhalla Ambulance	1309 Delano Ave	Ambulance Center
Walhalla Police	1007 Central Ave	Police Station
Altru Clinic	301 5th St	Clinic

Identified Impacts for Homeland Security Incidents

- Blocked Roads
- Building Collapse
- Business Interruptions
- Delayed Emergency Response
- Downed Power Lines
- Evacuation (full and localized)
- Explosion
- HAZMAT Release
- Increased Fire Potential
- Increased Public Safety Runs
- Loss of Potable Water
- Loss of Medical Facilities
- Mass Casualties
- Property Damage

Land Ports of Entry

Pembina County has 3 land ports of entry between the United States and Canada, including the busiest port of entry between Michigan and Seattle. The ports are at Walhalla/Winkler (ND32/PTH32), Neche/Gretna (ND18/PTH30) and Pembina/Emerson (I29/PTH75).



MAP 1: PEMBINA COUNTY PORTS OF ENTRY

Walhalla Land Port of Entry

Number of Individuals Crossing Border (10-year average, 2020 omitted*): 78,740
Number of Personal Vehicles Crossing Border (10-year average, 2020 omitted*): 43,117
Number of Trucks Crossing Border (10-year average, 2020 omitted*): 10,904
Number of Truck Containers Crossing Border (10-year average, 2020 omitted*): 11,050

**2020 has been omitted partially because accurate statistics will not be available for the entire year as of the printing of this document, and in part because of COVID19 travel restrictions skewing crossings low.*

The Walhalla Land Port of Entry sees primarily personal vehicles crossing the border with significant commercial trucking travel as well. This crossing connects the communities of Winkler, MB and Walhalla, ND and is located on major municipal highways on both sides of the border. Much of the traffic can be considered "local", as a high percentage of those crossing are doing for activities such as work, medical or other appointments, and shopping or leisure.

MAP 2: SATELLITE VIEW OF WALHALLA PORT OF ENTRY

Neche Land Port of Entry

Number of Individuals Crossing Border (10-year average, 2020 omitted*): 75,842
Number of Personal Vehicles Crossing Border (10-year average, 2020 omitted*): 44,539
Number of Trucks Crossing Border (10-year average, 2020 omitted*): 9,313
Number of Truck Containers Crossing Border (10-year average, 2020 omitted*): 9,326

**2020 has been omitted partially because accurate statistics will not be available for the entire year as of the printing of this document, and in part because of COVID19 travel restrictions skewing crossings low.*

The Neche Land Port of Entry sees primarily personal vehicles crossing the border with a sizable commercial trucking flow rate as well. Local knowledge of the border crossing compels many travelers to pass through the Neche port rather than the larger Pembina port to reduce wait times. Sizable agriculture equipment dealers north of the border increaseagricultural traffic through the port. Much of the traffic at this port tends to be “local”, similar to the Walhalla

port.

MAP 3: SATELLITE VIEW OF NECHE PORT OF ENTRY

Pembina Land Port of Entry

Number of Individuals Crossing Border (10-year average, 2020 omitted*): 719,552
Number of Personal Vehicles Crossing Border (10-year average, 2020 omitted*): 316,353
Number of Commercial Busses Crossing Border (10-year average, 2020 omitted*): 1,023
Number of Trucks Crossing Border (10-year average, 2020 omitted*): 216,438
Number of Truck Containers Crossing Border (10-year average, 2020 omitted*): 223,902

**2020 has been omitted partially because accurate statistics will not be available for the entire year as of the printing of this document, and in part because of COVID19 travel restrictions skewing crossings low.*

The Pembina Port of Entry is the busiest land entry from Detroit, MI to Seattle, WA, processing over 215,000 truck annually. According to a study done by a Canadian commerce group this number is expected to increase more than 50% by 2035 (MMM Group Limited, 2016). This port connects central Canada and the regional hub Winnipeg with the central United States for millions of tons of international commerce every year. Additionally, nearly three-quarters of a million people cross each year alone. This port is also used by many smaller companies to transport US goods that can be purchased at a lower price into

Canada for use in industries like construction. US community economies, such as those in Grand Forks and Fargo are also supported by Canadian customers.

The port at Pembina also oversees rail traffic from Canada into Minnesota to the tune of over 100,000 rail cars per year. Burlington Northern Sante Fe on the US side connects to Canadian Pacific Rail (CPR) north of the border.

Other immigration and internal travel services are handled at the port as well, including screaming for Canada Border Services' and US Customs and Border Protection's NEXUS Pass and the Transportation Security Administration's (TSA) Fast-Pass Services.

The Pembina Port and its service area has seen a rapid uptick in illegal crossings and asylum seekers since 2016, seen as tied to the election of President Donald Trump and his administration's crackdown on undocumented residents in the United States. The high volume of traffic through the port provides an opportunity not only for legal asylum seekers, but also for illegal human trafficking and the movement of controlled substances across the border.

Shortage of Critical Materials

Hazard Description

A shortage or outage of critical materials or infrastructure occurs when the demand for a life sustaining product exceeds the supply. These shortages and outages may include a wide variety of resources including energy-related products, power transmission, medical products, food, and water.

The disruption of the critical material supply system, whether caused by natural or human-caused disasters, global conflict, or embargoes, could severely diminish existing supplies, thereby threatening the immediate and long term health, safety, and well-being of Pembina County citizens. Examples of shortages or outages of critical material or infrastructure include:

- Widespread and prolonged electric power failure that impacts both day-to-day and emergency capabilities.
- A lack of transportation fuels causing surface movement gridlock and disruption of commerce.
- Diminished supplies of heating fuels during the winter causing severe economic and health impacts.
- A lack of medical supplies especially vaccines, antibiotics, and anti-viral medications posing a public health and safety threat.
- Private hoarding, compounding a shortage problem.
- A lack of adequate food, water, and shelter.

The public has come to rely upon utility, communication, and fuel services for everyday life and basic survival. Many in Pembina County depend on the typical utility and communication infrastructure such as water, sewer, electricity, propane, natural gas, telephone, internet, and gasoline. Water and sewer services are either provided through a public system or through individual wells and septic systems. Electricity is primarily provided by regional electric companies through overhead or buried lines. Homes and businesses are heated with fuels such as natural gas, propane, oil, and electricity. Those buildings heated with propane or oil typically have a nearby tank that is refilled regularly by a local vendor but still rely on electricity to power their heating systems. Natural gas is provided through underground piping. Telephone, cellular telephone, and internet services are provided by several local and national companies. Privately-owned gas stations are located throughout the state.

Almost any hazard can cause a shortage or outage of critical materials or infrastructure, but disruptions can also occur due to human error, equipment failures, or low supplies. The most common hazards that interrupt electric services are heavy snow, ice, and wind. Water supplies may be threatened by drought. Sewer services can be disrupted by flood. Often these types of outages are short lived. Crews quickly respond and resolve the problem causing the outage. During a widespread or complicated outage, services may be down for days or even weeks. Most problems arise during these longer term outages. For example, electricity is needed to maintain water supplies and sewer systems, but also to run blowers for heating systems. Essentially, without electricity, most facilities are without heat, water, fuel, or other appliances during a long term outage. This problem becomes particularly significant during the cold winter months. Telephone services are important for day-to-day business,

but are most important for 911 communications in an emergency. Without telephone service, emergency services can be severely delayed. In most cases, a long term utility outage would force many businesses to close until the services were restored. Gasoline shortages are also common during times of disaster.

In the event of a critical material or infrastructure shortage or outage, the National Weather Service has the ability to send out messages over the Emergency Alert System and NOAA Weather Radio (the radios often have battery back-ups). Examples of alerts include:

- Local Area Emergency Message: This message defines an event that by itself does not pose a significant threat to public safety and/or property, but the event could escalate, contribute to other more serious events, or disrupt critical public safety services. Instructions, other than public protective actions, may be provided by authorized officials. Examples of when this message may be used include: utility disruptions, road closures, or a potential terrorist threat where the public is asked to remain alert.
- 911 Telephone Outage Emergency Message: This message notifies the public of a local or state 911 telephone network outage by geographic area or telephone exchange. The message may provide alternative phone numbers to reach 911 or dispatch personnel (National Weather Service, 2011).

Critical material or infrastructure shortages and outages are often related to other hazards. Hazards that have the potential to damage structures frequently have the ability to damage infrastructure, resulting in a loss of services. Critical material or infrastructure outages can be a component of almost any hazard, but the following hazards can directly cause outages: floods, strong winds, tornadoes, hail, lightning, wildfires, drought, homeland security incidents, transportation accidents, heavy snow, and ice storms. The ability to restore services may also depend on the ability of repair crews to access the affected areas. In the case of a quarantine or pandemic, repair crews may not be available to quickly restore services.

Identified Impacts for Shortage of Critical Materials

- Blocked Roads
- Business Interruptions
- Delayed Response
- Downed Power Lines
- Downed Trees
- Evacuation (localized)
- Loss of Potable Water
- Loss of Medical Facilities
- Loss of Power
- Mass Casualties
- Property Damage
- Increased Fire Potential
- Increased Public Safety Runs
- Sewer Backup
- Civil Unrest
- School Closure

Transportation Incidents

Hazard Description

A transportation accident, for the purposes of this plan, is any large-scale vehicular, railroad, or aircraft accident involving mass casualties. Mass casualties can be defined as an incident resulting in a large number of deaths and/or injuries that reaches a magnitude that overtaxes the ability of local resources to adequately respond. In most disasters, death and injury represent one of the effects of the hazard while in transportation accidents, the mass casualties often become the hazard.

For planning purposes, we will define mass casualty accidents as: "A transportation accident that is of such magnitude that the disruptive event overtaxes both a county's resources and its ability to respond."

State Highways 5 and 66 are the major east-west routes across the county. Interstate 29, U.S. Highway 81, State Highways 18 and 32 are major north-south routes. These state and federal highways along with the hard surfaced and graveled county and township roads provide a good transportation network. The U.S. Port of Entry in Pembina, ND is the busiest U.S./Canadian port between Blain, WA, and Detroit, MI.

Community airports: Cavalier, Pembina, and Walhalla. Drayton and St. Thomas have grass landing strips available. The nearest major airline facilities are located in Grand Forks County. The Burlington Northern Santa Fe Railroad and numerous motor transport carriers support freight needs.

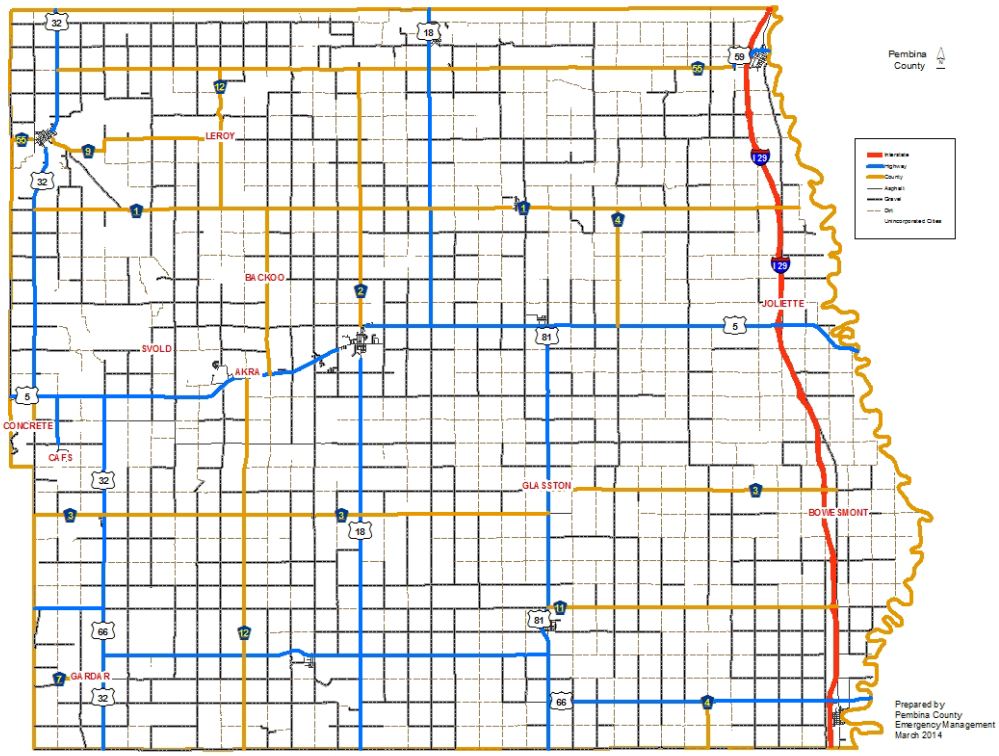
Probably the most significant and common hazard associated with transportation accidents is the release of hazardous materials. Many hazardous material releases occur as an element of a transportation accident.

Any transportation accident involving the release of hazardous materials significantly increases the complexity and potential damages from such an accident. Transportation accidents can also occur independently due to poor operator judgment or equipment problems.

Many times, weather hazards lead to transportation accidents. Examples include winter weather when snow and ice make roadways slick. Blizzards, smoke, and dust storms can lead to reduced visibilities and increase the probability of an accident. Floods may damage the infrastructure of transportation networks.

Summer storms can cause confusion, reduce visibilities, damage infrastructure, and knock down trees and poles, blocking roadways. Terrorists have used transportation, particularly mass transportation, as a method of delivering their attacks throughout the world. Should above-ground electric or telephone infrastructure be damaged in a transportation accident, it could lead to a long-term utility or communication outage. Almost any hazard can cause or aggravate a mass casualty transportation incident.

Mass casualty accidents occur with little or no warning. They involve a large number of people and require special types of equipment and emergency medical personnel.



Identified Impacts for Transportation Accidents

- Blocked Roads
- Building Collapse
- Business Interruptions
- Delayed Emergency Response
- School Closure
- Increased Fire Potential
- Increased Public Safety Runs
- Loss of Potable Water
- Loss of Medical Facilities
- Mass Casualties
- Downed Power Lines
- Evacuation (full and localized)
- Explosion
- HAZMAT Release
- Property Damage

Road

Pembina County is crossed by 6 state highways, 10 county roads and an interstate, totaling several hundred miles of paved road and nearly one thousand miles of gravel and dirt road. There is commercial traffic, agricultural, local, interstate and international travel moving thousands of vehicles a day. *Map 1*

There are several dozen bridges in the county as well, crossing rivers, drains and coulees, owned by everyone from the federal to local governments. These bridges are in various states of repair and while many of the main travel corridors on highways are well kept and often inspected, some bridges on county roads are falling into disrepair and whose lifetime may be coming to an end. Bridges are critical in an agricultural economy, as being able to cross a river at a certain point could save a farmer several miles of travel, rather than having to loop around by some other means. Stricter bridge and roadway codes passed on

by the state and federal government are forcing local officials to make difficult decisions of what bridges to keep open and those to close. *Map 2*

Rail

There is approximately 60 miles of railroad track, though only a single active line moving rail traffic from south of Crystal to Walhalla moving exclusively agricultural product. *Map 1*

The rail is owned by Burlington Northern Sante Fe (BNSF) and operated by Dakota Northern Railroad out of Crookston. The line has been in disrepair for years over disagreements over whose responsibility it is to maintain, the owner or the operator. Because of this, in 2018 when a bridge burned down (reference section on wildfires), the line was intended to be abandoned. Loss of rail would be a catastrophic hit to the local economy and several elevators pooled together to encourage the repair of the bridge. After the bridge was repaired, several other crossings have been improved upon, apparently signifying more involvement from the railroad parties.

It is anticipated that before all repairs are made, there is a greater than average likelihood of rail incidents. Fortunately, all rail cargo is agricultural commodities and no hazardous materials are on board (other than engine oil and fuel) and the environmental risk is minimal. However, the trains do pass through relatively populated areas which could cause significant damage and possible loss of life, depending on the nature of the crash and if the train leaves the rails. For this reason, responders commit a sizable amount of training to rail emergencies. BNSF often provides free-of-cost trainings to all first responders.

Air

The county also has three public airports – Walhalla (96D), Cavalier (2C8), and Pembina (PMB) – which all operate private pilots, spray pilots and the occasional emergency life flight. There are numerous private fields around the county as well, operating primarily spray services to service agricultural clients. *Map 3*

With the prevalence of unmanned aerial systems (UAS), pilots and especially spray pilots are relying more heavily on flight planning and working with farmers to determine “safe” airspace. Aid from the Federal Aviation Administration (FAA) and their Part 107 requirement have alleviated some of these concerns.

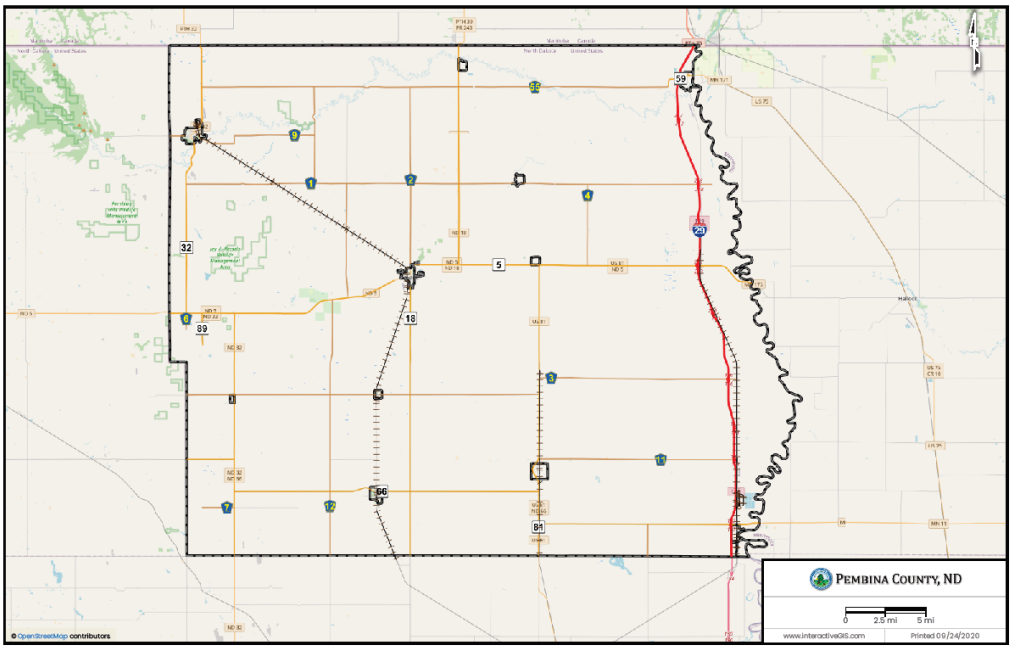
Occasionally, but rare enough to not be routine, a plane will experience a crash landing which will require a call out from local responders. As much of the air traffic is single-seater aircraft, the response is quite similar to that of an automobile accident, and following a summer 2020 incident, better information-sharing procedures with the FAA and the sheriff’s department have been established for reports and security.

Pipeline

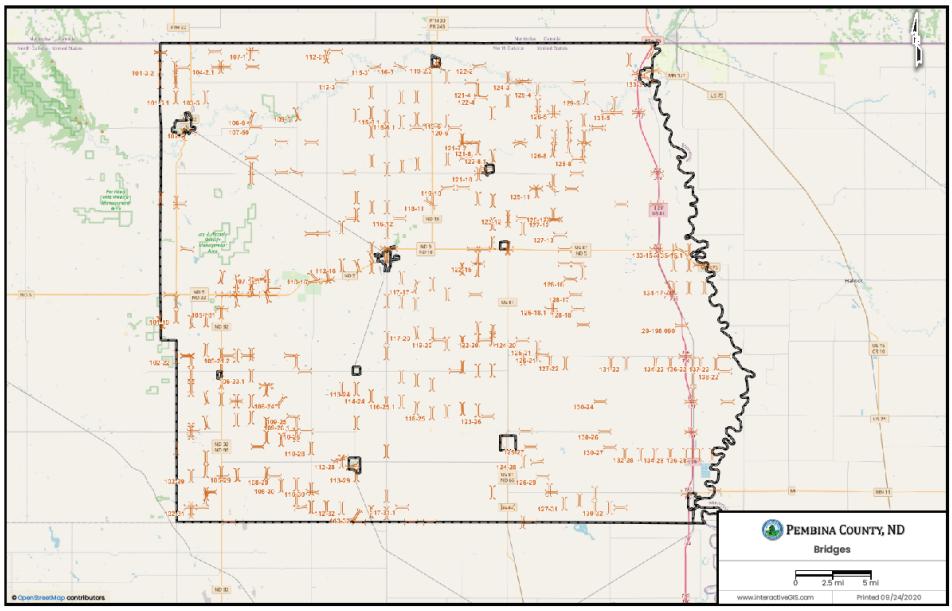
Two large crude oil lines cross under the area, a 32” line operated by TC Energy along the western border and a 36” line operated by Enbridge Energy which passes from near Neche and exits approximately 6 miles north of Drayton into Minnesota. A line replacement was performed by Enbridge Energy in order to meet new safety specs and will be in operation 2021-22 depending on the permitting process taking place in Minnesota. In 2016, protesters unlawfully entered a TC Energy facility southwest of Walhalla and closed an above ground valve as a form of protest in solidarity with the Standing Rock Tribe and the Dakota Access Pipeline.

These activities in conjunction with several other protests taking place in 2020 prompted area law enforcement to put an emphasis on crowd control and riot training, understanding that this new kind of adversarial attack by means of riot was here to stay. Additional adversarial actions will be detailed in the section of the same name.

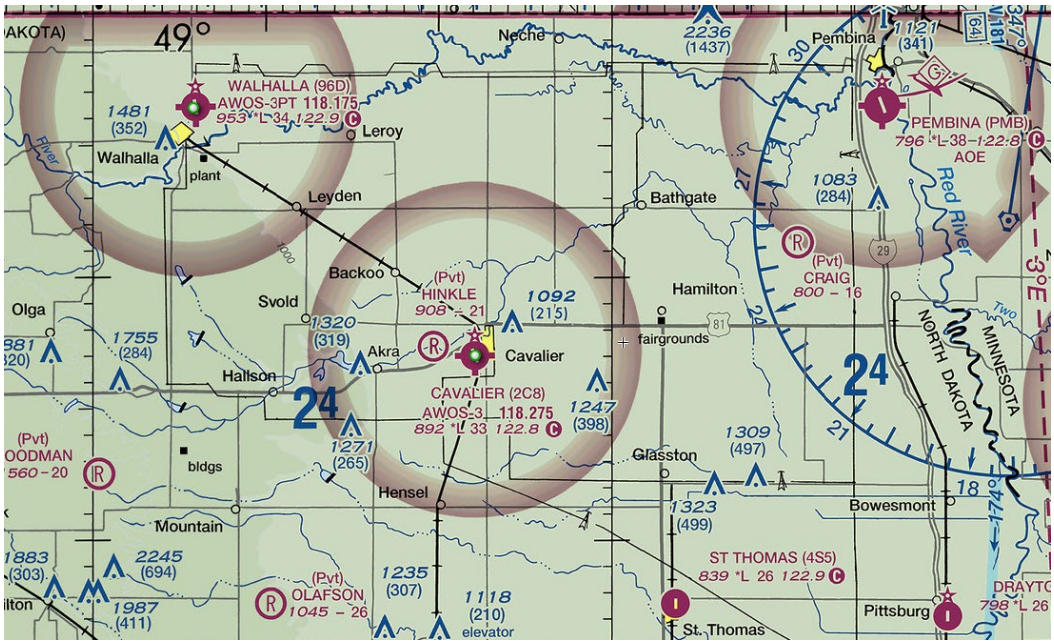
Buried throughout the county is a substantial network of natural gas lines operated by Montana-Dakota Utilities (MDU) and Williston Basin Interstate (WBI) pipeline to supply homes and farms with gas for drying crops and heating structures. Some of these smaller pipes are routinely struck – generally where they leave the ground and enter the structure – by workers or vehicles. Workers in the region are familiar with this utility and are usually quick to report. Responders in the area are familiar with procedures to contain the leak and to cordon the hazard and a good working relationship has been built with workers from the pipelines to close down flow and solve the incident.



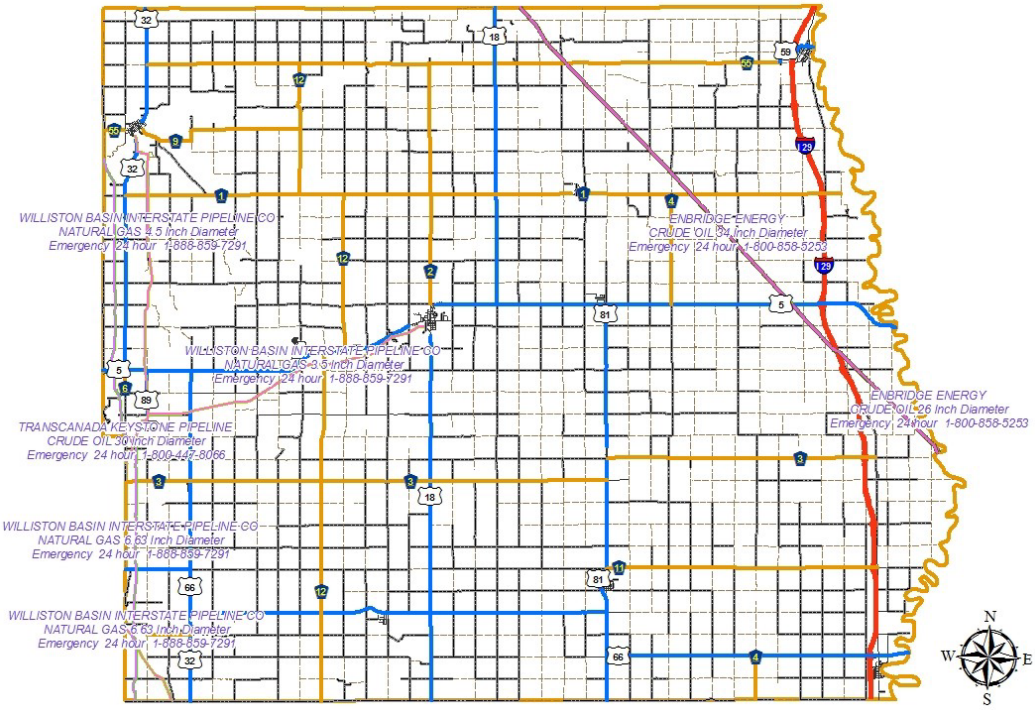
MAP 4: HIGHWAYS AND RAILROADS IN PEMBINA COUNTY



MAP 5: BRIDGES IN PEMBINA COUNTY



MAP 6: AIRPORTS IN PEMBINA COUNTY



MAP 7: PIPELINES IN PEMBINA COUNTY

Community Profile: Bathgate, ND 58216

The small community of Bathgate is a rural farming community located in northeast Pembina County. It has an area under 200 acres and an estimated population of 58 in 2018. Much of the population is involved in some way in agriculture, and the only major industry in the town is an office center for Bethlehem Books, a publishing company catering to religious and home-schooled families. The business was started by a religious order known as the Bethlehem Community. Members make up another significant portion of the population.

Pembina County Highway 1 passes east and west through the community and services most traffic through the region. The only Tier II facility is located along this route – a card-tol fueling station with above ground gasoline and diesel tanks (*Figure 3*).

Much of Bathgate exists within a floodway, and that which doesn't is in the 1% flood risk area (*Figure 1*). For that reason, it is very difficult to obtain flood insurance or to buy or sell residential property. Despite this, there is very few flood related incidents within city limits. The greatest challenge posed by flooding in Bathgate is floodwater accumulating in a few low-lying areas and some water in basements.

Bathgate has a community-built fire department serving all structures within city limits and providing mutual aid to neighboring fire jurisdictions. The department poses a fire hall, single truck and full turnout gear for a department of 10. EMS and law enforcement are provided by Cavalier Ambulance and Pembina County Sheriff, respectively.

Mitigation Priorities

Neche lies along ND 18 and is home to a U.S. Customs Port of Entry. For that reason, in addition to transportation accidents, Neche also faces the possibility – though remote – of a homeland security incident.

The economy of Neche relies on agriculture, though the town also boars a rather robust industrial park. Hazardous materials are abundant in town and the potential exists for a large-scale release. Drainage and a river coupled with release could produce an ecological disaster.

The Pembina River running north of the city creates flooding issues on a somewhat regular basis. The city has taken measures to construct a dike around the city and has a pretty good handle at responding to floods and the town can stay dry even after the highway has water running over it. Supply lines are a must both for resources like food, and materials to keep the industrial sector functioning.

The city has several stout structures that could be used as severe weather shelters, but need to be identified and made known to residents and visitors.

- Certify dike,
- Upgrade pumps and valves in the city's pumping station to handle growing needs,
- Clean city lagoon.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	A	B	C	D	C	D	D	C	C
Critical Transportation	C	B	C	D	B	C	C	C	C
Mass Search and Rescue	C	C	B	C	C	C	D	D	C
Mass Care Services	C	B	C	B	B	C	D	D	A
Logistics and Supply Chain	C	B	C	B	C	C	C	C	B
Housing	A	B	B	C	D	C	D	B	B
Environmental Health/Safety	B	B	C	A	C	C	C	D	D
Fatality Management	B	D	C	C	B	C	D	D	B
Public Health, Healthcare	B	C	B	B	B	C	D	D	A
Fire Management	A	C	B	A	A	C	D	D	B
Law Enforcement	A	C	B	A	A	A	D	D	A
Economic Recovery	C	C	C	C	D	B	C	A	B
Health and Social Services	B	C	C	C	C	B	D	B	B
Natural and Cultural Res.	C	C	B	B	C	B	C	C	C
Planning	B	A	A	A	B	B	C	C	A
Operational Coordination	A	A	A	A	A	A	C	C	A
Situational Assessment	A	A	A	A	A	A	C	C	A
Public Info. and Warning	B	B	A	C	B	B	D	D	A

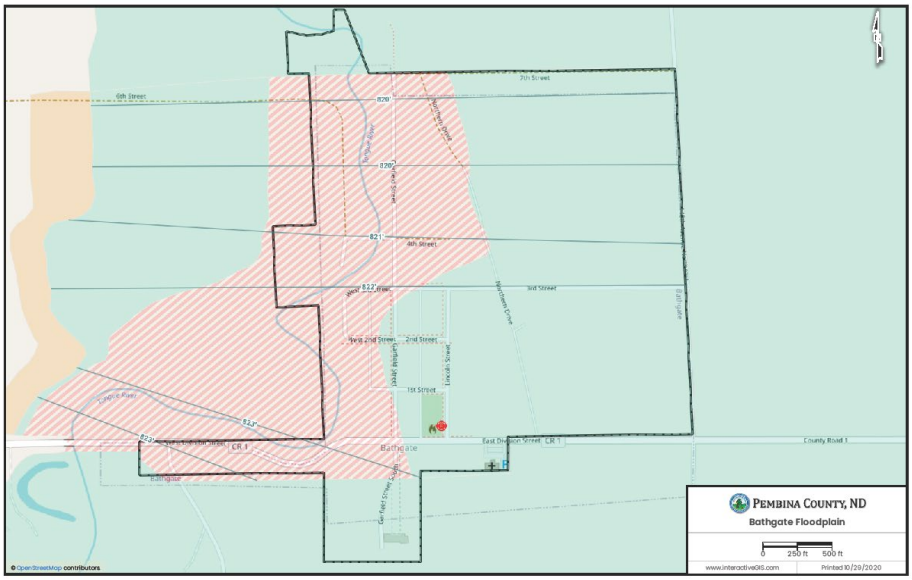


FIGURE 16: BATHGATE FLOODWAY AND FLOODPLAIN

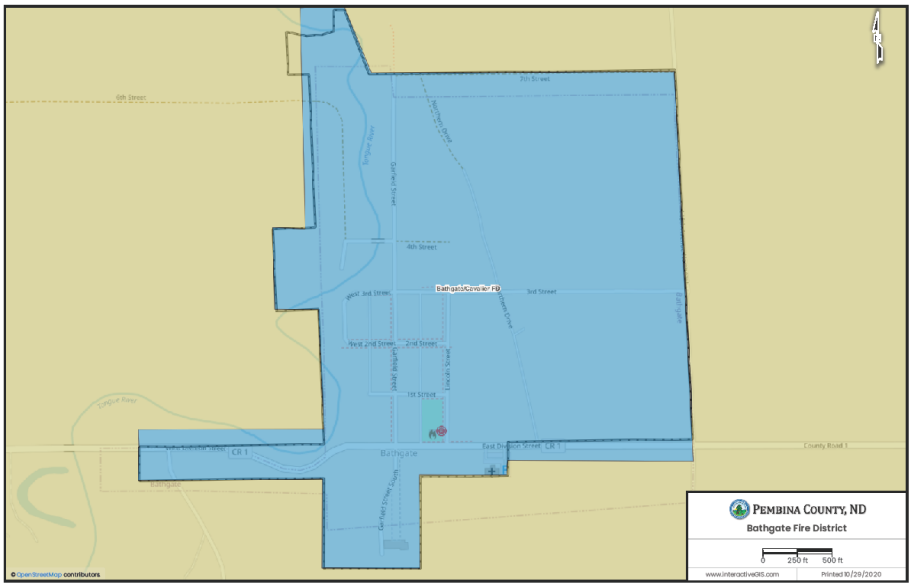


FIGURE 17: BATHGATE FIRE DISTRICT

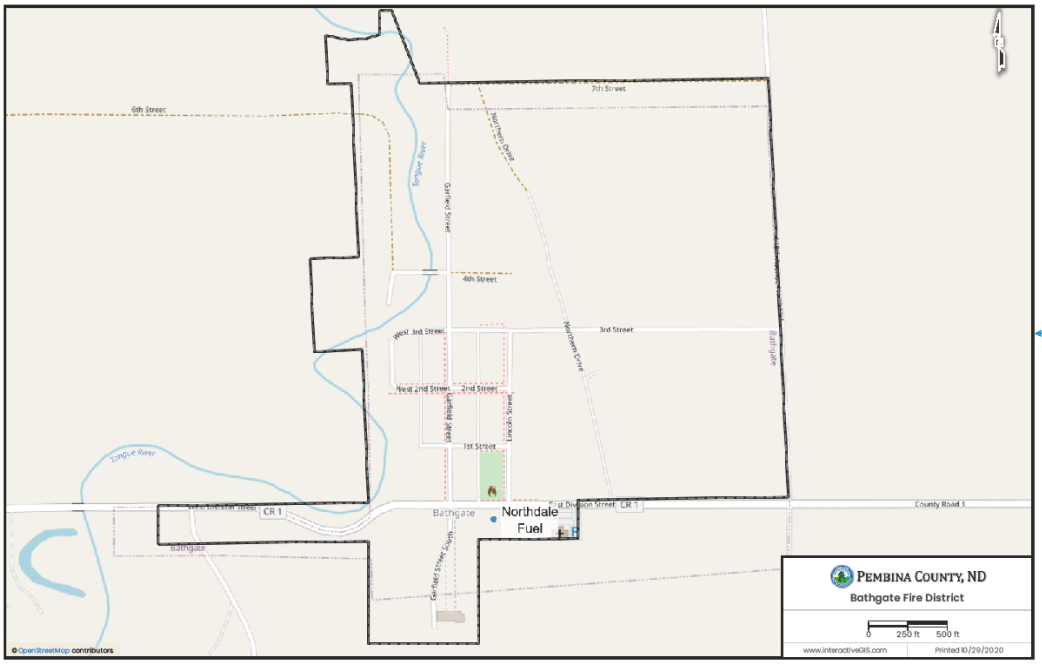


FIGURE 18: BATHGATE TIER II

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Special Vulnerability Assessment
Extreme Weather
There is no detailed history of particular extreme weather events for the town, however since the plan was updated, a designated shelter has been established at a church in the event of displaced or stranded persons. Many homes have basements or other sheltered interior room in the event of high winds or tornadoes. Severe winter weather poses a threat to critical transportation into and out of the community, however many of the residents have taken the initiative to invest in snow moving attachments to farm machinery to help dig the town out. Historically, a significant drift forms on the bridge just west of town on Pembina County Highway 1, which has been identified by highway personnel and is mitigated with snow fence.
Wildland Fire (Wildland-Urban Interface)
The city is surrounded mainly by agricultural development and much of the year crops are either too wet to burn, or the fields are bare to mineral earth. The likelihood of a wildfire burning into town under normal conditions is low. However once in city limits, there is an abundance of old trees that if ignited, would require substantial resources to extinguish.
Flooding
There is a moderate risk of flooding to the community with the Tongue River passing through the western edge of town. Residents have naturally moved structures away from the riverbank, and generally no flood protective measures need to be initiated. Several low-lying areas will fill with water providing risk of secondary effects, such as pollution or breeding grounds for pests, but generally do not impact the community.
Dam Failure
It is disputed if a dam failure at Renwick Dam (six miles west of Cavalier) would impact the community of Bathgate. Several hydrological studies have been conducted that lack consensus of a total failure. It is supposed by this office a total failure would impact the community similar to a 100-year flood.
Drought
While causing secondary threats to the urban interface mentioned above, draught would not directly impact the community, though many have a detritus effect on the local economy.

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Community Profile: Cavalier, ND 58220

From the City of Cavalier website:

"Cavalier is located in the heart of the Rendezvous Region, an area bordering Canada and Minnesota in the northeast corner of North Dakota, steeped in history and natural beauty. Established in 1878 along the winding banks of the Tongue River, Cavalier is a growing community of 1500. The four seasons allow opportunities to enjoy a wide range of outdoor activities including golf, tennis, water sports, hunting, bicycling, snowmobiling and skiing. The blend of history and tradition, with a spirit of cooperation and ongoing commitment to economic development is all part of what makes Cavalier, "The Friendly City.""

The City of Cavalier is centrally located in the county and serves as the county seat. It is bisected north and south by ND Highway 5 and east/west by ND Highway 18. The Tongue River meanders through the city, and a Burlington Northern Sante Fe (BNSF) pass through – north and south – to serve the industrial park. Despite what is advertised on the website, the 2018 Census places the population at 1,191 in 2018 (US Census Bureau, 2018).

An in-depth LiDAR and elevation study in 2016 greatly increased the accuracy of the floodplain in and around Cavalier, impacting many homeowners and presenting challenges to homebuyers looking in the floodplain areas. Broadly, Cavalier has planned consciously around the river and major flooding events and – save for one neighborhood – the city is well protected thanks in large part to a series of retention structures on the Tongue River. *Figures 1&2* show FIRMettes of these areas and the level of detail of the 2016 mapping. These updates have sparked important conversations with insurance companies and lenders especially related to flood insurance, the needs of the insured, and the limitations of homeowners' insurance.

Relatively few hazardous materials facilities are located within city limits and are instead clustered on the fringes of the city or in the industrial park (*Figure 3*). In the past several years, there have been a handful of releases including breaches of buried natural gas lines and accidental releases of anhydrous ammonia. Employees of the tier II facilities live in or near the city and integrate into response efforts to provide technical expertise on hazardous material releases.

Cavalier's economy matches much of the rest of the region – primarily agriculture, commerce, tourism, and a slightly higher concentration of government-based industry, due to its nature as county seat. The higher concentration of government facilities makes Cavalier a higher-risk target for adversarial or terrorism activities. An incident of note was in 2005 when a local man shot at the law enforcement center and set fire to the courthouse, interrupting work and displacing employees for several months afterward. Since then, law enforcement has increased training relating to active threat incidents.

Pembina County's largest ambulance service and fire department are both based out of Cavalier, in terms of membership and coverage area. *Figure 4* shows the fire coverage area and *Figure 5* shows the ALS ambulance services area. Additionally, Cavalier Ambulance provides ALS service and transport for all ambulances and quick response units, save for Drayton which is covered by Altru Grand Forks.

Cavalier has its own sworn police department of 3 officers and works closely with Pembina County Sheriff's Department and other state and federal agencies.

Mitigation Priorities

Cavalier is the largest city in Pembina County, and so faces the most challenges. A higher population means a higher chance of communicable disease spreading between people at social events, the city school, or just in public places. A higher population also means more buildings and aging structures, increasing the chance for structural fire and structural collapse.

The city is built along the Tongue River which flows out from Renwick Dam, the last in a series of retention structures built through the county. The retention structures serve to slow the flow of melting snow and heavy rain, and the city has become reliant on that slowdown. Should a dam fail, especially while at full pool volume, it is likely to create a domino effect, and

could flood Cavalier and surrounding areas. Areas most likely inundated by a dam release are low-lying areas on the northwest side of town and properties along the Tongue River. Even with functioning retention structures, the city is susceptible to aerial flooding, especially in low areas of town.

Two state highways run through Cavalier, ND 5 and ND 18, and a railroad owned by BNSF. The city sees a lot of traffic, heavy and otherwise, which presents an issue. Minor incidents are relatively common, though the potential exists for a large traffic incident or a hazardous materials release. The danger is increased by services and business along transportation routes, such as fueling stations along the highway, and bulk anhydrous and propane tanks along the railroad.

Finally, Cavalier faces a threat from severe weather. While the community has enough resources on hand that they may be self-sufficient for some time should they be snowed in and poses some resources to dig themselves out, eventually they may need outside support. As will all communities, Cavalier has the potential to be greatly damaged by summer storm, but has public warning resources to help prepare the public and shelters to help protect citizens.

- Purchase generators for lift stations.
- Purchase small floatable pump to drain low areas during floods.
- Clear debris out of Tongue River.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	C	B	C	B	A	C	C	C
Critical Transportation	C	C	B	A	A	A	C	C	D
Mass Search and Rescue	A	A	C	B	B	C	D	D	D
Mass Care Services	B	B	B	A	A	A	C	C	A
Logistics and Supply Chain	C	B	A	B	B	A	C	B	C
Housing	A	C	C	C	D	B	D	B	C
Environmental Health/Safety	C	C	C	A	C	D	C	B	A
Fatality Management	C	B	C	C	D	B	D	C	B
Public Health, Healthcare	C	C	C	A	C	C	C	C	A
Fire Management	A	C	B	A	A	B	C	C	B
Law Enforcement	A	B	B	A	A	A	C	C	A
Economic Recovery	B	B	C	C	C	A	C	A	A
Health and Social Services	B	B	C	C	C	B	C	B	B
Natural and Cultural Res.	A	A	C	C	D	C	B	C	C
Planning	B	A	A	A	B	A	C	B	A
Operational Coordination	A	A	A	A	A	A	C	C	B
Situational Assessment	A	A	A	A	A	A	C	C	A
Public Info. and Warning	A	A	A	A	C	B	D	D	A

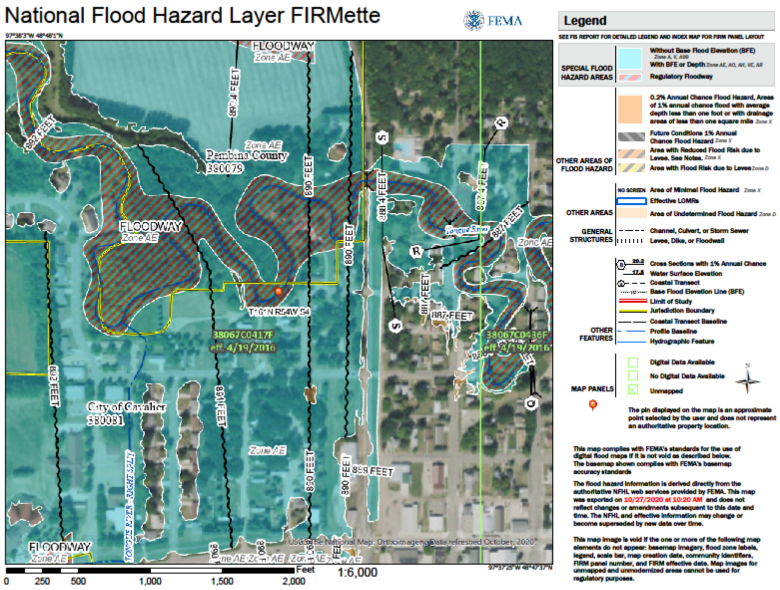


FIGURE 19: BEDROCK LANE, CAVALIER

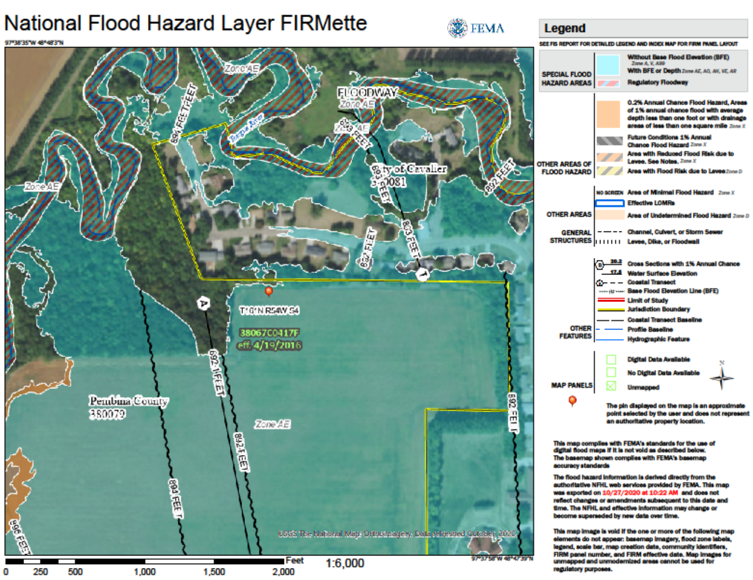


FIGURE 20: BJORINSON DRIVE, CAVALIER

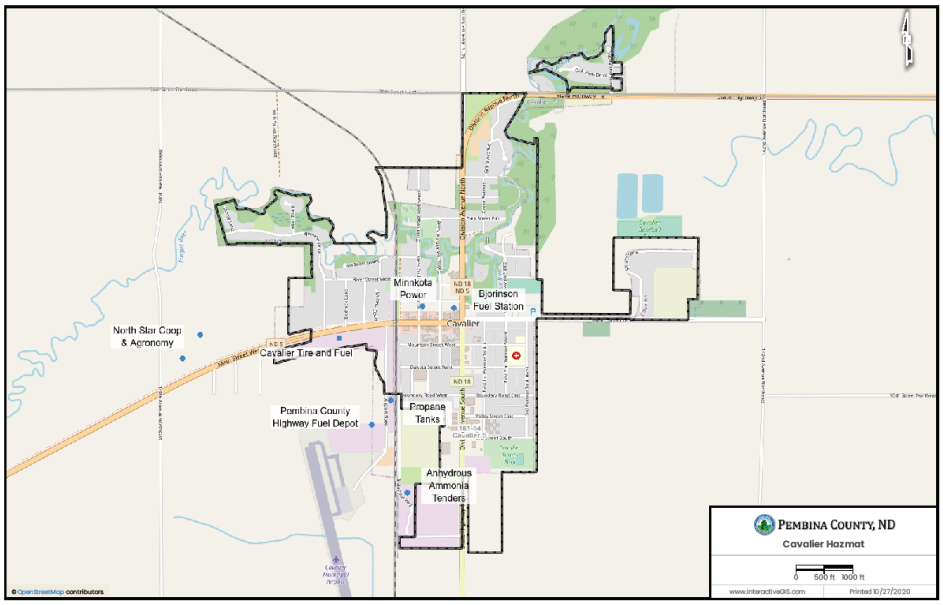


FIGURE 21: CAVALIER HAZARDOUS MATERIALS FACILITIES

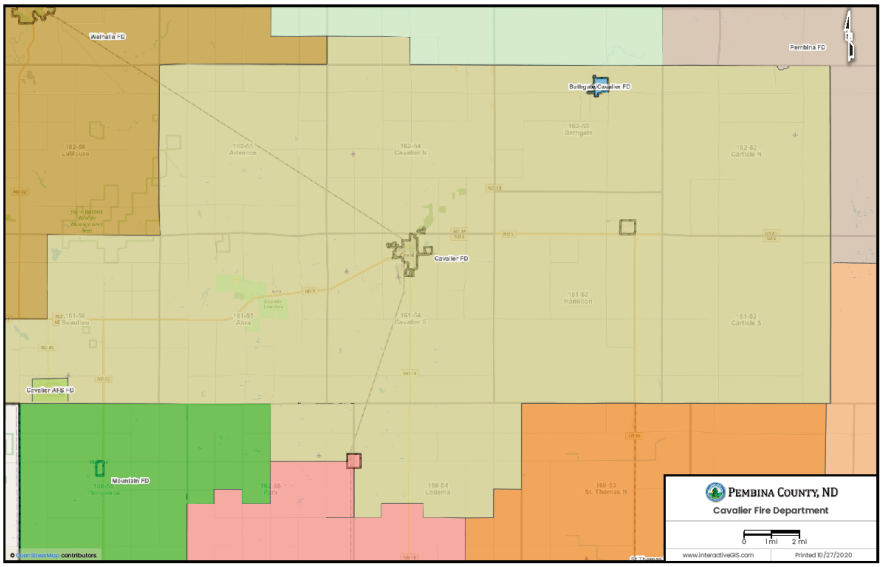


FIGURE 22: CAVALIER FIRE DEPARTMENT RESPONSE AREA

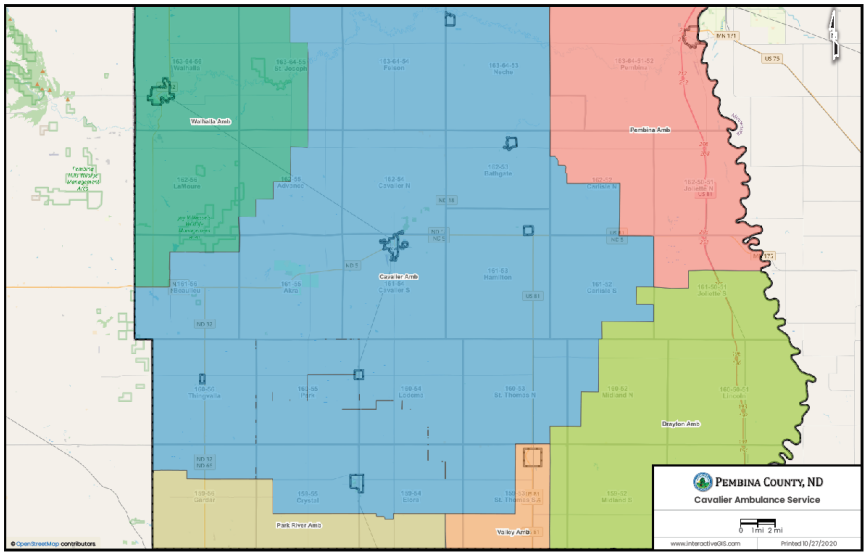


Figure 23: Cavalier Ambulance response area

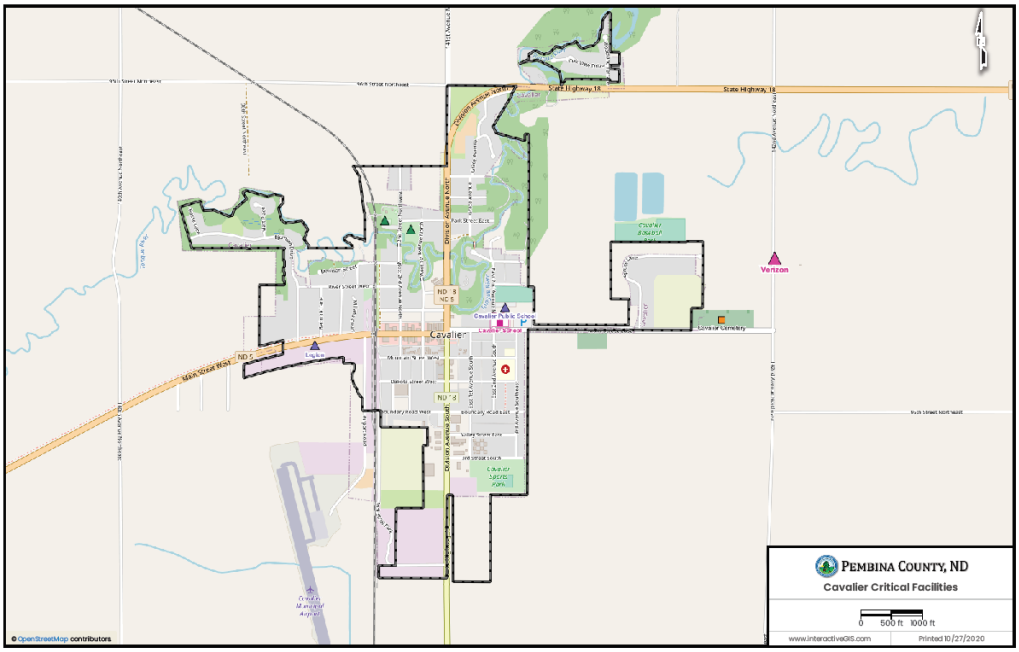


FIGURE 24: CAVALIER CRITICAL FACILITIES

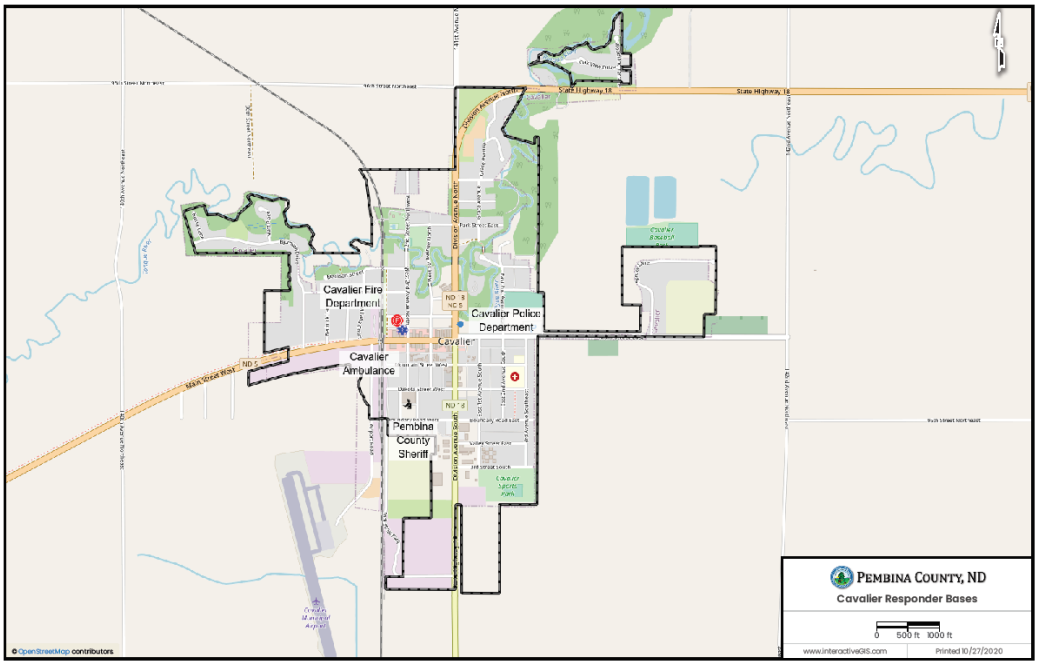


FIGURE 25:CAVALIER RESPONDER BASES

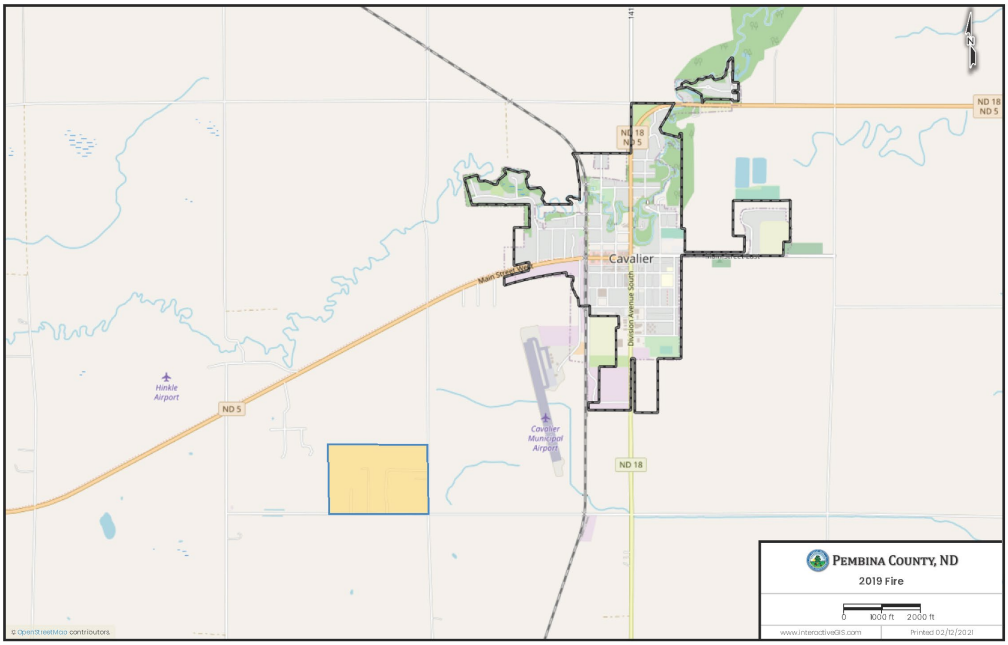


FIGURE 26 SITE OF WILDFIRE IN 2019

Special Vulnerability Assessment
Extreme Weather
Despite the community school's mascot being a tornado, no tornado event has been recorded in the city. Strong wind or rain events have caused damage to natural resources, such as trees in the community, but no major claims have been reported. Due to the high population, several shelters have been identified, several that can withstand significant winds or severe weather in the event of a major event. Snow events are generally absorbed well in the community, as a full-time public works department can be employed to clear streets.
Wildland Fire (Wildland-Urban Interface)
Most of the area around Cavalier is agricultural lend that generally is not conducive to spreading fire. There are a number of small developments further out of town and located more "in the brush" than the town proper, and in 2019, a wildfire conveyed by cottonwood seeds threatened a neighborhood of ten homes. Several fire departments were able to respond and no property was lost, and the lesson was learned to keep the land clear of debris to help abate wildfire spread.
Flooding
The Tongue River passes through Cavalier, and provides significant risk to the northwest part of town around the city park and the Bjornson Development identified earlier in this section. Zoning practices, such as prohibiting basements has helped mitigate damage, though some streets are routinely impassable due to water. Areal flooding is the primary concern, especially on the west side of the city. ND Highway 18 and railroad tracks owned by Burlington Northern Sante Fe act as an artificial barrier to floodwater.
Dam Failure
Notably in 2013, snowmelt and massive rains contributed to the undercutting of Renwick Dam, a flood control structure 6 miles west of Cavalier. It was supposed that were the dam to fail, most of the community would be inundated with water, and a significant portion of infrastructure would be disrupted. Following this event, and in conjunction with planned updates, the dam was repaired and updated to help reduce this risk.
Drought
As less of the city economy relies on agriculture than some other communities, Cavalier is slightly more resilient to the second order effects of draught to the economy. **Cavalier recently finished construction on a new water tower that should be operational sometime in 2021 nearly doubling the capacity of the current tower and providing additional technological upgrades. The ability to store water normally provides additional water and pressure for emergency situations like fire, but in the event of drought or water disruption from Northeast Regional Water, the tower may be used for additional potable water.**

Community Profile: Crystal, ND 58222

Crystal is a small farming community of approximately 128 residents located in southern Pembina County. Traditionally, the economy is based around the high concentration of potato farmers in the area and the operation of a potato warehouse on the north edge of the city. In 2010, Columbia Grain, an international commodity company invested heavily in a 1.3-million-bushel grain elevator to serve farmers in the region. Additionally, Simplot Growers' Solutions (SGS) made significant improvements to their facilities and added an agronomy department to increase growers' effectiveness.

While these business provide substantial economic prosperity to the region, Crystal has put all its eggs in one basket as it were, and impact to these businesses may significantly harm the regional economy and quality of life.

Also to be expected with a farming community, a major North Dakota Highway (ND66) bisects Crystal, providing transportation to the aforementioned agricultural business linking them with other local highways and eventually to Interstate 29. Columbia Grain also made significant investments into the Burlington Northern Sante Fe rail line including a rail loop around the facility (*Figure 1*). While this causes an increased potential for a transportation incident, these lines see only a slight increase in hazardous materials.

Crystal lies between two branches of Cart Creek, and the branches rejoin on the south side of town. There is not much conveyance of water through the streams, however they hold very little volume and are quite congested with snags and general lack of maintenance. Generally the only flooding risk comes from rapid snowmelt and overland flooding, or heavy downpours when the water cannot drain fast enough. The highest risk spots have largely been zoned out of development, making room for green space for floodwaters to expand onto.

The Crystal Fire Department has the unique distinction of being able to transport more water via tender than any other department in Pembina County. This is due to a well thought out cistern and pump system and multiple tenders with drop tanks. The fire hall is under renovation at the writing of this document, where the system will be updated and the fire department merged with quick response and community center. Because of their water-toting capabilities, Crystal is often requested for mutual aid to ensure a steady supply of water.

Crystal and the surrounding area are serviced by a quick response unit supported by Cavalier Ambulance. This provides quick medical response to an incident, with a more capable department shortly behind, able to administer more potent medications and provide transport.

Mitigation Priorities

The City of Crystal is heavily influenced by the ag industry. A major grain corporation and fertilizer distributer have large presence in the community bringing economic gains, and also an increased threat of traffic accident and hazmat release. In case of draught, hail or wind damage, the town's economy would suffer and in turn, put strain on the populace.

The North Branch of the Park River flows through the City of Crystal, and unlike the Tongue River, has no retention structures, so water flows uninhibited into the city. There is also a risk of flash flooding from the west, as there is a relatively large gradient change from the City of Mountain to the west along ND Highway 66. Snowmelt and rain runoff has a veritable highway down the large ditches right into town and the North Branch and leaves its banks in town.

Crystal has very few businesses and a small public works division and must wait for assistance from the county and state to help dig out from snow storms, downed trees, or other damage from severe weather. A supply chain to the town is critical to get resources to residents.

- Additional property buyouts
- Clearing and snagging of Cart Creek

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	C	C	D	C	D	D	D	D	D
Critical Transportation	C	C	D	C	C	D	D	D	C
Mass Search and Rescue	C	D	C	C	C	C	D	D	D
Mass Care Services	D	D	C	C	C	C	D	D	D
Logistics and Supply Chain	D	B	D	D	B	C	D	C	C
Housing	B	C	D	D	D	D	C	C	D
Environmental Health/Safety	C	C	D	B	D	D	C	D	D
Fatality Management	D	D	C	C	C	D	D	D	C
Public Health, Healthcare	D	D	C	C	C	D	D	C	B
Fire Management	A	C	B	A	B	C	D	D	D
Law Enforcement	A	C	B	A	A	A	D	D	D
Economic Recovery	C	C	C	C	D	C	B	B	C
Health and Social Services	D	C	D	D	C	D	D	C	B
Natural and Cultural Res.	D	D	D	D	D	D	D	D	D
Planning	B	A	B	B	C	B	C	D	C
Operational Coordination	A	A	A	A	A	A	C	D	C
Situational Assessment	A	A	A	A	A	A	B	C	C
Public Info. and Warning	B	B	A	B	B	C	C	D	C

FIGURE 27: RAIL LOOP

Field Code Changed

Field Code Changed

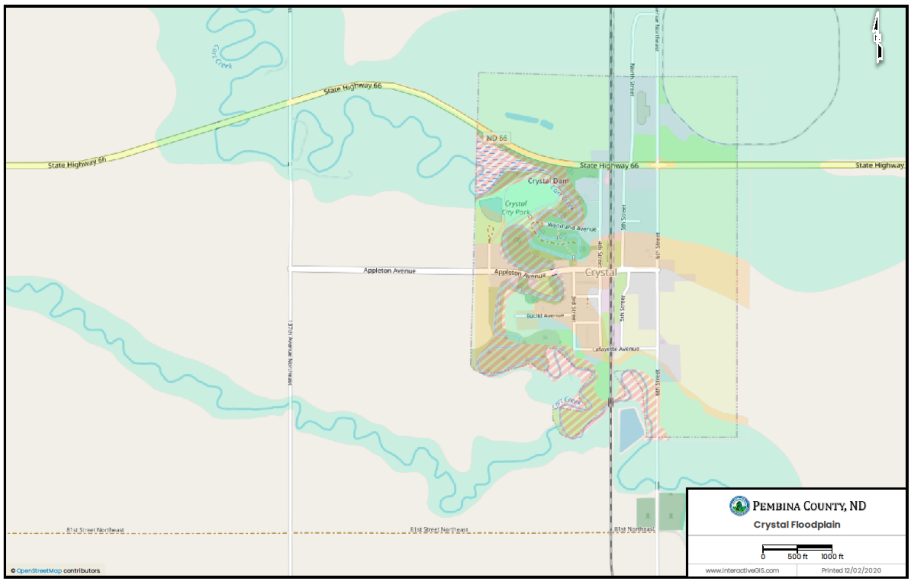


FIGURE 28: FLOOD HAZARD AREAS

Field Code Changed

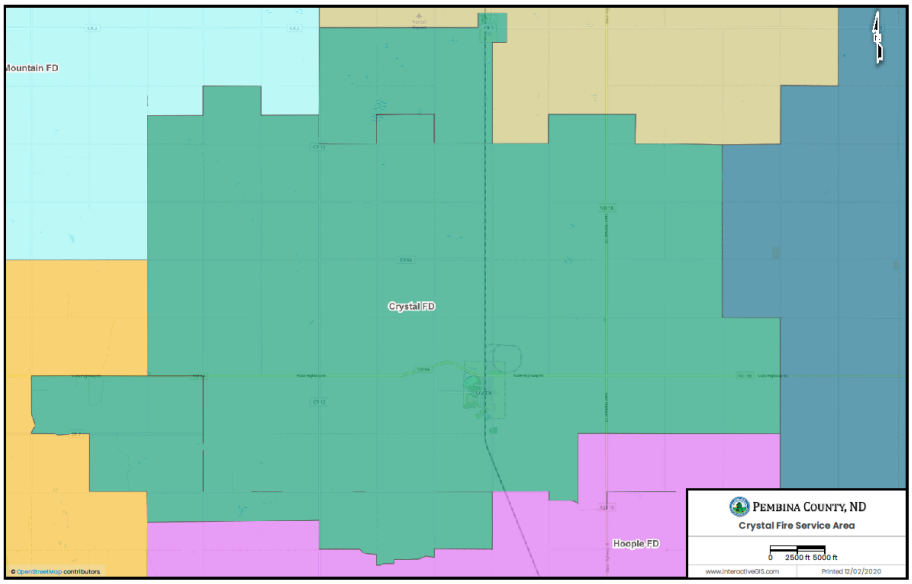


FIGURE 29: FIRE DEPARTMENT SERVICE AREA

Field Code Changed

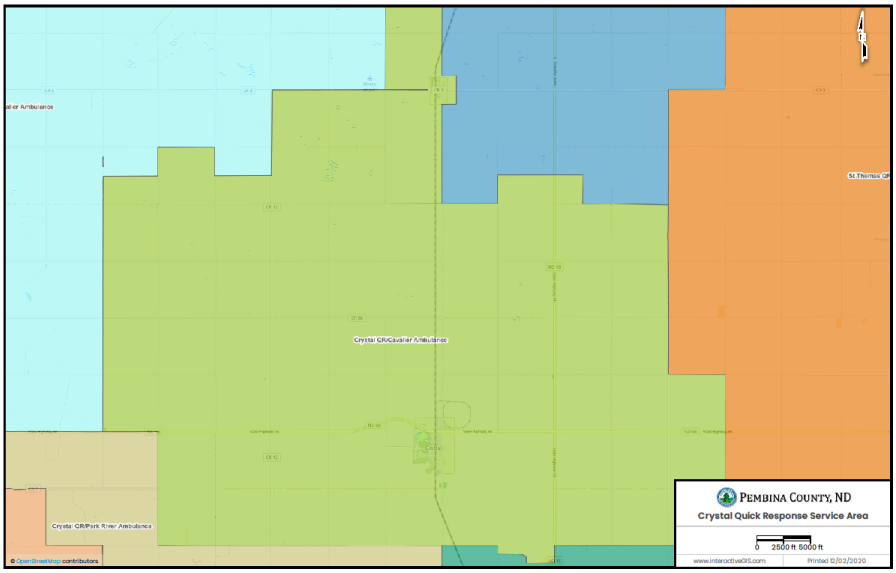


FIGURE 30: QUICK RESPONSE SERVICE AREA

Special Vulnerability Assessment
Extreme Weather
Most residents are protected from severe weather by basement foundations. Many of the private industry business are old brick and mortar buildings that provide substantial safety from severe winds and weather. At the time of this writing, a community center is in the process of construction that will include a storm shelter and is slated to be complete in 2022. Crystal has a relatively low transient population and little sheltering is needed for visiting persons.
Wildland Fire (Wildland-Urban Interface)
Greenspace and a neglected flood zone provide ample fuel for the spread of wildfire. Snagging and clearing of Cart Creek would greatly increase protection against wildfire.
Flooding
Crystal faces significant threat from overland flooding, spurred by snowmelt rolling off the Pembina Gorge escarpment. In 2013, snowmelt and heavy rains inundated much of the community and threatened a large fertilizer warehouse that would have contaminated much of the area.
Dam Failure
There is no dam failure risk for Crystal.
Drought
The risk of draught to Crystal is secondary in its increased risk of wildfire, and effects on the Crystal economy.

Community Profile: Drayton, ND 58225

From the Drayton Community Website:

"Nestled along the Red River of the North, Drayton, North Dakota is one of North Dakota's most picturesque little cities. From its early days as a landing along the Red River to being home to one of the American Crystal Sugar plants, the industrious people of Drayton have always looked to the future.

Located just north of Grand Forks, one of North Dakota's largest cities, Drayton is an excellent location to live and work or to start and grow your business. We have an active chamber of commerce and economic development group supporting our business community, a growing school system with top-notch staff, programs, and facilities, plentiful and affordable housing, and easy access to Interstate 29, ND Hwy 66 and MN Hwy 11.

As the Catfish Capital of the North we host hundreds of anglers every fishing season and have ample paved river access with ramps below and above Drayton Dam, a modern fish cleaning facility, and plenty of motel rooms and camping spaces available. Each summer, we host Rod and Reel Rally Catfishing Tournament and Drayton Riverfest, our annual community festival.

To get to know this little gem of the North, stop by and visit Drayton, ND, Catfish Capital of the North!"

As the entry suggests, much of the Drayton economy is based around river tourism and agriculture. This presents unique challenges to risks and hazards, both natural and technological.

The primary threat to the city is the Red River of the North, providing the eastern border of the town. The river provides flooding challenges to the eastern half of the county at large, however Drayton's proximity makes the Red a threat even on a good year. Years of experience have provided significant experience for the residents of Drayton and developed a robust and detailed flood fighting checklist with action items for river levels. Examples of these reactive actions include pump stations, plugging culvers and the placement of a temporary earthen levy on a roadway.

The primary permanent flood protection feature is a permeant levy running along the river. Originally a temporary flood protective measure, the city spent some time working with the state water resource board and finally working with Congressman John Hoeven to have the structure designated "permanent" to help protect the city. A recent floodplain remapping designated much of the city in the floodplain, therefore making real estate marketing and insurance (*Figure 1*). This too is in the process of review, based on Drayton's robust flood fighting plans.

Drayton's tourism industry is highly dependent on bringing outside populations into the town and the region. Many secondary industries in the city rely on these events for income and would not last long otherwise. This presents the issue of balancing the risk of bring outsiders in, such as the risk of bringing outside disease in, or an increase in crime. This hazard is compounded further by the city's proximity to Interstate 29 increases the likelihood of bring guests in, even those just stopping for a break on an otherwise long trip. The city has taken steps to ensuring visitors spend as much time as possible in town as well, establishing several campgrounds for guests to stay at (*Figure 2*). This presents the added challenge of having to shelter a transient population in the event of severe weather. It is also worth noting here that riverine activities and recreation create potential for missing persons in the water. Drayton has moderate water search and rescue capabilities, but the hazard exists.

Drayton also serves as a main entry into Minnesota via ND Highway 66. The bridge crossing the Red River was replaced in 2009 to help compensate for the frequent heavy flooding in the region, so that many times the bridge remains dry while the roads on either side are inundated. The piers of the bridge have also been spaced so as to impede ice and debris on the river as little as possible. The ND66 bridge provides another corridor for hazardous materials.

Relatively few Tier II facilities exist within Drayton city limits. The most significant site of mention is a Northdale fuel and propane facility located at 912 N Main St (*Figure 3*) that has several above ground tanks and was the site of a major propane release from a truck in 2017 (*Photo 1*).

Drayton is home to an American Crystal Sugar (ACS) refining facility which makes up much of Drayton's economy. While out of city limits, it is near enough to provide a hazard to the city and surrounding areas. While ACS provides several hazards, including more chronic issues, such as pollution that may contribute to climate change, to banal issues, such as molasses spills, the major concern is the use of sulfur dioxide gas (SO2) that the plant uses for cleaning purposes. The quantities and toxicity of this chemical creates a potentially massive plume affecting Drayton, I29, and several square miles of surrounding area. Additional information on this hazard can be found below.

Drayton is served by a dedicated fire department and basic life support (BLS) ambulance, the latter supported by Altru Hospital in Grand Forks. Drayton's proximity to Grand Forks makes emergency medical calls unique, as patients requiring hospital care are transported directly to Altru, rather than Pembina County Memorial Hospital in Cavalier, like most other towns. There is also a dedicated police service of one dedicated to overseeing law enforcement in city limits and is supported by Pembina County Sheriff's Department for additional needs. Drayton Ambulance also supports St. Thomas Quick Response unit for complex calls (*Figures 4, 5 & 6*).

An active rail line runs through the heart of Drayton – north and south – and to supply several industries in town, such as American Crystal Sugar, Cenex Harvest States, and other elevators in the area. The majority of these shipments are non-hazardous, hauling mainly agricultural commodities.

Mitigation Priorities

Drayton's biggest threat continues to be the Red River and the city would benefit from increase flood protective measures. Specifically mentioned was the addition of another pump that could be utilized as a backup for backup lift stations.

Additionally, specific practices with support from the North Dakota State Water Commission and State Senators to officially remove portions of Drayton from the high risk flood area.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

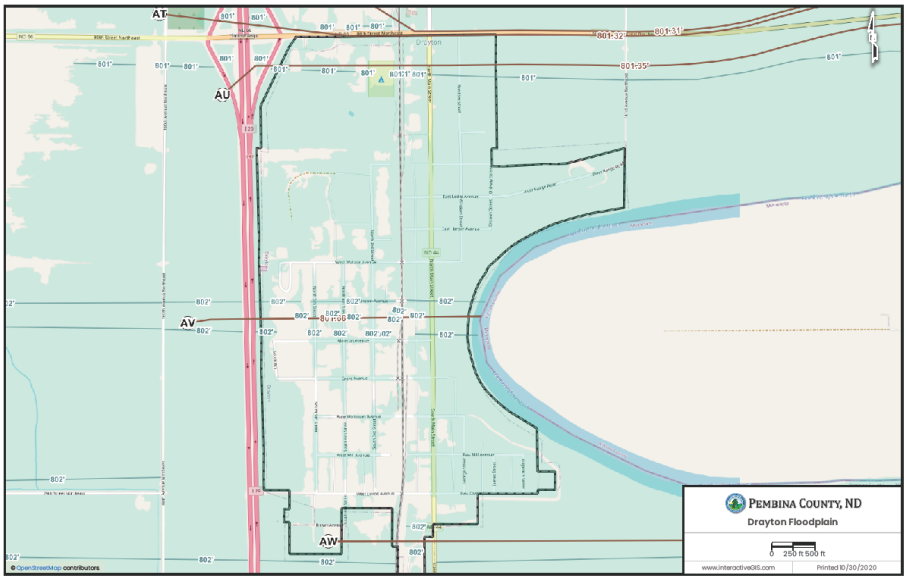
Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

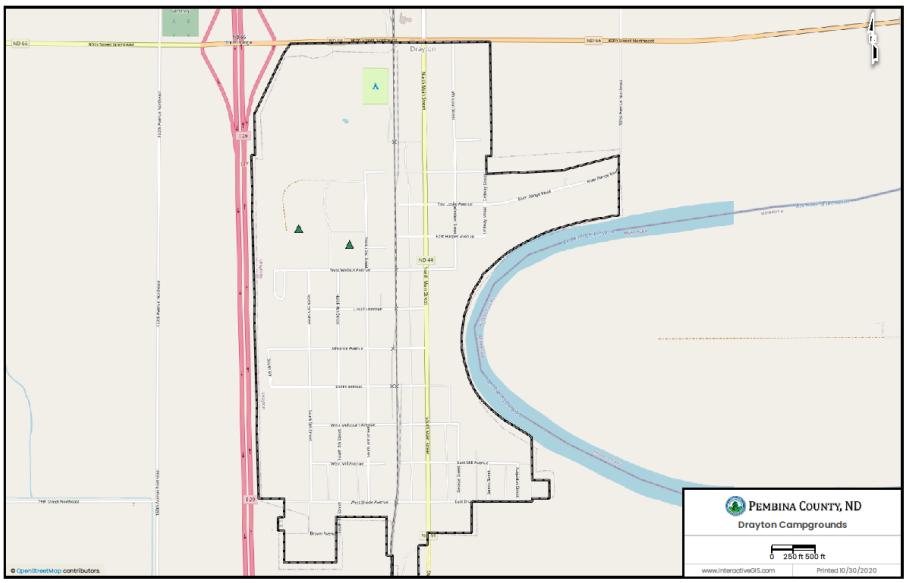
Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	A	C	B	C	D	C	D	D
Critical Transportation	C	A	B	B	A	C	C	D	D
Mass Search and Rescue	B	B	A	B	C	C	D	D	D
Mass Care Services	C	B	C	B	B	C	D	D	A
Logistics and Supply Chain	C	A	B	C	B	B	C	B	A
Housing	A	A	A	C	D	D	C	B	B
Environmental Health/Safety	A	A	C	A	C	D	C	D	B
Fatality Management	C	C	D	C	B	C	D	D	A
Public Health, Healthcare	C	B	C	C	C	B	D	C	A
Fire Management	A	B	C	A	A	B	B	C	C
Law Enforcement	A	B	B	A	A	A	C	C	B
Economic Recovery	D	A	D	D	D	A	B	A	B
Health and Social Services	B	B	C	D	D	C	D	B	C
Natural and Cultural Res.	C	C	C	C	D	C	B	C	D
Planning	B	A	B	A	C	A	C	C	A
Operational Coordination	A	A	B	A	A	A	C	C	A
Situational Assessment	A	A	A	A	A	A	B	C	A
Public Info. and Warning	A	A	A	A	C	B	C	D	A



Field Code Changed

FIGURE 31: DRAYTON FLOODPLAIN, LESS DRAYTON INDUSTRIAL DISTRICT



Field Code Changed

FIGURE 32: DRAYTON CAMPGROUNDS

Field Code Changed

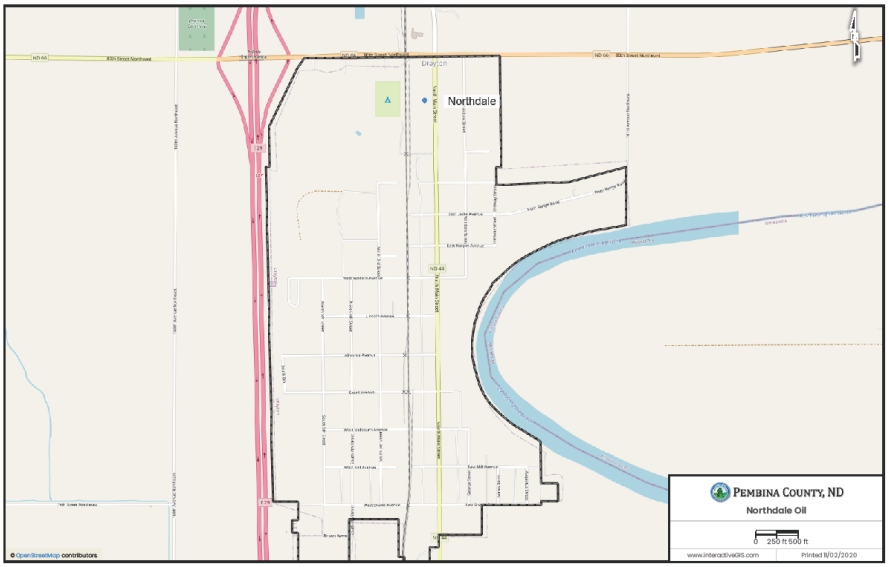


FIGURE 33: NORTHDALE OIL, DRAYTON

PHOTO 2: DRAYTON PROPANE RELEASE

Field Code Changed

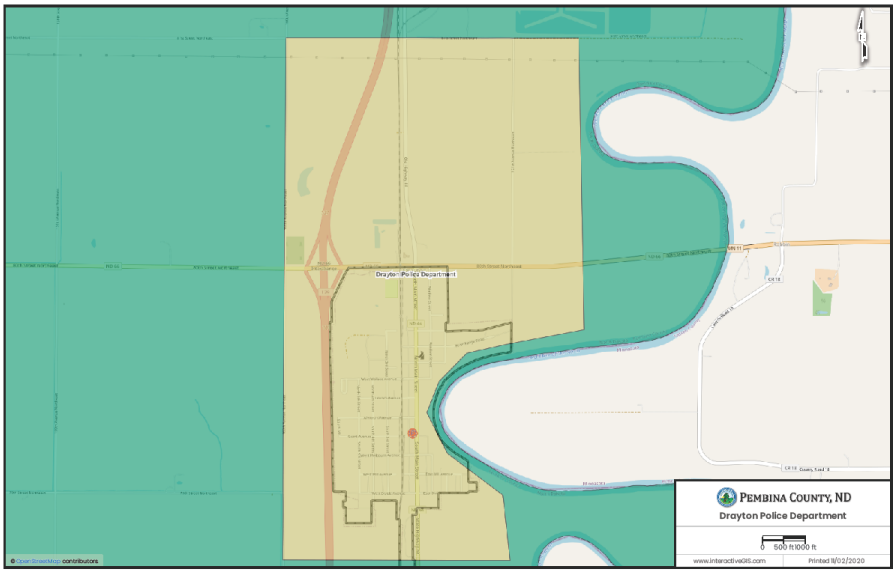


FIGURE 34: DRAYTON POLICE DEPARTMENTS RESPONSE AREA

Field Code Changed

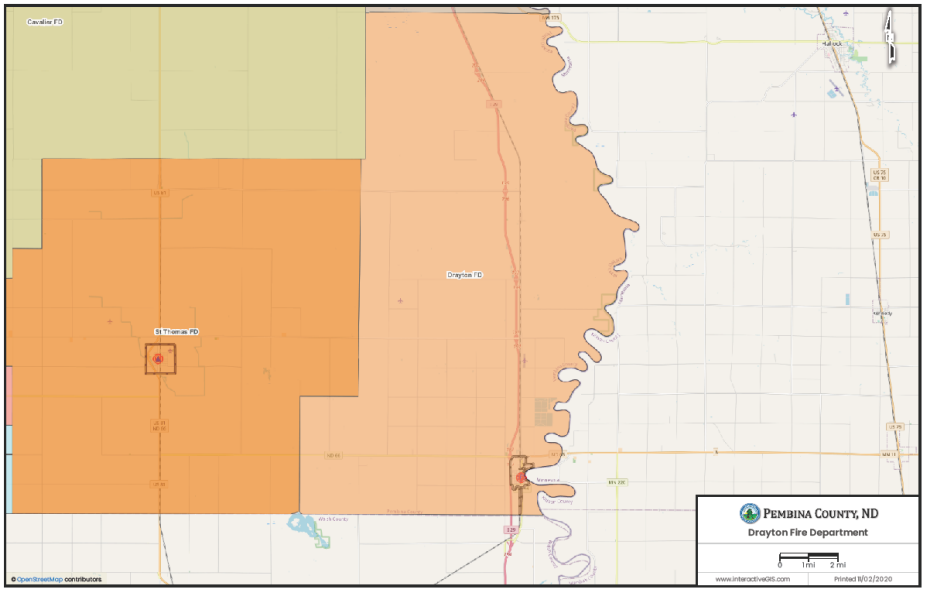


FIGURE 35: DRAYTON FD RESPONSE AREA

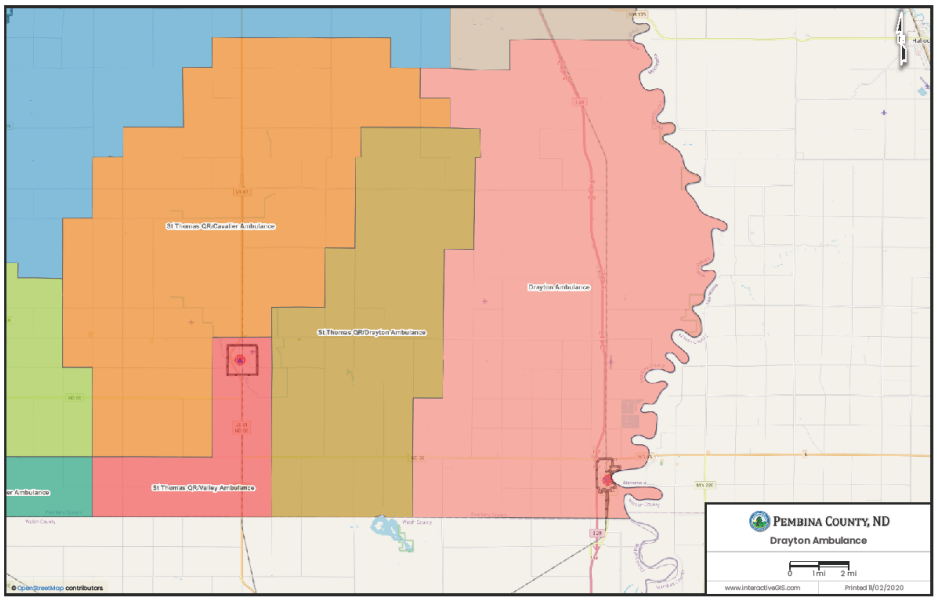


FIGURE 36: DRAYTON AMBULANCE RESPONSE AREA

ERG Pages relating to sulfur dioxide listed below.

Field Code Changed

GUIDE 125 GASES - TOXIC AND/OR CORROSIVE

POTENTIAL HAZARDS

HEALTH

- **TOXIC; may be fatal if inhaled, ingested or absorbed through skin.**
- Vapors are extremely irritating and corrosive.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may cause environmental contamination.

FIRE OR EXPLOSION

- Some may burn but none ignite readily.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Some of these materials may react violently with water.
- Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.
- For UN1005: Anhydrous ammonia, at high concentrations in confined spaces, presents a flammability risk if a source of ignition is introduced.

PUBLIC SAFETY

- **CALL 911. Then call emergency response telephone number on shipping paper.** If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Many gases are heavier than air and will spread along the ground and collect in low or confined areas (sewers, basements, tanks, etc.).
- Ventilate closed spaces before entering, but only if properly trained and equipped.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer **when there is NO RISK OF FIRE.**
- Structural firefighters' protective clothing provides thermal protection **but only limited chemical protection.**

EVACUATION

Immediate precautionary measure

- Isolate spill or leak area for at least 100 meters (330 feet) in all directions.

Spill

- For highlighted materials: see Table 1 - Initial Isolation and Protective Action Distances.
- For non-highlighted materials: increase the immediate precautionary measure distance, in the downwind direction, as necessary.

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping paper and/or the ERAP Program Section (page 390).

EMERGENCY RESPONSE

FIRE

Small Fire

- Dry chemical or CO_2.

Large Fire

- Water spray, fog or regular foam.
- If it can be done safely, move undamaged containers away from the area around the fire.
- Do not get water inside containers.
- Damaged cylinders should be handled only by specialists.

Fire Involving Tanks

- Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

SPILL OR LEAK

- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements or confined areas.
- Do not direct water at spill or source of leak.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- Isolate area until gas has dispersed.

FIRST AID

- Call 911 or emergency medical service.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air if it can be done safely.
- Give artificial respiration if victim is not breathing.
- **Do not perform mouth-to-mouth resuscitation if victim ingested or inhaled the substance; wash face and mouth before giving artificial respiration. Use a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- **In case of skin contact with hydrogen fluoride, anhydrous (UN1052),** if calcium gluconate gel is available, rinse 5 minutes, then apply gel. Otherwise, continue rinsing until medical treatment is available.
- Keep victim calm and warm.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.

HOW TO USE TABLE 1 – INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES

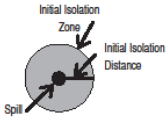
(1) The responder should already have:

- identified the material by its ID number and name (if you cannot find an ID number, use the Name of Material index in the blue-bordered pages to find that number);
- confirmed that the material is highlighted in green in the yellow or blue-bordered pages. If not, Table 1 doesn't apply;
- found the three-digit guide for the material, in order to consult emergency actions it recommends along with this table; and
- **noted the wind direction**

(2) Look in Table 1 (green-bordered pages) for the ID number and name of the material involved. Some ID numbers have more than one shipping name listed. Look for the specific name of the material. If you do not know the shipping name and Table 1 lists more than one name for the same ID number, use the entry with the largest distances.

(3) Determine if the incident involves a SMALL or LARGE spill and if it is DAY or NIGHT. A SMALL SPILL consists of a release of 208 liters (55 US gallons) or less. This generally corresponds to a spill from a single small package (for example, a drum), a small cylinder, or a small leak from a large package. A LARGE SPILL consists of a release of more than 208 liters (55 US gallons). This usually involves a spill from a large package, or multiple spills from many small packages. DAY is any time after sunrise and before sunset. NIGHT is any time between sunset and sunrise.

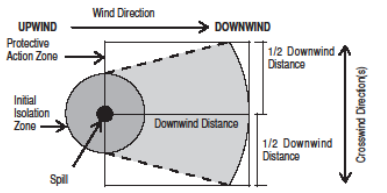
(4) Look up the INITIAL ISOLATION DISTANCE. This distance defines the radius of a zone (initial isolation zone) surrounding the spill in ALL DIRECTIONS. In this zone, protective clothing and respiratory protection is required. Evacuate the general public in a direction perpendicular to wind direction (crosswind) and away from the spill.



(5) Look up the PROTECTIVE ACTION DISTANCE. For a given material, spill size, and whether day or night, Table 1 gives the downwind distance—in kilometers and miles—from the spill or leak source, for which you should consider protective actions. For practical purposes, the protective action zone (i.e., the area in which people are at risk of harmful exposure) is a square. Its length and width are the same as the downwind distance shown in Table 1. Protective actions are the steps you take to preserve the health and safety of emergency responders and the public. People in this area should be evacuated and/or sheltered-in-place. Consult pages 289-291.

(6) Initiate protective actions beginning with those closest to the spill site and working away in a downwind direction. When a water-reactive TIH (PIH in the US) producing material is spilled into a river or stream, the source of the toxic gas may move with the current or stretch from the spill point downstream for a large distance.

In the figure below, the spill is located at the center of the small black circle. The larger circle represents the initial isolation zone around the spill. The square (the protective action zone) is the area in which you should take protective actions.



Note 1: For factors that may change the protective action distances, see "Introduction to Green Tables" (page 286).

Note 2: When a product in Table 1 has the mention (when spilled in water), you can refer to Table 2 for the list of gases produced when these materials are spilled in water. The TIH gases indicated in Table 2 are for information purposes only.

For more information on the material, safety precautions and mitigation procedures, call the emergency response telephone number listed on the shipping paper or the appropriate response agency as soon as possible.

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Special Vulnerability Assessment
Extreme Weather
Extreme wind and precipitation events in the area are prepared for with advanced warning, and the ability of several community shelters, intended for stranded individuals as well as the citizens. Drayton his home to several campgrounds, and campers are encouraged to monitor the weather for themselves, and provided advanced warning by storm sirens around the town. While shelters are available, dedicated shelters in closer proximity to campgrounds would be of benefit. Severe winter weather has the greatest effect on transportation and traveling population which may be stranded on their journey along Interstate 29 on the west side of the community. These roads are cleared and maintained by the ND Department of Transportation, which operate a station out of Drayton's industrial park.
Wildland Fire (Wildland-Urban Interface)
The greatest threat for wildland fires comes from the brush along the Red River on the east side of Drayton. During draught years, vegetation can dry out, providing a rapid corridor for fire promulgation. The median between lanes of interstate, and ditches alongside if not properly maintained may also provide fuel for fire, though the community is set back far enough from the road that fire personnel would have ample time to respond to and protect the community.
Flooding
The proximity to the Red River poses an extreme risk to flooding, however the city continues to learn lessons and build a robust flood fighting plan. Several lift stations help move water out of neighborhoods, and rented pumps expand this capability. Several earthen dikes provided by FEMA help protect the town, and problem areas are routinely temporarily diked by clay provided by a local contractor.
Dam Failure
There is no dam failure risk for Drayton.
Drought
The risk of draught to Drayton is secondary in its increased risk of wildfire, and effects on the Drayton economy.

Community Profile: Hamilton, ND 58238

Hamilton is a small farming community in central Pembina County at the intersection of North Dakota Highway 5 and North Dakota Highway 81. A standard farming community, Hamilton is also home to the Pembina County Fairgrounds, a 32 acre property on the south edge of town. This area is used annually to host the Pembina County Fair, drawing hundreds from the region and without hosing a carnival and midway, horse races, and 4-H farm and livestock showing. These grounds are used as a campground for temporary harvest workers in the fall, and has been used for special projects, such as a pipeline replacement project in summer 2020.

There are no direct hydrological threats to Hamilton, though the flat geography of the area means overland flooding can impact the community, especially in terms of transportation and supply. Regardless of its distance from waterways, a significant portion of the city exists in the 1% floodplain (*Figure 1*).

Because of its low population – estimated to be 60 residents in 2018 – Hamilton has no first responder agencies within city limits. Instead, the town relies on fire and medical support from Cavalier and law enforcement from the Pembina County Sheriff's Office. For this reason, emergency aid typically has a slight delay compared to other cities with their own services. During large events, like the county fair, first responders will often be staged in the city to reduce the responder latency.

American Crystal Sugar Company has a beet piler approximately ½ mile away from city limits and contributes to the economy of the town. It also introduces a high concentration of temporary employees to the city every fall for several months. Occasionally, these temporary employees bring criminal records and actives with them and can pose a risk to residents. Law enforcement is aware of this situation and schedules patrols accordingly.

Mitigation Priorities

Hamilton is a small community along ND Highway 5/US 81 that hosts the Pembina County Fair every year. The major risks on a day to day basis are transportation accidents or hazmat release along the highway. While vulnerable to severe weather, the city's location along the highway provides easy access to responders and supply units. Though the city itself has very little in terms of public works or stores for supplies, they can be easily hauled in.

The town is susceptible to severe weather due to its limited public works and aging structures. The city has no designated storm shelter, and residents would need to rely on safe rooms in their own homes. In the winter time, residents would need to wait for assistance from state or county resources for heavy equipment to remove snow.

- Build a high-capacity storm shelter,
- Plant a living snow fence along the west side of the city,
- Conduct an engineering study to determine better drainage practices for the fairgrounds.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	A	B	B	D	C	D	D	C	C
Critical Transportation	C	B	C	D	B	C	C	C	C
Mass Search and Rescue	C	C	B	D	C	C	D	D	C
Mass Care Services	C	B	B	C	B	C	D	D	A
Logistics and Supply Chain	C	B	C	C	C	C	C	C	B
Housing	A	B	B	C	D	C	D	B	B
Environmental Health/Safety	C	B	C	A	C	C	C	D	D
Fatality Management	C	D	C	C	B	C	D	D	B
Public Health, Healthcare	B	C	B	C	C	C	D	D	A
Fire Management	A	C	B	B	A	C	D	D	B
Law Enforcement	A	C	B	B	A	A	D	D	A
Economic Recovery	B	C	C	D	D	C	C	A	B
Health and Social Services	B	C	C	D	C	C	D	B	B
Natural and Cultural Res.	C	D	C	C	C	C	C	C	C
Planning	B	B	A	B	C	C	C	C	A
Operational Coordination	A	B	A	B	B	A	C	C	A
Situational Assessment	A	B	A	B	B	A	C	C	A
Public Info. and Warning	B	B	A	C	B	B	D	D	A

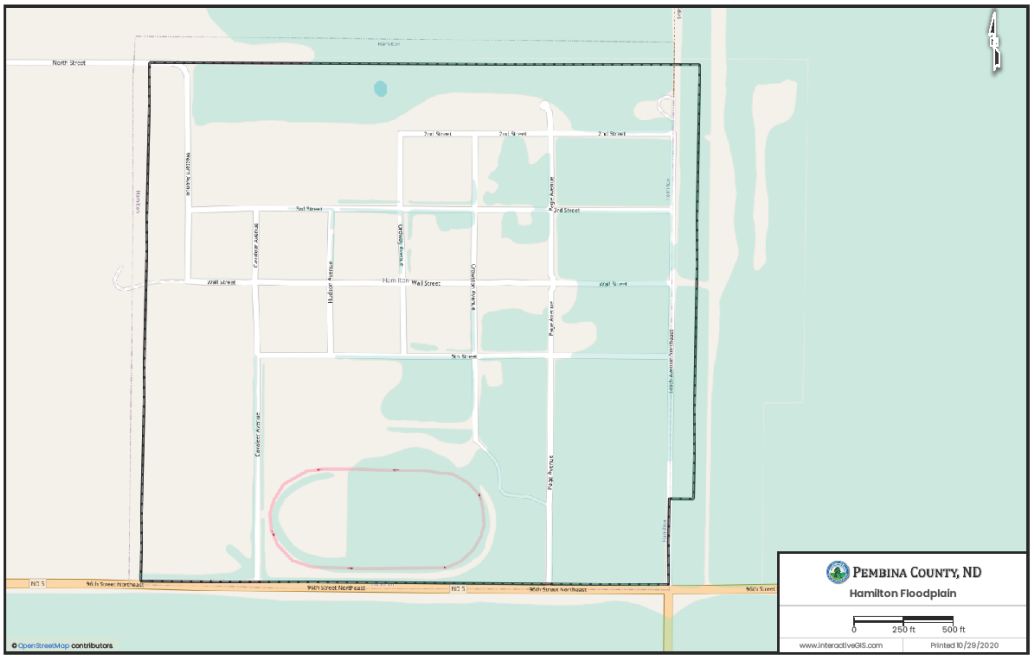


FIGURE 37: HAMILTON FLOODPLAIN

Special Vulnerability Assessment
Extreme Weather
Severe weather events have long been planned for and scrutinized in Hamilton, as every year the fair brings in hundreds of guests. Emergency Management works closely with the National Weather Service for advanced warning of events, and many buildings have been converted into storm shelters that can withstand most events. Winter weather has a moderate impact, mainly effecting transport in and out of the town, sometimes critical in the event of life threat emergencies.
Wildland Fire (Wildland-Urban Interface)
Hamilton is well protected against wildfire, as it is bordered on all sides by cropland, often too lush to contribute to fire spread.
Flooding
There is minimal risk of flooding to businesses or residences, though low-lying areas in the fairgrounds often have to be pumped out after heavy rains before they can be utilized.
Dam Failure
There is no dam failure risk for Hamilton.
Drought
Draught has the greatest impact on Hamilton's economy, as most residents work in agriculture and other industries support local farmers.

Commented [DKB27]: Requirement B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction?

Either in the hazard profile of this section, include an analysis of vulnerability for each of the natural hazards (and, if time permits, the others). Some jurisdictions include a chart, others narrative.

As examples of vulnerability, discuss at a minimum:

Extreme Weather – Is there adequate sheltering? What is the construction of the homes – wood or brick? Are there snow load building codes? Are there schools or daycare? If so, how many? How many seniors? How many people under 5? For the county, do most residents have generators?

Wildland Fire – Where is the wildland fire urban interface? Which sides of the city? Is the city surrounded by cropland? For the county, where are the areas of greatest risk (such as the Pembina Gorge).

Flooding – The maps are good. Consider a brief narrative identifying the sections of town at risk and also whether there is critical infrastructure in those locations. For the county, discuss areas and infrastructure most at risk.

Dam Failure – Not all jurisdictions will be impacted, so you will need to state which ones are at risk and indicate the others are not at risk. Be sure to identify potential areas of inundation for the cities. Also discuss areas of inundation for the county.

Drought – This is a tough one in that all impacts are similar for each jurisdiction. A good way to address this is to list each jurisdiction's water source and indicate whether the city considered adequate for drought conditions. For the county, discuss potential livestock and agricultural losses.

If time permits, consider including communicable diseases (such as vulnerable populations), structural and automotive fires (how many reports of structural and automotive fires or does the jurisdiction think it has adequate resources), shortage of critical materials (what loss of resource is most concerning to the community?), homeland security incident (how many vulnerable sites) and transportation incidents (identify rail, roads and airports).

Community Profile: Hensel (Canton City), ND 58241

There is some local dispute whether the community seven miles south-southwest of Cavalier should be named "Hensel" or "Canton City". For the purposes of this document, it will be referred to as "Hensel" in congruence with local maps.

Hensel is a small farming community located along Pembina County Highway 3 and bisected by a Burlington Northern Sante Fe rail line. There are only an estimated of 35 residents in a 2018 survey, which includes people technically outside of community boundaries. There are no Tier II facilities, no fire, EMS or law enforcement, and the only critical facility is a post office. There is a functioning grain elevator, but no other businesses. Fire services are provided by Crystal FD, EMS by Cavalier Ambulance, and law enforcement by Pembina County Sheriff's Department.

Mitigation Priorities

Hensel is home to only a few homes and runs through the town, presenting both a possible transportation incident scenario, as well as the possibility for a hazardous materials release. More plausible as it relates to natural hazards is the likelihood of severe weather. Hensel is a relatively isolated community, with few city resources. Following a major snowstorm, residents would likely need assistance from the county or state to dig out. The town has no community tornado shelters, potentially leaving non-residents out in severe weather.

The community has the risk of flooding as it is downhill of the community of Mountain, and the ditches along County Highway 3, provide channels to funnel the water into the town.

- Construction of a severe weather shelter

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

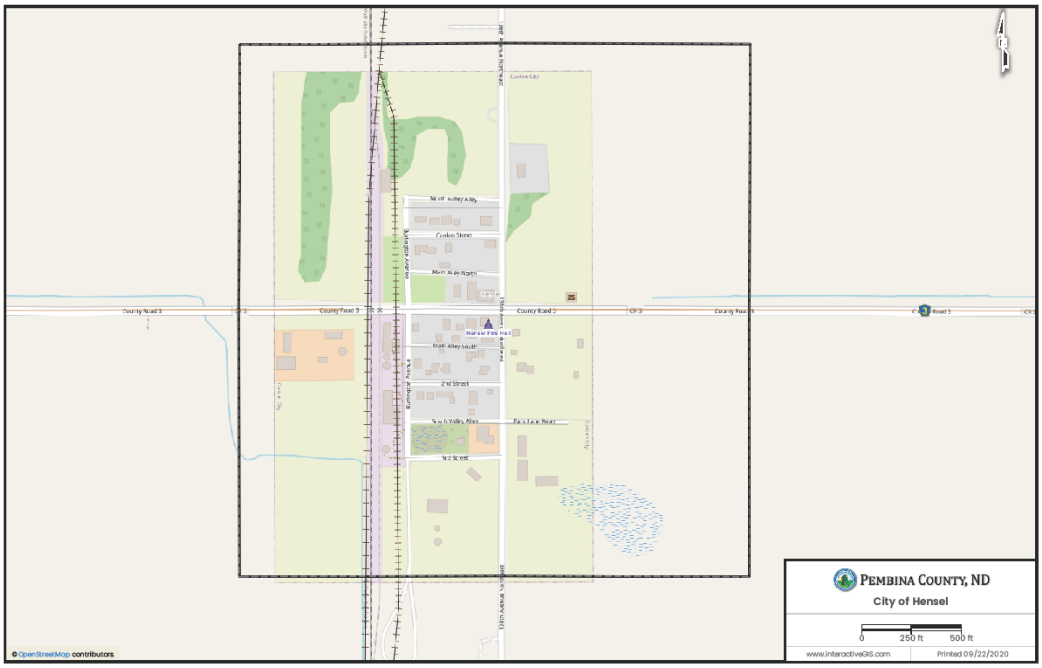
Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	A	B	D	D	D	C	D	D
Critical Transportation	C	A	C	D	C	D	C	D	D
Mass Search and Rescue	C	D	C	D	C	D	D	D	D
Mass Care Services	C	D	C	C	C	D	D	D	B
Logistics and Supply Chain	C	B	C	D	D	D	C	D	B
Housing	A	C	C	D	C	D	C	D	C
Environmental Health/Safety	A	C	C	C	D	D	C	D	C
Fatality Management	C	D	D	D	D	D	D	D	B
Public Health, Healthcare	C	D	D	D	D	D	D	D	B
Fire Management	A	D	C	D	B	D	B	D	D
Law Enforcement	A	C	B	B	B	A	C	D	C
Economic Recovery	D	C	D	D	D	D	C	B	D
Health and Social Services	C	C	D	D	D	D	D	C	C
Natural and Cultural Res.	D	D	D	D	D	D	D	D	D
Planning	C	C	C	C	C	C	C	D	C
Operational Coordination	A	B	C	B	B	B	C	D	C
Situational Assessment	A	B	B	B	B	B	C	C	C
Public Info. and Warning	A	B	B	C	D	C	D	D	C



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Special Vulnerability Assessment
Extreme Weather
Hensel has no identified storm shelters, though residents often have individual plans, such as going to a neighbor's with a basement, etc. Advanced warning is key for this small community.
Wildland Fire (Wildland-Urban Interface)
Very low risk for wildfire spread due to nearby agricultural practices.
Flooding
Hensel faces significant threat from overland flooding, spurred by snowmelt rolling off the Pembina Gorge escarpment. A railroad track owned by Burlington Northern Sante Fe provides some protection from this threat, though the greatest impact is generally just limited mobility of infrastructure.
Dam Failure
There is no dam failure risk for Hensel.
Drought
Long-term dry trends impact the exclusive agriculture economy of Hensel.

Community Profile: Mountain, ND 58262

Mountain is a small agricultural-based community located on the western edge of Pembina County. Most of the town's residents are involved in agriculture some way or another and the few businesses in the community support agriculture almost exclusively. The exception is the Borg Home – an assisted living community with 43 beds available.

Every year, the community holds an Icelandic folk festival, known as August the Deuce. Many of the town's residents and founders shared a strong Icelandic heritage and this festival pays homage to that, though has been opened up to include festivities for many other locals as well. The festival as even brought in Icelandic officials, as high as the Icelandic Primer Minister Katrin Jakobsdottir in 2018.

As with any gathering, this provides a potential risk for unrest, terrorism or communicable disease outbreak. Significant planning goes into the event, including meetings with health officials, law enforcement and city government. The event provides significant income for the entire region and is anticipated by the whole region in the lead-up.

Mountain derives its name from the community's location on the Pembina Gorge escarpment, or what was once the beaches of historic Lake Agassiz. This location leaves the city susceptible to inclement weather, especially for summer storms. Reference the Severe Storm section of this document for detailed incidents regarding this region. Due to its relatively varied geography, the risk of areal flooding is almost non-existent. However the slope conversely provides minor risk of flash flooding that can interrupt some transportation services in very specific instances.

The eastern edge of Mountain is formed by North Dakota Highway 32 and the north edge defined by Pembina County Highway 3. Residents and business are set back from the state highway far enough that hazardous material incidents rare extremely unlikely. There is a single Tier II facility in Mountain, a cardtol service station operated by Northdale Oil.

Mountain Fire/Rescue services a moderate sized area around the city and provides mutual aid to Cavalier Air Force Station, a military radar installation nearby. Support is reciprocated by the Air Force installation and mutual aid provided by Cavalier Fire Department and Cavalier Ambulance. Pembina County Sheriff's Department provides law enforcement services.

Mitigation Priorities

Mountain is another small farming community. It is situated at the intersection of ND 32 and County 3 and survives primarily on the ag economy and a yearly Icelandic festival known as August the Deuce. Transpiration accidents are of concern along the highway, and ag-related products being hauled create an opportunity for hazardous material release.

Severe weather poses a threat for the community, as few stores means a relatively small stockpile of critical supplies. There is a large community center and café that can serve as a shelter for displaced citizens. The community center is also wired with communication lines and backup power to serve as a secondary EOC for the county.

Mountain is one of the few communities susceptible to wildfire. As its name may imply, Mountain is on a hill, and should there be dry conditions, unkempt ditches, etc., fire can spread rapidly uphill and into the town. Many of the town's structures are historical and the streets are tree-lined.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

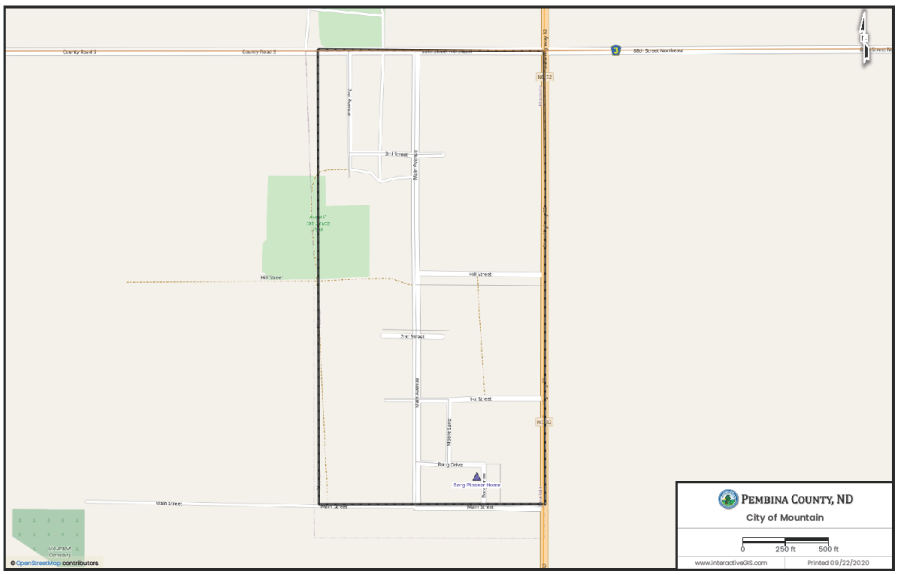
Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

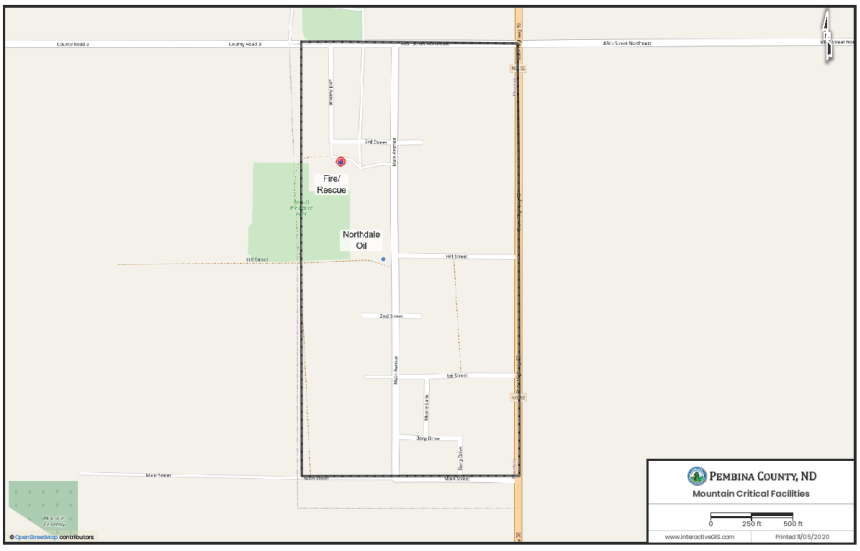
Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	C	D	A	D	C	D	C	D	D
Critical Transportation	D	C	B	D	B	C	C	D	D
Mass Search and Rescue	C	D	B	D	C	C	D	D	D
Mass Care Services	C	D	C	C	B	B	D	D	A
Logistics and Supply Chain	C	C	B	D	B	B	C	B	A
Housing	A	D	B	C	D	C	C	B	B
Environmental Health/Safety	A	D	C	B	D	D	C	D	B
Fatality Management	C	D	C	C	C	C	D	D	A
Public Health, Healthcare	C	D	C	C	C	B	D	C	A
Fire Management	A	D	B	A	A	B	B	C	C
Law Enforcement	A	C	B	A	A	A	C	C	B
Economic Recovery	C	D	C	D	D	A	B	A	B
Health and Social Services	B	D	C	D	D	C	D	B	C
Natural and Cultural Res.	C	C	B	C	D	C	B	C	D
Planning	C	C	B	A	C	B	B	C	A
Operational Coordination	A	C	B	A	A	A	C	C	A
Situational Assessment	A	C	A	A	A	A	A	A	A
Public Info. and Warning	A	D	A	B	C	B	B	B	A



Field Code Changed

FIGURE 38: BORG ASSISTED LIVING FACILITY



Field Code Changed

FIGURE 39: CRITICAL FACILITIES IN MOUNTAIN

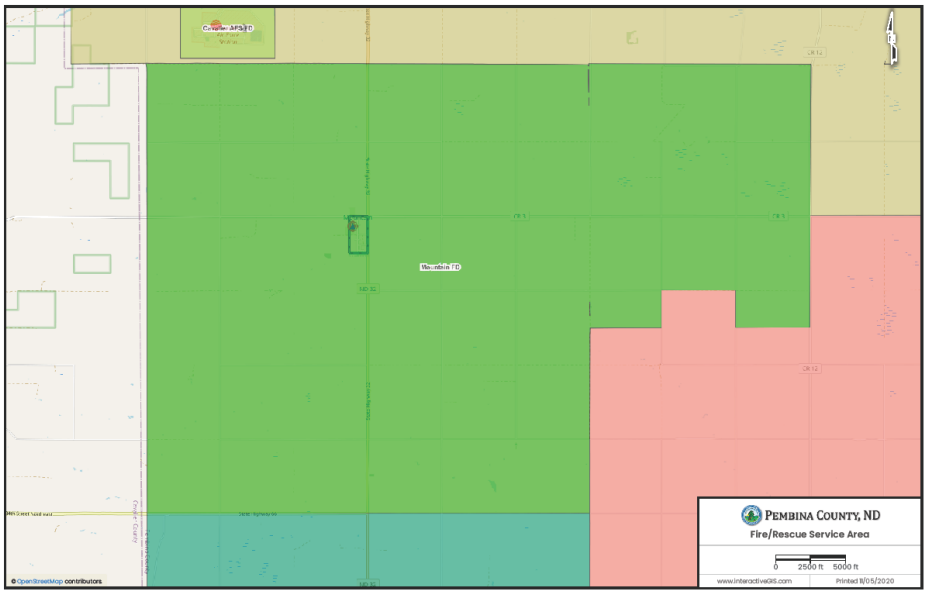


FIGURE 40: MOUNTAIN FIRE/RESCUE SERVICE AREA

Field Code Changed

PHOTO 3: GOVERNOR BURGUM AND PRIME MINISTER JAKOBSDOTTIR AT THE 2018 AUGUST THE DEUCE

PHOTO 4: PARADE AT AUGUST THE DEUCE

Special Vulnerability Assessment
Extreme Weather
More than any other community in Pembina County, Mountain seems to receive a higher incidence of severe weather. Meteorologists contribute this to the unusual weather patterns from the Pembina Gorge at almost annually bring one or more significant wind event. The town is primarily self-sufficient in cleanup and recovery and are supported by advanced warning by the county. A storm shelter and mass shelter facility for the displaced exist within town.
Wildland Fire (Wildland-Urban Interface)
Proximity to the gorge also greatly increases the risk of wildfire in and around the community. Mountain fire department has made themselves very proactive, investing in grassland firefighting apparatus as well as foam retardant to better control wildfire.
Flooding
No flooding risk exists for the community due to its location on a hill.
Dam Failure
There is no dam failure risk for Mountain.
Drought
The risk of draught to Mountain is secondary in its increased risk of wildfire, and effects on the Mountain economy.

Community Profile: Neche, ND 58265

The City of Neche is located centrally in Pembina County, just a mile from the Canadian Border. It was established in 1882 as a trading post and became a port of entry between the United States and Canada in 1883, connecting to the nearest Canadian city, Gretna, Manitoba. North Dakota Highway 18 acts as the western border of the city, providing easy access to business and manufacturing in Neche. A railroad used to serve elevators in Neche, but that line has since been abandoned.

Much of the economy of Neche is based around manufacturing and agricultural support industries, such as seed and fertilizer sales. Many of the manufacturing business are owned and run by families belonging to the Plymouth Brethren Christian Church. Products are shipped nationwide and internationally. Agricultural services sell almost exclusively to US farmers within 10-15 miles of Neche. The border crossing consists of mainly local international traffic, as much of the commercial, long-range traffic passes instead through the Pembina-Emerson Port of Entry.

The Pembina River winds around the north end of Neche and provides a minor threat to the city. The greatest threat from the river is realized through river jams and debris pileups as flood runoff moves through the many twists and turns of the river. This impedance prevents floodwaters from receding into the river and are instead forced to flow across the landscape. To reduce risk, Neche constructed an earthen dike around the city limits to reduce risk from this overland flooding. For many years, Neche has battled to have this dike certified by the Army Corps of Engineers and to be recognized by the National Flood Insurance Program (NFIP), though has received very little assistance from the state or Federal Governments. The town therefore has funded much of the studies themselves and are finally on the verge of approval of the dike as of the writing of this document (October 2020). The rough placement of the dike can be seen on *Figure 1*. The green shading seen in the map is the 1% flood hazard area and certification of the dike would remove risk within the blue line.

Despite the amount of manufacturing in Neche, there are only two registered Tier II Facilities within Neche city limits. They can be found on *Figure 2* marked in blue.

Neche is served by an independent fire response unit, and is supported by Cavalier Ambulance for medical, and Pembina County Sheriff's Department for law enforcement. Mutual aid agreements exist with US Border Patrol and US Customs and Border Protection for assistance in emergencies as well, the best example of which was a plane crash in the summer of 2020 where a Border Patrol agent and trained EMT assisted Neche Fire Department to extricate the pilot. The fire district area and photos of the plane crash can be found in *Figures 3 & 4* respectively.

Mitigation Priorities

Neche lies along ND 18 and is home to a U.S. Customs Port of Entry. For that reason, in addition to transportation accidents, Neche also faces the possibility – though remote – of a homeland security incident.

The economy of Neche relies on agriculture, though the town also boars a rather robust industrial park. Hazardous materials are abundant in town and the potential exists for a large-scale release. Drainage and a river coupled with release could produce an ecological disaster.

The Pembina River running north of the city creates flooding issues on a somewhat regular basis. The city has taken measures to construct a dike around the city and has a pretty good handle at responding to floods and the town can stay dry even after the highway has water running over it. Supply lines are a must both for resources like food, and materials to keep the industrial sector functioning.

The city has several stout structures that could be used as severe weather shelters, but need to be identified and made known to residents and visitors.

- Certify dike,

Commented [DKB28]: I can review the actions, the previous actions and existing authorities when you are done. Also don't forget to consider an action for all of the NFIP participating jurisdictions to continue compliance with NFIP requirements such as reviewing ordinance and holding NFIP workshops.

- Upgrade pumps and valves in the city's pumping station to handle growing needs,
- Clean city lagoon.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	A	A	C	D	C	D	D	C	C
Critical Transportation	C	A	C	D	B	C	C	C	C
Mass Search and Rescue	C	C	B	C	B	C	D	D	C
Mass Care Services	B	B	C	B	B	C	D	D	A
Logistics and Supply Chain	C	A	C	B	B	C	C	C	B
Housing	A	A	B	C	D	C	D	B	B
Environmental Health/Safety	B	A	C	A	B	C	C	D	D
Fatality Management	B	C	C	C	B	C	D	D	B
Public Health, Healthcare	B	B	B	B	B	C	D	D	A
Fire Management	A	C	B	A	A	C	D	D	B
Law Enforcement	A	B	B	A	A	A	D	D	A
Economic Recovery	C	B	C	C	D	B	C	A	B
Health and Social Services	B	B	C	C	C	B	D	B	B
Natural and Cultural Res.	C	B	B	B	C	B	C	C	C
Planning	B	A	A	A	B	B	C	C	A
Operational Coordination	A	A	A	A	A	A	C	C	A
Situational Assessment	A	A	A	A	A	A	C	C	A
Public Info. and Warning	B	B	A	C	B	B	D	D	A

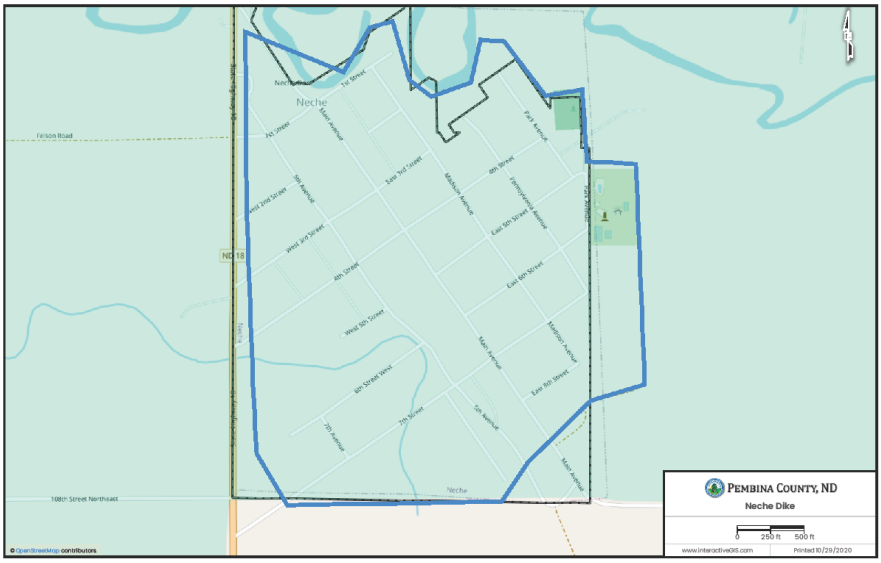


FIGURE 41: NECHE DIKE

FIGURE 42: NECHE HAZMAT

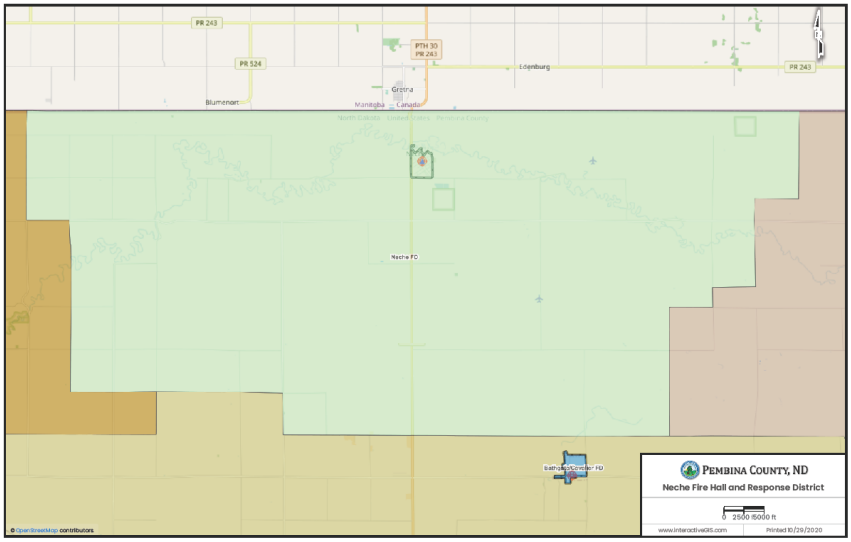


FIGURE 43: NECHE FIRE/RESCUE SERVICE AREA3

FIGURE 44: NECHE PLANE CRASH

Special Vulnerability Assessment
Extreme Weather
Neche has no designated storm shelters, however several robust buildings provide shelter for residents. Severe winter weather can inhibit travel, but generally has few other detriments to the community.
Wildland Fire (Wildland-Urban Interface)
The nearby Pembina River can provide a vector for spreading fire, but generally the urban interface reduces this risk.
Flooding
Neche is doubly susceptible to flooding, one as floodwaters escape the Pembina River and flow overland, and as ice jams and debris restricts the flow out of the city. Much of this has been mitigate through planning and levee construction.
Dam Failure
There is no dam failure risk for Neche.
Drought
The risk of draught to Neche is secondary in its increased risk of wildfire, and effects on the Neche economy. **Neche has performed significant repairs and upgrades to their water tower in order to hold and store water in case of emergency. While these repairs have solved problems short term, it is anticipated that a replacement may be needed.**

Community Profile: Pembina, ND 58271

From the City of Pembina website:

The first settlement in the Dakota Territories; the first trade link between the Mississippi River at Minneapolis/St. Paul and Hudson Bay at Winnipeg, Manitoba. Home of Oxcart Trails and the Metis Culture, we are the entry to the Rendezvous Region. We are a community steeped in history and growing toward the future.

As stated above, the City of Pembina has a deep history and significance to the region, and is the namesake for Pembina County. A town of 553 people in 2018, the community is located in the northeast corner of the county and is situated on the confluence of the Pembina and Red Rivers. Its proximity to Interstate 29 and a river crossing into Minnesota makes Pembina a critical trade town, not just for the county but for the region. More road traffic passes through the Pembina Port of Entry than any other US land port of entry from Detroit to Seattle, feeding directly into the heartland of the United States. This also demands a higher than average concentration of federal employees to oversee the border crossing and protection.

Much of Pembina's economy is in support of travel and trade, creating a thriving environment of parcel drop off and shipping services for items that cannot be shipped internationally. Many of these are "mom and pop" local business, but there is also a presence of larger carriers, such as FedEx. Other support business such as a duty free station and major truck stop also exist. Pembina is also home to a major employer – Motor Coach Industries that builds and repairs large buses meant for over the road travel and metro area transit.

Federal agency stations include the port of entry approximately two miles north of town along I-29, a US Customs and Border Protection station in downtown Pembina (which is in the process of being decommissioned and staff transferred to the port of entry), and a regional Border Patrol station on the south side of town. The Border Patrol station is the main depot for agent training, motor pool, weapons and ammunition, offices, and has the ability to function as a detention facility.

Like much of the rest of the region, agriculture also plays a major role in the Pembina economy, and many residents either farm or work in agriculture-related fields. As flooding becomes more frequent and more severe in the region, much of the farmland has been transitioned into Conservation Reserve Program (CRP) land or waterfowl protection land as the growing window is simply too small, or the soils never dry enough to be feasible.

Due to flooding concerns, Pembina has developed a robust flood protection strategy, including an Army Corps of Engineers (ACE) levee around the city proper in order to reduce flood risk, and provide relief for citizens participating in the National Flood Insurance Program (NFIP). This levee was completed in 2018 and is a combination of earthen dikes and cement structures, and several "invisible" flood walls over roadways that can be shored up by dropping in water-tight gates. While this activity reduces traffic in and out of town, it does protect properties within.

Reporting hazardous materials facilities in the city are relatively limited – only fueling stations and commercial liquid petroleum tanks used for heating in the federal buildings. Motor Coach Industries has several listed hazardous materials on-site in the forms of large quantities of motor oil, antifreeze and pant products.

Pembina has separate fire and ambulance services, and contracts law enforcement through the county sheriff. Pembina Ambulance coverage area encompasses the entire northern section of Interstate 29, as well as the port of entry, providing them with a higher than normal amount of vehicle related calls. Pembina Ambulance is supported by advanced life support capabilities of Cavalier Ambulance who will assist with treatment and transport on request.

Pembina Fire Department has a similar response zone, and similar to the ambulance has devoted a great amount of time and training to vehicle extrication. Also, due to their proximity to two major rivers in the county, they have a history of robust water rescue training.

Finally of note, there is a state natural history museum on the northwest side of town featuring many exhibit relating to the history of the region, and includes an observation deck several stories above the ground.

Mitigation Priorities

Pembina is home to the busiest port of entry from Detroit to Seattle. The border crossing is approximately 2 miles from town, but Pembina is also base for several Border Patrol and Customs Offices. Interstate 29 is the western boarder of the town and there is a boarder rail crossing station across the Red River in Minnesota to the east. There is a very high risk for a homeland security incident, traffic incident, and hazardous materials incident.

The Pembina River joins the Red River in city limits, causing massive flooding problems from two rivers. Flooding occurs most often in the springtime with snow melt, although the hazard also exists during wide-spread heavy rains when both rivers become engorged. There is diking around much of the city, but there are part of the town that are still at risk.

Due to the flooding, many of the fields in around Pembina have been converted into CRP land or put into other federal programs. With land returned to its natural state, wildfires pose a serious problem during dry conditions and a lack of trees in the region means wind plays a much larger role in any hazard. The city has a large enough public works department that they are able to handle most damages from summer storms, and they are able to dig out from most winter events.

As a larger community, and with a high number of visitors moving through town, there is the possibility for communicable disease within city limits. There is no clinic in city limits, so any ill individuals would have to travel to Cavalier, or beyond to Grand Forks.

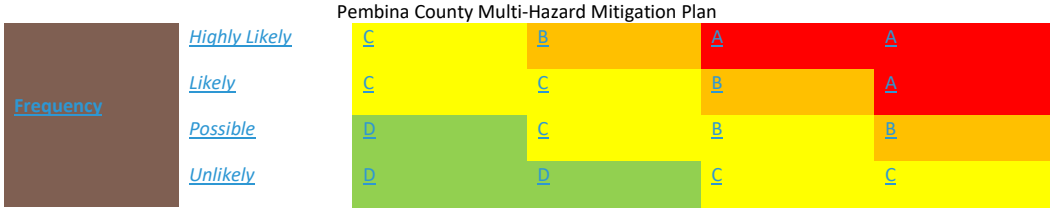
Severe weather moving through the area has the potential to cause damage to aging infrastructure and aging trees in town. There are some sheltering structures in the community for citizens to seek shelter in, though most would have to rely on their own homes.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

	Severity			
	Negligible	*Limited*	*Critical*	*Catastrophic*


Frequency
Highly Likely
Likely
Possible
Unlikely
C
B
A
A
C
C
B
A
D
C
B
B
D
D
C
C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	A	C	C	C	C	C	D	B
Critical Transportation	B	A	B	B	B	C	C	C	B
Mass Search and Rescue	B	B	C	D	C	C	D	D	D
Mass Care Services	A	B	D	C	C	D	D	D	A
Logistics and Supply Chain	B	A	C	C	B	D	C	C	B
Housing	B	C	D	D	D	D	C	C	D
Environmental Health/Safety	C	C	D	B	D	D	C	D	D
Fatality Management	C	C	D	C	C	D	D	D	C
Public Health, Healthcare	C	B	D	D	C	C	C	C	A
Fire Management	A	B	C	C	A	C	C	D	D
Law Enforcement	A	A	C	C	A	A	D	D	D
Economic Recovery	C	C	D	D	D	B	C	B	C
Health and Social Services	C	C	D	C	D	C	D	C	A
Natural and Cultural Res.	B	B	C	C	C	B	C	B	B
Planning	B	A	B	D	B	A	C	B	A
Operational Coordination	A	A	B	C	B	A	D	D	A
Situational Assessment	A	A	C	B	C	A	C	D	A
Public Info. and Warning	B	A	A	C	C	B	C	D	B

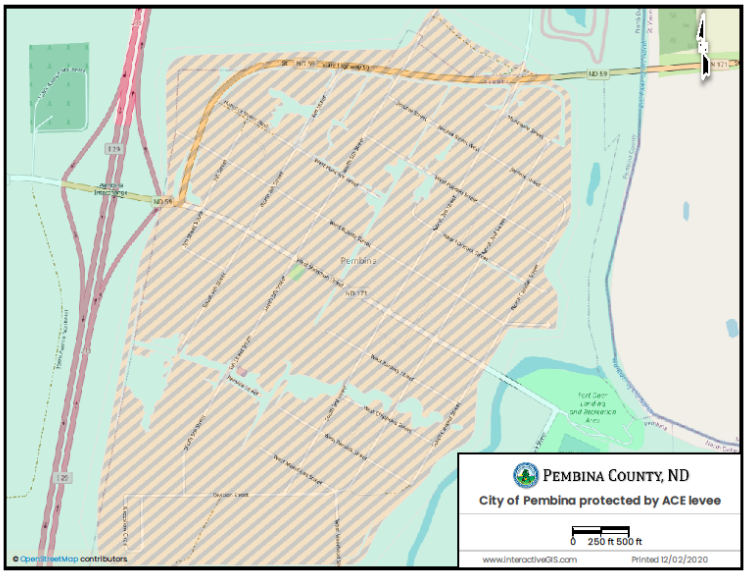


Figure 45: Pembina protected by levee

Field Code Changed

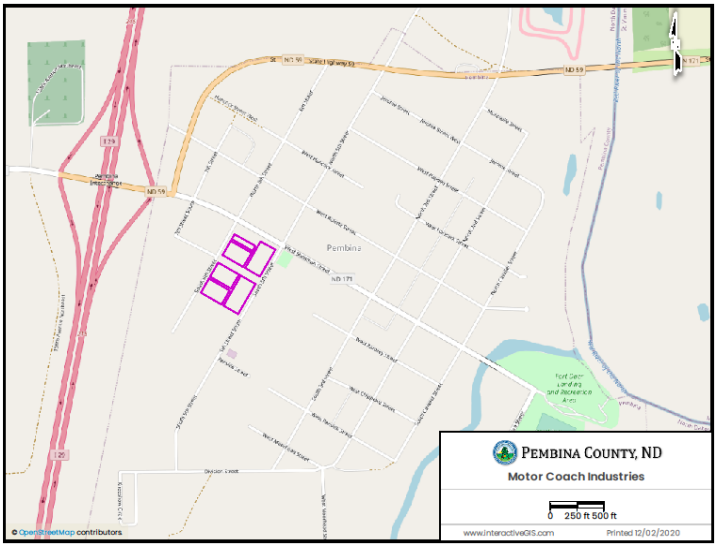


Figure 46: Location of Motor Coach Industries

Field Code Changed

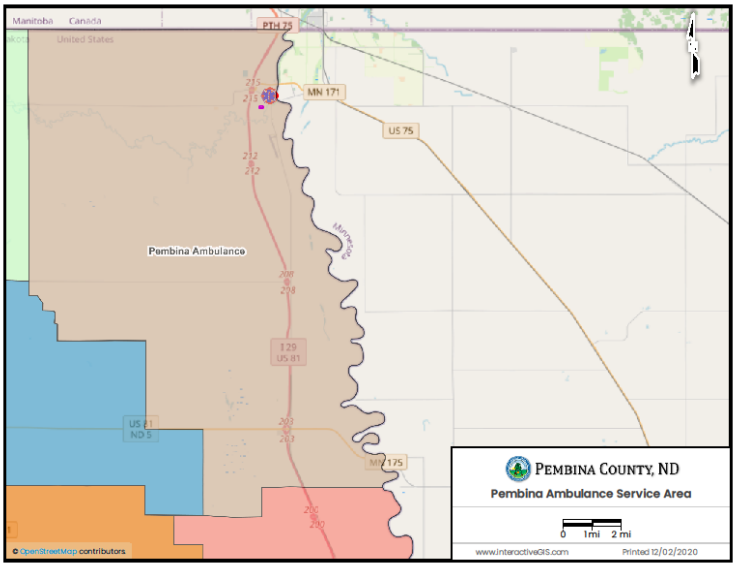


Figure 47: Pembina Ambulance Service Area

Field Code Changed

Field Code Changed

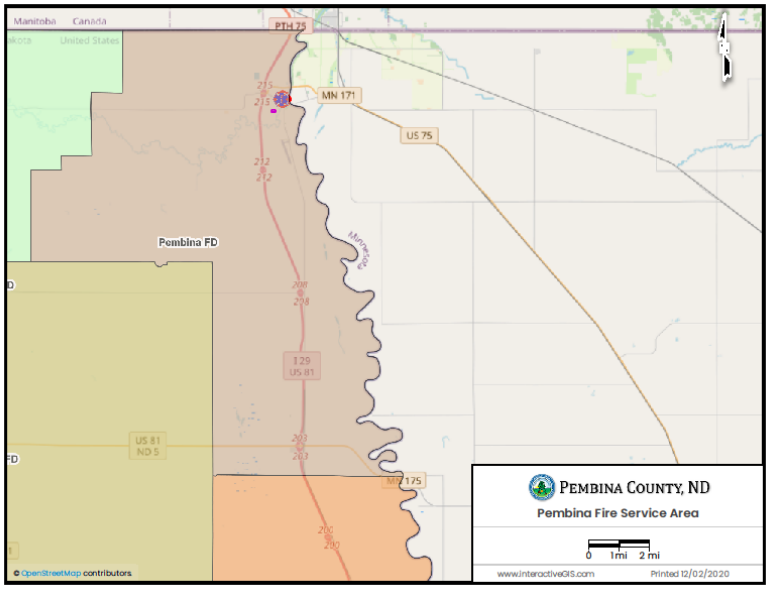


FIGURE 48: PEMBINA FIRE SERVICE AREA

PHOTO 5: ENTRANCE TO THE PEMBINA MUSEUM

Special Vulnerability Assessment
Extreme Weather
The City of Pembina has several storm shelters and buildings that can serve as such. Additionally, there is space to house displaced individuals, including travelers along Interstate 29. Winter weather poses few challenges to a full time public works crew.
Wildland Fire (Wildland-Urban Interface)
Some potential exists along the river where during dry years fire may promulgate through dry brush, but few other challenges for the promulgation of wildfire.
Flooding

Flooding has historically been a challenge to Pembina with the confluence of the Red and Pembina Rivers just south of city limits. However Pembina has worked closely with federal partners to develop flood defenses and flood action plans to keep residents safe.
Dam Failure
There is no dam failure risk for Pembina.
Drought
The risk of draught to Pembina is secondary in its increased risk of wildfire, and effects on the Pembina economy. Economic impacts are lessened by the diversity of the local economy.

Community Profile: St. Thomas, ND 58276

St. Thomas is a small community of 331 (2018 Estimate) comprised mainly of agricultural services and whose residents are in some way related to agriculture. It is located in the southeast portion of Pembina County and is bisected by US Highway 81. ND Highway 66 connects with US81 just south of the city and provides a transportation corridor to service the city. A railroad once operated in St. Thomas as well, but has since been abandoned.

St. Thomas school district has operated for some time, operating in conjunction with nearby schools at different periods in its history. Currently, it is operating as a part of Grafton, ND's school district and shares resources with the larger school. Despite its small size, the school is a K-12 school with special staffing for students with additional learning needs.

Just outside city limits is a beet piling site for American Crystal Sugar which each year dramatically increases traffic in the region and also brings in a large temporary worker population from all over the country. This traffic is generally subsided by mid-October, however truck traffic carrying beets to be processed often persists for months following. Additionally, these trucks and heavy equipment deposit large amounts of mud onto the roadway making travel more hazardous. Law enforcement is aware of these additional hazards and adjusts patrols accordingly. Additionally, American Crystal Sugar's commitment to communities compels them to clean roads to ensure safer conditions (*Figure 1*).

The area around St. Thomas is notorious for having very little elevation change. Because of this, much has been done by farmers to try and increase water conveyance off of fields and towards natural waterways. However, projects that may serve some landowners well occasionally have detrimental effects on others. Historically, the Pembina County Water Resource district has been tasked with ensuring the safe development of legal drains in the area ensuring a proper forum for landowners and residents to be heard before construction of these projects. Recently there appears to be increased conflict between landowners and the water resource board and additional regulations may need to be considered (*Figure 2*).

The only listed Tier II Facility near St. Thomas does not exist within city limits. Northdale Oil operates a service station on the southern edge of the city, serving gasoline and diesel fuel, as well as other vehicle-related goods, such as oil and anti-freeze.

St. Thomas fire services a large area of farmland and farmsteads around the city of St. Thomas and has a markedly high number of professional firefighters on the volunteer force. These professionals are employed at the Cavalier Air Force Station Perimeter Acquisition Radar (PAR) Site and commute for shifts. This arrangement provides a high level of training and experience for the small department. The rescue element of the fire department services a sizable area as well and is supported by several ALS agencies, depending on the location. *Figures 4 & 5* show the scope of these districts.

Mitigation Priorities

St. Thomas is a farming community along ND 18/US 81 with a service station, café, and a few small business. The majority of income comes from agriculture and support business, so the town is greatly impacted by drought, and severe weather such as hail, straight-line winds, tornadoes, etc.

Flooding affects the town, as it is also in the transition of the rolling hills in the southwest of the county to the flat of the valley floor. Water coming in quickly from the west cannot pass fast enough through the town due to antiquated drain systems, and cannot go around due to ND Highway 18. The town is forced to pump the water through town as best they can in times of need.

Summer storms also play a role in the town, as many of the buildings are aging, and were not built to current codes. Large aging trees pose a threat to buildings, above ground utilities, and street access.

Winter storms have the ability to strand citizens until public works and assistance from the county can dig the city out.

- Mobile generator and hookups to critical facilities,

- Update storm drain systems,
- Repair culverts running under city streets and approaches.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	A	C	D	B	D	C	C	D
Critical Transportation	D	A	B	C	B	C	C	D	D
Mass Search and Rescue	C	C	B	C	C	D	D	D	D
Mass Care Services	C	C	B	C	B	C	D	D	A
Logistics and Supply Chain	C	A	C	C	B	B	C	B	A
Housing	A	C	C	C	D	C	C	B	B
Environmental Health/Safety	B	A	C	A	C	D	C	D	B
Fatality Management	C	D	D	C	C	C	D	D	A
Public Health, Healthcare	C	D	C	C	C	C	D	C	A
Fire Management	A	C	C	A	A	C	B	C	C
Law Enforcement	B	C	B	A	A	A	C	C	B
Economic Recovery	D	C	D	D	D	B	B	A	B
Health and Social Services	B	B	D	D	D	C	D	B	C
Natural and Cultural Res.	C	C	D	D	D	C	D	C	D
Planning	B	A	C	B	C	B	B	C	A
Operational Coordination	A	A	C	A	A	A	C	C	A
Situational Assessment	A	A	A	A	A	A	C	B	A
Public Info. and Warning	A	A	A	B	C	B	D	B	A

Field Code Changed

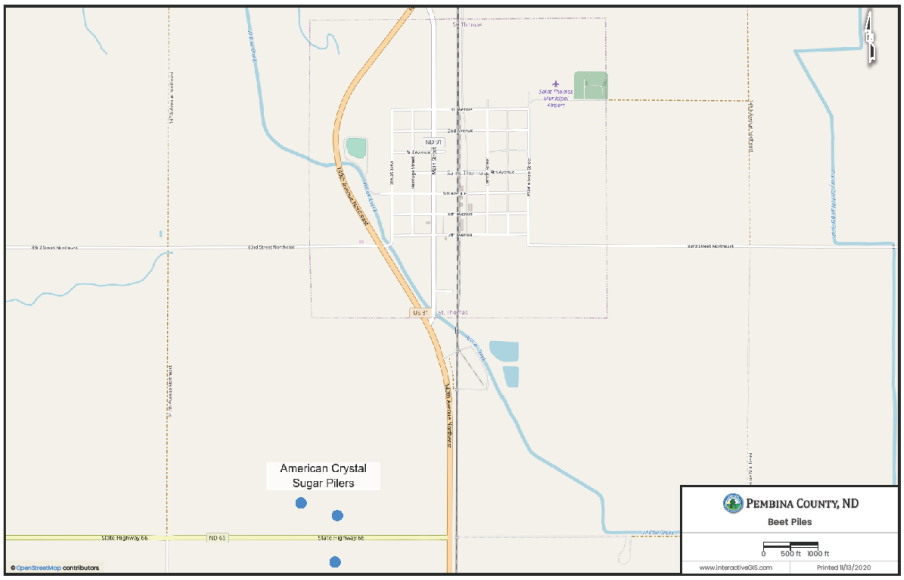


FIGURE 49: PILER STATIONS NEAR ST. THOMAS

Field Code Changed

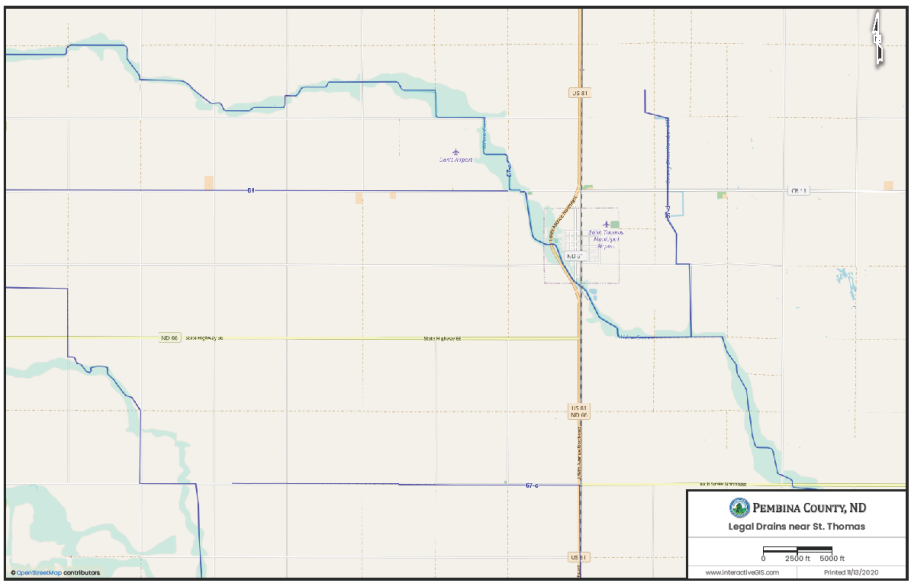


FIGURE 50: ST. THOMAS DRAINS AND FLOODPLAIN

Field Code Changed

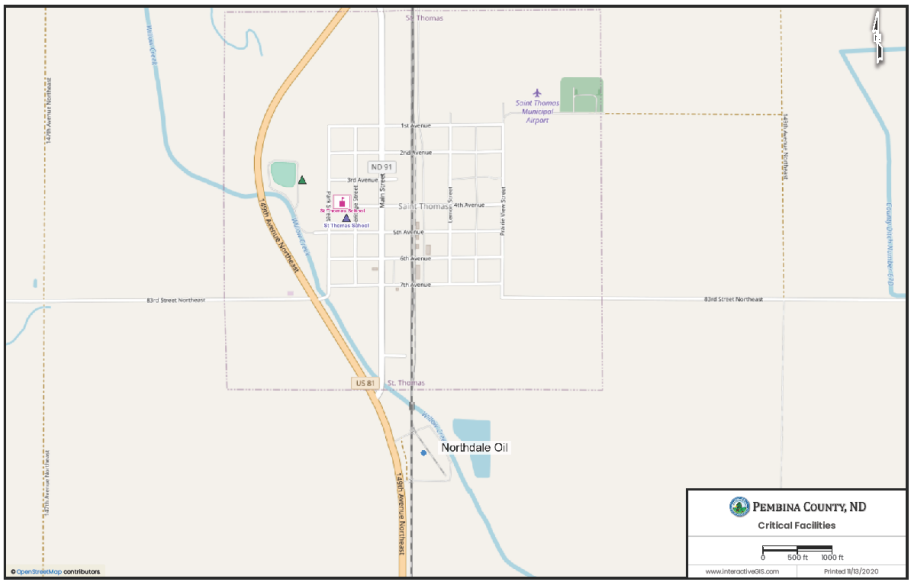


FIGURE 51: ST. THOMAS CRITICAL FACILITIES

Field Code Changed

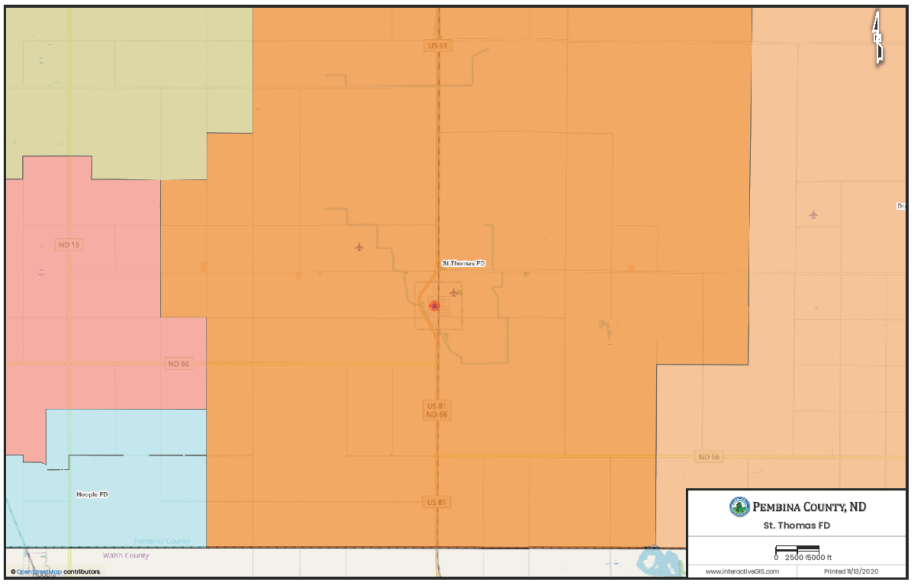


FIGURE 52: ST. THOMAS FD RESPONSE DISTRICT

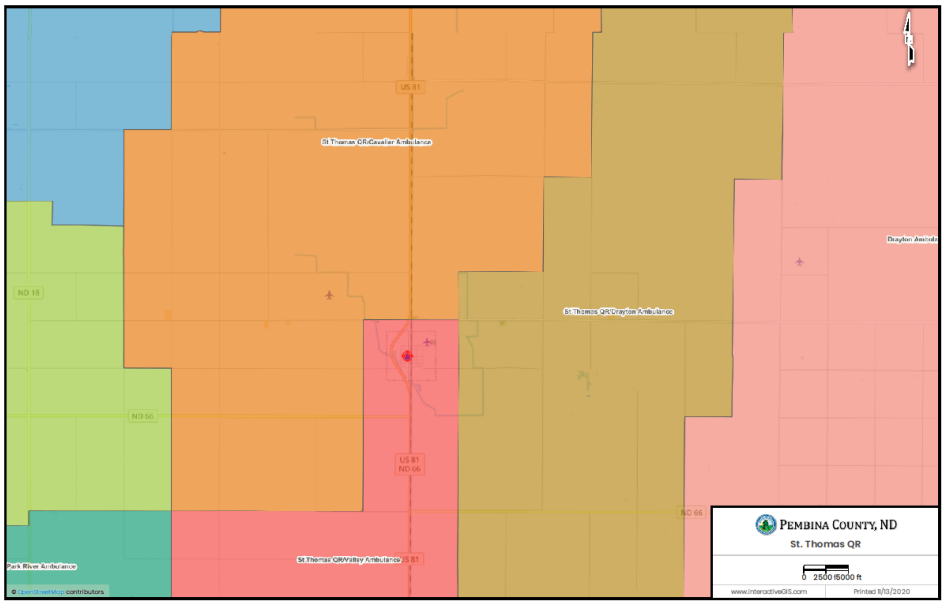


FIGURE 53: ST. THOMAS RESCUE SERVICE DISTRICT

Special Vulnerability Assessment
Extreme Weather
Many of the residences have basements or other kinds of shelter to protect themselves.
Wildland Fire (Wildland-Urban Interface)
Very low risk due to proximity to agricultural land.
Flooding
Historically small risk of overland flooding, however increased draining from upstream fields is making this a more frequent a severe threat.
Dam Failure
There is no dam failure risk for St. Thomas
Drought
The threat of draught has the biggest impact on St. Thomas's economy. **A water tower helps provide additional storage and pressure in times of hardship.**

Field Code Changed

Community Profile: Walhalla, ND 58282

From the City of Walhalla website:

Walhalla, the center of the Pembina Hills, is located in northwestern Pembina County in the extreme northeastern part of North Dakota. It is approximately 66 miles south and 34 miles west of Winnipeg, Manitoba, Canada and approximately 66 miles north and 34 miles west of Grand Forks, ND. The city is 5 miles south of the Canadian border and 30 miles west of Minnesota; is served by ND State Highway No. 32, County Highway No. 55 and by Burlington Northern Railroad. Walhalla serves as a trade center of western Pembina and northeastern Cavalier Counties. It is a residential center and serves as an outlet for the agricultural and manufacturing products produced in the area. (Walhalla Community Data, 2020)

The community of Walhalla is located in the northwest corner of Pembina County, covering approximately 1 square mile and is home to an estimated 907 residents (US Census Bureau, 2020). Due to its proximity to the US-Canadian Border, there is a high volume of foreign traffic and commercial traffic traveling to and from Canada. One state highway (ND32) and 2 county highways (CR9 and CR55) pass through the city. Traffic is mainly local passenger traffic and agriculture-related commerce vehicles – though as mentioned before – the proximity to the border invites higher volumes of international commerce as well. *See Figure 1.*

Walhalla city officials have made a conscious effort to zone construction away from the Pembina River on the southeast side of the city and save the neighborhoods for greenspace and parks. Utilities in the park were heavily damaged in 2013 and were repaired using mitigation programs from NDDES and FEMA to harden them against future flooding damages. Since then, there have been no repetitive damages to city property or private property due to zoning practices. Part of the greenspace includes a 25-site campground which can be reserved week to week or season-long. This transient population brings income to the community in tax revenue, but has presented challenges to sheltering guests in inclement weather and communicating emergency situations. *See Figure 1 and Figure 2.*

There are several hazardous facilities within the city, namely two gas stations with underground fuel tanks. The Walhalla Coop on the northeast side of town also has large propane tanks and services residential and commercial tanks in the region. These tanks provide a significant risk to a negligent or adversarial containment breach, but are secured and have reasonable protection against accidental run-ins. The highways running through town also pose a risk of hazmat spill in the event of hazardous materials being hauled, or by spill due to ruptured lines from crashed vehicles. *See Figure 3.*

The city is at the end of a rail line owned by Burlington Northern Sante Fe (BNSF) and operated by Dakota Northern Railroad, based out of Crookston, MN. The line sees little rail traffic, and carries almost exclusively agricultural product. This does pose a transportation risk and hazmat risk in the event of a fuel line or fuel tank rupture, but is considered relatively low risk. *See Figure 1.*

The economy of Walhalla is built on agriculture, manufacturing and tourism. There is a secondary economy supporting the main sources of income, including retail, commerce and food service. Due to the reliance on agriculture, the primary and secondary economies can be greatly impacted by long-term climate trends, such as draught, *see Figures 5, 6 & 7.* While there is little mitigation that can be performed to remedy this risk, it is worth noting in this document. Fortunately, at the time of this writing, the region appears to be in a relatively “wet” cycle. Certain draught-resistant crop varieties help reduce draught vulnerability.

Due to the community’s location in the hills of the Pembina Gorge, flooding risk is generally low. As mentioned previously, good zoning practices have reduced this hazard further. It is of note that the main south entrance of Walhalla (ND32) crosses the Pembina River and exists within the floodplain and floodway. A secondary south entrance (CR9) is higher, but the bridge is susceptible to ice jams and secondary effects to flooding, *see Figure 2*. The north (ND32/CR55) and west (CR55) road remain relatively unaffected to flooding damages.

Walhalla has one of the largest fire departments in the county, in terms of membership, and apparatus. Figure 8 below shows their fire response region in Pembina County, but not the portion of the response area 10 miles west into Cavalier County. Also not shown is WFD's auto extrication district which they cover further east towards Neche. Primarily, WFD is tasked with fighting grass and wildfires, however recently they have been called out to several auto extrications and even a missing person event. Mutual aid agreements with all departments in Pembina County assure that WFD will be aided on ALL structural fires and are often supported on wildfires and car accidents as well. Walhalla Ambulance service is called on all fire calls and is able to respond with a dedicated ambulance and at least 1 EMT on all fire calls. In the event of transport or need for advanced life support, Cavalier Ambulance is able to dispatched alongside Walhalla fire/rescue (*Figure 10*).

Walhalla Police Department is comprised of two sworn officers cross deputized with the Pembina County Sheriff's Office to serve and protect the city limits of Walhalla. Sheriff's deputies are able to assist within city limits in case of low coverage or a large incident, and aid agreements are established with the ND Highway Patrol, ND Game and Fish, ND Parks and Recreation, US Border Protection and US Border Patrol to assist with law enforcement. Law enforcement in Walhalla is also overseen by the Grand Forks Drug Task Force and the Northeastern Special Response Team for more complex incidents.

Mitigation Priorities

Walhalla is a large enough town and relies heavily on tourist traffic, making the propagation of communicable diseases quite easy.

Though Walhalla has several forms of industry, some of its largest business support agriculture. A drought could have a severe economic impact on community elevators, seed companies, and bulk fuel delivery. Drought could also affect the tourism industry, reducing traffic viewing fall foliage, reducing game numbers in the area, and increasing the risk of fire.

The economy of Walhalla is driven by agriculture and the manufacturing industry. For that reason, there is a high number of hazardous materials, sometimes in large quantities, making the potential of a hazardous material spill quite likely. ND Highway 32 also runs through Walhalla, creating a very likely risk of transportation incident. Walhalla is also home to a port of entry into Canada, creating a target for a homeland security incident.

The city is set in the middle of a valley with a mostly natural environment surrounding it. For that reason, any wildfires would quickly spread around and into the city. Aging buildings and trees into increase the likelihood of structural fires spreading.

Walhalla is susceptible to severe weather because of its relatively remote location in the county. Winter weather is compounded by the hilly terrain and trees acting as a windbreak and causing snow to pile higher as compared to other cities in the county. Icy conditions make driving the hills even more treacherous. Summer storms have the potential to fell trees and damage aging buildings in the community.

- Updated pumps in lift stations in order to better move precipitation runoff from developed areas.
- Storm shelter in the Walhalla City Park for campers and Walhalla residents.
- A generator backup for the existing storm shelter and fire department.

Hazard Risk Assessment

The following table help identify the relative risk to the community of Walhalla based on core capabilities and hazards identified for this community.

Local Risk Analysis Criteria

Frequency	
Highly Likely	Nearly 100% probability in the next year
Likely	10-100% probability in the next year
Possible	1-10% probability in the next year
Unlikely	Less than a 1% probability
Severity	
Catastrophic	More than 50% of jurisdiction affected
Critical	25-50% of jurisdiction affected
Limited	10-25% of jurisdiction affected
Negligible	Less than 10% of jurisdiction affected

Local Risk Analysis Classifications

		Severity			
		Negligible	*Limited*	*Critical*	*Catastrophic*
Frequency	*Highly Likely*	C	B	A	A
	Likely	C	C	B	A
	Possible	D	C	B	B
	Unlikely	D	D	C	C

Risk Analysis Summary

Core Capability	Fire	Flood	Severe Weather	Hazardous Materials	Transpiration Incidents	Civil Unrest	Climate Change	Economic Unrest	Communicable Disease
Infrastructure Systems	B	A	C	D	C	D	C	D	D
Critical Transportation	D	A	B	D	B	C	C	D	D
Mass Search and Rescue	B	C	A	C	C	C	D	D	D
Mass Care Services	B	C	B	B	B	B	D	D	A
Logistics and Supply Chain	C	A	B	C	B	B	C	B	A
Housing	A	B	B	C	D	C	C	B	B
Environmental Health/Safety	A	A	C	A	C	D	C	D	B
Fatality Management	C	C	D	C	B	C	D	D	A
Public Health, Healthcare	C	C	C	C	C	B	D	C	A
Fire Management	A	D	C	A	A	B	B	C	C
Law Enforcement	A	C	B	A	A	A	C	C	B
Economic Recovery	D	C	D	D	D	A	B	A	B
Health and Social Services	B	B	C	D	D	C	D	B	C
Natural and Cultural Res.	C	C	C	C	D	C	B	C	D
Planning	B	A	B	A	C	B	B	C	A
Operational Coordination	A	A	B	A	A	A	C	C	A
Situational Assessment	A	A	A	A	A	A	A	A	A
Public Info. and Warning	A	A	A	B	C	B	B	B	A

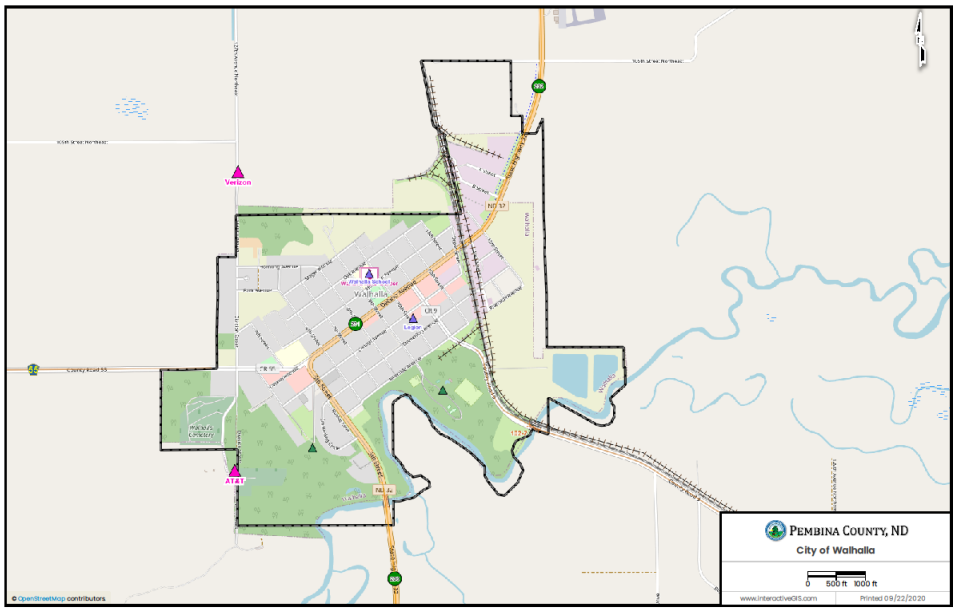


Figure 54: Critical Facilities

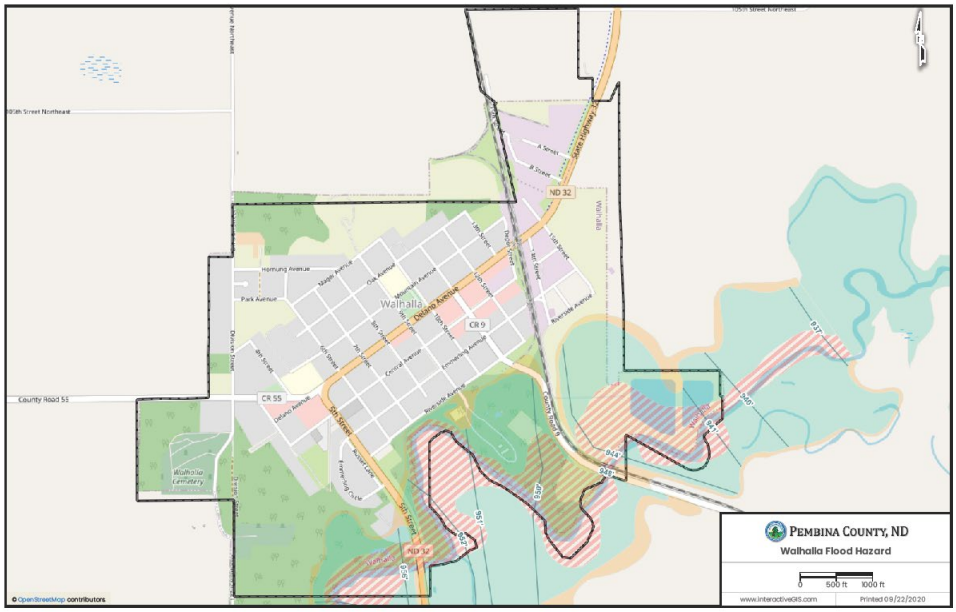


FIGURE 55: FLOOD HAZARD AREA

Special Vulnerability Assessment
Extreme Weather
Unlike the community of Mountain, the gorge escarpment acts as a kind of shield for Walhalla, sheltering it from most severe storms passing through. A notable exception is the "Father's Day Storm", where residents debate if it was before or after year 2000. Straight-line winds felled several trees in a campground injuring one and drastically altering the city's appearance. Since then, more advanced warning is available and MOUs have been written for community shelters. Winter weather has a unique impact on travel in the city due to its hilly terrain which can make icy roads especially treacherous.
Wildland Fire (Wildland-Urban Interface)
Walhalla's setting in the foothills of the Pembina Gorge provides a much tighter wildland-urban interface providing substantial risk for wildfire. Walhalla Fire Department undertakes significant wildland firefighting training and acquiring specialize equipment.
Flooding
Flooding poses little risk to the town due to effective zoning practices.
Dam Failure
There is no dam failure risk for Walhalla.
Drought
The risk of draught to Walhalla is secondary in its increased risk of wildfire, and effects on the Walhalla economy.

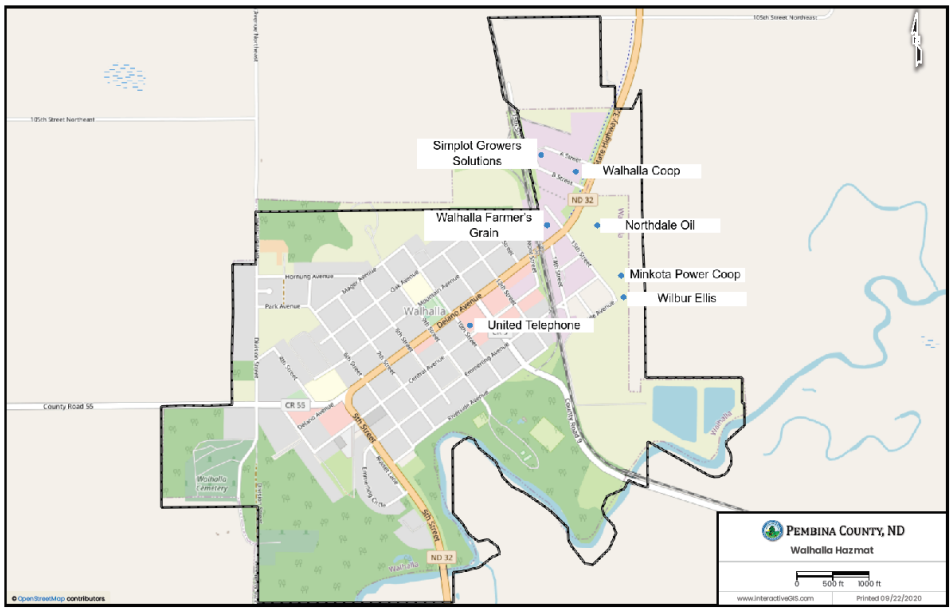


Figure 56: Hazmat Facilities

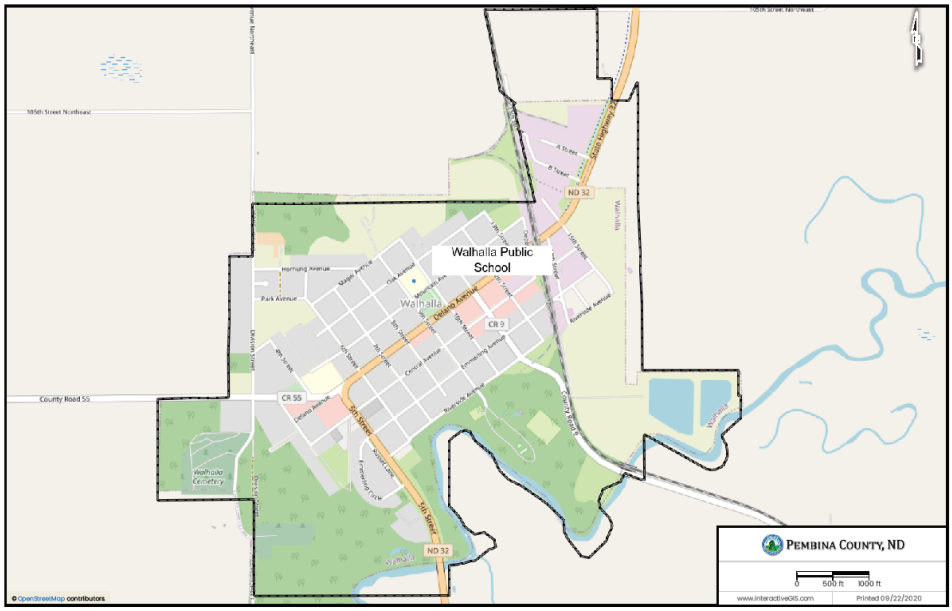
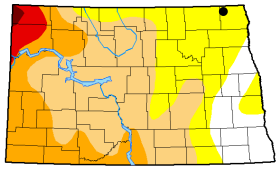


FIGURE 57: WALHALLA SCHOOL

U.S. Drought Monitor
North Dakota



September 26, 2017
(Released Thursday, Sep. 28, 2017)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	11.07	28.08	39.36	20.13	2.94	0.41
Last Week 09-19-2017	0.13	12.52	54.48	29.41	3.05	0.41
3 Months Ago 06-27-2017	0.02	33.22	19.66	21.64	25.08	0.38
Start of Calendar Year 01-03-2017	93.87	6.13	0.00	0.00	0.00	0.00
Start of Water Year 09-27-2016	96.70	2.90	0.41	0.00	0.00	0.00
One Year Ago 09-27-2016	96.70	2.90	0.41	0.00	0.00	0.00

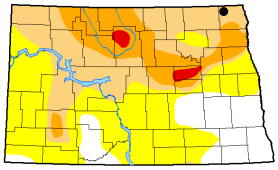
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brad Rippey
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/

U.S. Drought Monitor
North Dakota



September 25, 2018
(Released Thursday, Sep. 27, 2018)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	16.36	39.26	27.59	15.49	1.29	0.00
Last Week 09-18-2018	16.36	39.46	27.66	15.92	0.60	0.00
3 Months Ago 06-26-2018	39.25	51.69	7.21	1.85	0.00	0.00
Start of Calendar Year 01-02-2018	7.74	31.70	56.09	4.47	0.00	0.00
Start of Water Year 09-26-2017	11.07	28.08	39.36	20.13	2.94	0.41
One Year Ago 09-26-2017	11.07	28.08	39.36	20.13	2.94	0.41

Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
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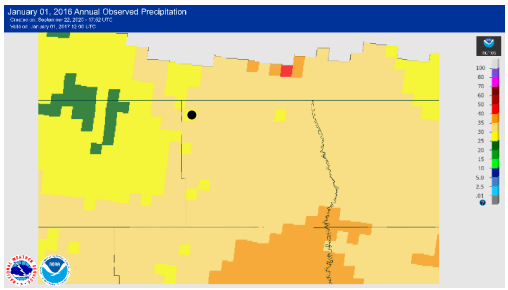
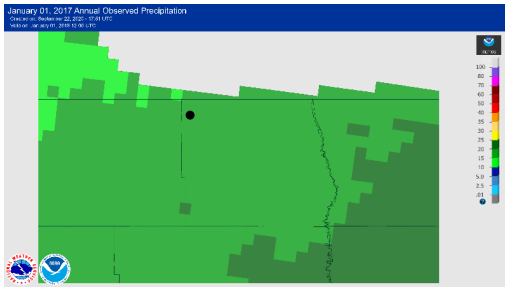
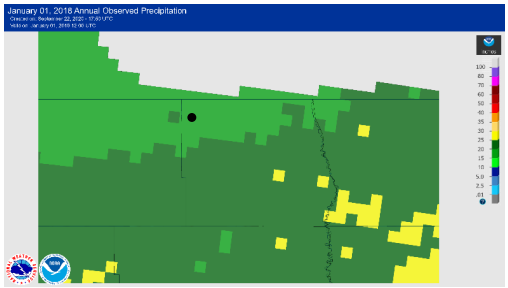
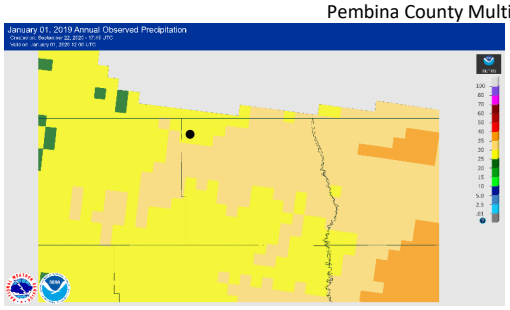
NCEI/NOAA

http://droughtmonitor.unl.edu/

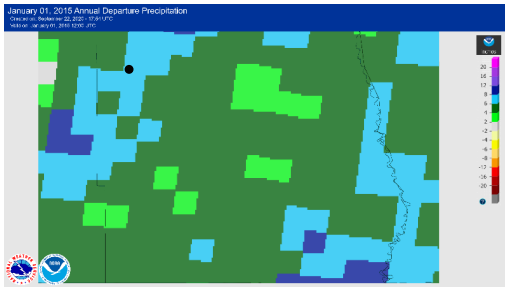


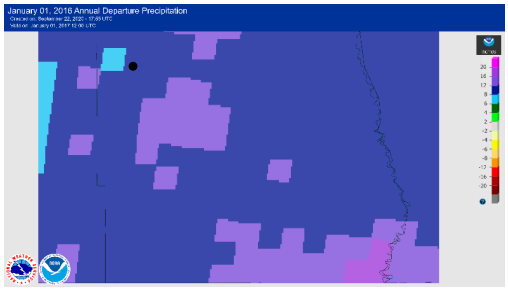


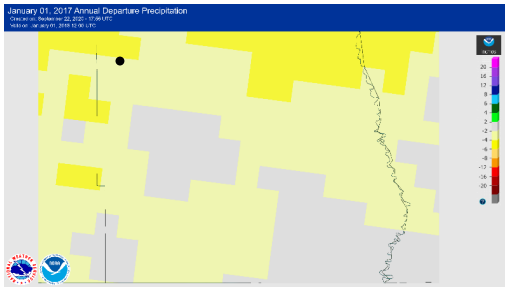


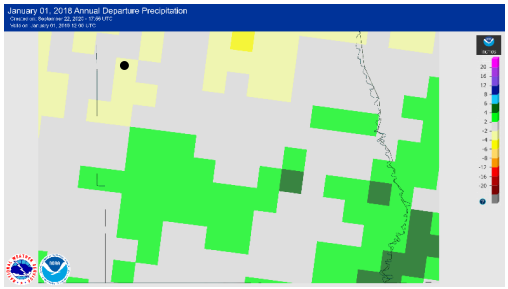


~~Figure 6: Total Annual Precipitation~~









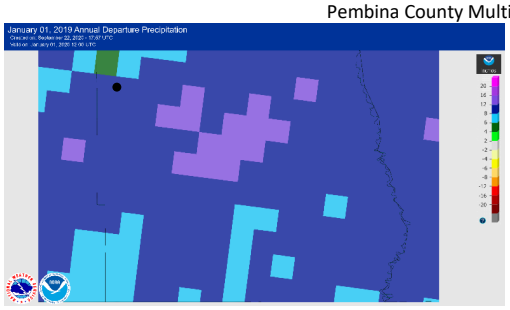


Figure 7: Precipitation Departure from Normal

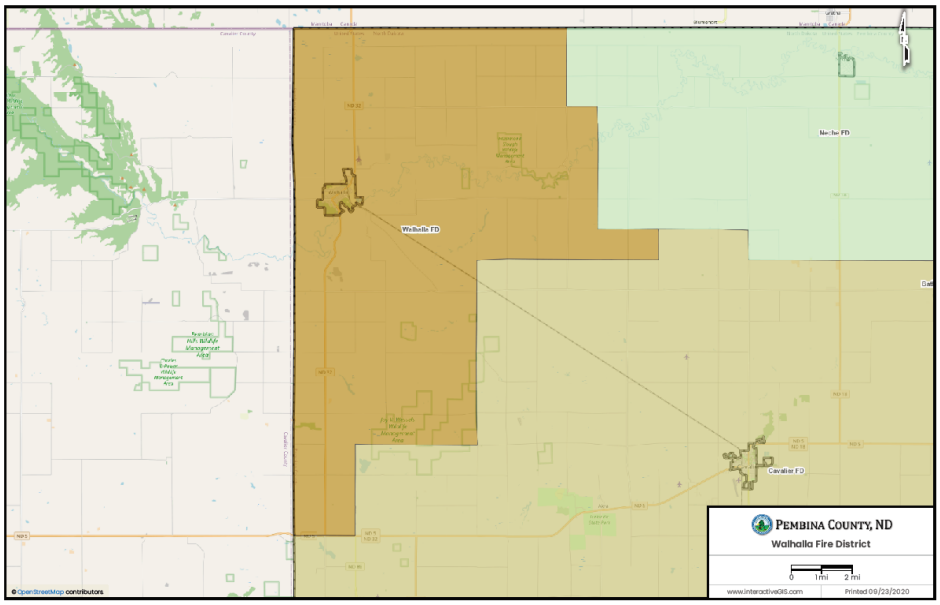


FIGURE 58: WALHALLA FIRE DEPARTMENT RESPONSE DISTRICT

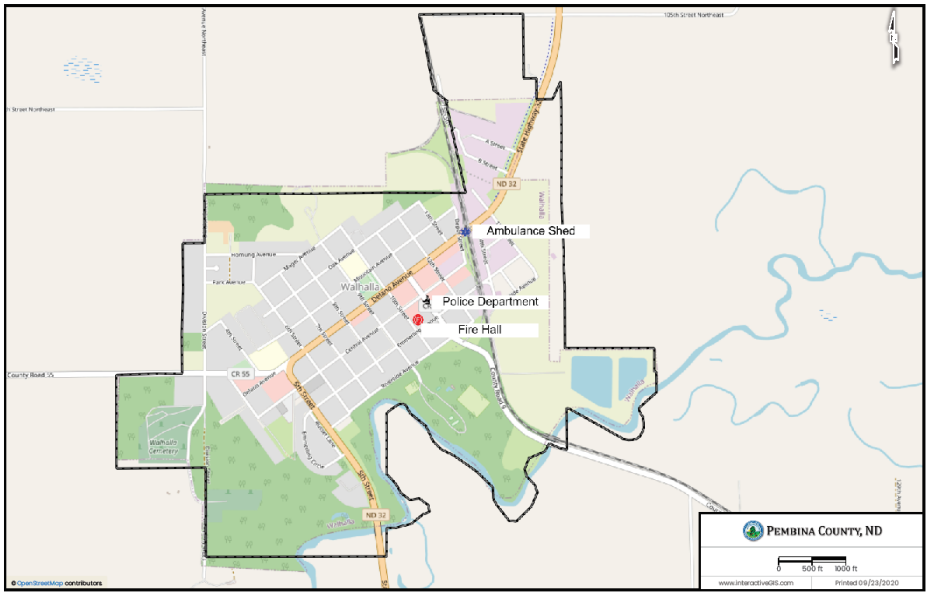


FIGURE 59: WALHALLA RESPONDER BASES

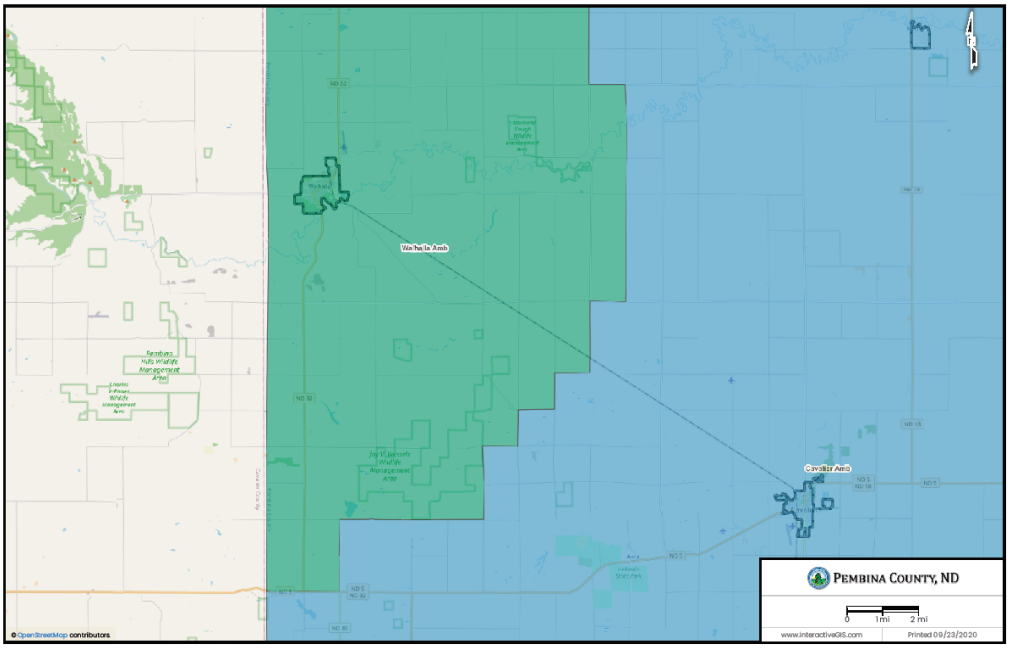


FIGURE 60: WALHALLA AMBULANCE RESPONSE DISTRICT

Mitigation Project Updates Since 2015

City	Project	Cost / Funding Source	Status / Timeframe
Bathgate	PTO pump	$5,300	On-Going
Bathgate	6" Floating pump Hose for floating pump	$1,500 $ 100	Complete
Bathgate	Culvert placement	$1,400	On-Going
Bathgate	3" Gas powered trash pump	$850	On-Going
Bathgate	Living windbreak	Pembina County Soil Conservation	Early conversations
Cavalier	Bjornson Drive Drainage	$50,000 to 70,000	On-Going
Crystal	Clean out build-up of sedimentation in Cart Creek, East & West of Crystal	$91,000 ($apx.$ 13,000 x apx. 7 miles)	Deferred due to funding
Crystal	Engineering survey for solution of flood protection	$15,000	Deferred due to funding
Drayton	Removal of large, dead trees along river bank	Competitive bid out	On-Going
Drayton	Dike Rehabilitation – flood gates or plugs for dike culverts	$20,000	On-Going
Drayton	Relocation of City Shop	$ 200,000	On-Going
Drayton	Drayton Dam	$2-$3 Million	On-Going
Drayton	City Lagoons-repair or relocate	$2 Million	On-Going
Hamilton	Shelter w/ safe room	$50,000	On-Going
Hamilton	Engineering survey for storm water drainage, And project cost, Storm water project / drainage issues,	$150,000	On-Going
Hamilton	Living tree fence	$2,500	On-Going
Mountain	New water mains	$500,000	Deferred due to funding
Neche	Waste Station Pumping House – new pumps and valves	$25,000	On-Going
Neche	Upgrade dike system / Corps Certification of Permanent Protection level	$2,500,000	On-Going
Neche	City Lagoon clean-out	$50,000	Deferred due to funding

Neche	Generator hook-up @ City Shop	Project Impact. Cost pending	Complete
Pembina	Engineering survey of Sludge pond, and project cost	$15,500	On-Going
Pembina	Lift station generator and hookup	$10,000	On-going
Pembina	Storm sewer pump house-portable generator and hookup	Generator: $1,000 Hook-up: $1,950	On-Going
Pembina	Engineering survey of Storm water runoff, and project cost	Competitive bids out	On-Going
Pembina	Engineering expense Lagoon – 2nd cell	$1 Million	On-Going
Pembina	Raising of church in South Pembina	$23,000 to $30,000 Phase I through grant from Ft Pembina Historical Society	On-Going
Pembina	Culvert cleaning	$1,000	Complete
Pembina	Project: Bottleneck for spring runoff	Unknown	On-Going
St Thomas	Trailer acquisition for generator, Wiring of generator	$20,000	Deferred due to funding
St Thomas	Water distribution repairs, Inspect city water/sewer system	$25,000	On-Going
St Thomas	Repair leak @ lagoon	$15,000	On-Going
St Thomas	Brochure with instructions during a disaster, Emergency kits available to Senior Citizens (appx. 50), and those in need/disabled, Equipment purchased to have at shelter, if need be	$250 with match from Economic Development Committee, fundraisers, match from booster club	On-Going
Walhalla	Generator with wiring	$7,000	On-Going
Walhalla	Riverside Park	Competitive Bids out	On-Going Repetitive Loss

Resolutions

Bathgate: Pending approval

Cavalier: Pending approval

Crystal: Pending approval

Drayton: Pending approval

Hamilton: Pending approval

Hensel: Pending approval

Mountain: Pending approval

Neche: Pending approval

Pembina: Pending approval

St. Thomas: Pending approval

Walhalla: Pending approval

Pembina County: Pending approval