

Bismarck

FEMA Approved: January 21, 2021

2020 Multi-Hazard Mitigation Plan

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Executive Summary

The community specific City of Bismarck Multi-Hazard Mitigation Plan (MHMP) was originally developed and approved by the Federal Emergency Management Agency (FEMA) in 2015 and has been updated in 2020. The plan identifies and profiles the hazards to assess risk and vulnerability relating to natural, technological, and human-caused hazards, and identifies mitigation strategies and specific mitigation actions for reducing impact.

Throughout the planning process, Bismarck conducted a thorough analysis of each hazard including vulnerability assessments and identified opportunities to mitigate hazards. The updated 2020 City of Bismarck MHMP has also included climate change impact information within each hazard profile in Section 10 as well as a summary of climate change data relevant to North Dakota included within Section 9: Risk Assessment.

Section 3 of the MHMP provides for a summary of the following for each hazard addressed in the plan: 1) a summary of new and on-going mitigation actions, 2) a summary of primary vulnerabilities relating to each hazard, 3) and a summary of mitigation actions completed in the past which remain relevant when analyzing hazard risk and community vulnerability to each hazard.

Although emergencies and disasters have impacted Bismarck, and can impact Bismarck in the future, actions can be taken ahead of time to reduce or eliminate the negative impacts. The 2020 MHMP represents the City's commitment to take action to lessen the impacts potential disasters may have on life, the economy, infrastructure and our ability to continue to operate as a community and city.

Much of the work in hazard mitigation and sustainable development must be carried out at the local level. It is at the local level where land use decisions are made, growth and development take place, and where the impacts of hazards are most direct.

The Bismarck Multi-Hazard Mitigation Plan identifies over 50 mitigation action items to enhance our status of mitigating all hazards. The plan also identifies over 150 mitigation measures already completed or integrated into Bismarck city departments as standard or on-going operations.

Some of the hazards with potential for catastrophic impact require that primary mitigation efforts be pursued by key partners including private industry, state and federal government. Based on combined mitigation and response capability status at the local, state, and national level, the most significant of these for the City of Bismarck would include Shortage or Outage of Critical Materials, Train Derailment (involving Fire and/or Hazardous Materials), and Dam Failure. Although likelihood of these potentially catastrophic incidents are considered of lower probability, they are possible.

The major hazards as noted in the table below, are each profiled for the purpose of identifying our risk and significant vulnerabilities, and ultimately, to identify feasible mitigation opportunities.

Based on probability, potential impacts, and current response and mitigation capabilities, the hazards are prioritized as follows for the City of Bismarck:

	Natural Hazards	**Technological or Human Caused**
High	Winter Storm Tornado	
Moderate	Severe Summer Weather Flood Communicable Disease	Shortage or Outage of Critical Materials or Infrastructure; Hazardous Materials Release Train Derailment Active Threat Civil Disturbance
Low	Biological Infestation: *Urban Forest* Drought Geologic Hazard Wildland Fire	Fire Dam Failure Aircraft Accident

Mitigation Strategy

The following purpose statement and goals are outlined in the plan's mitigation strategy:

Purpose: Minimize the vulnerability of the life and health of people, property, environment, and economy of Bismarck from the impacts of natural, technological, and human-caused hazards.

Protection of:

- Life
- Property and Environment
- Economy

Goal 1: Enhance local planning efforts related to hazard understanding and mitigation.
Goal 2: Enhance the public's awareness of hazards and participation in mitigation planning.
Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.
Goal 4: Reduce impacts natural disasters may have on people and property.
Goal 5: Reduce impacts of technological and human-caused disaster may have on people and property.

Plan sections 2 through 6 outline the mitigation strategy and identify, prioritize, and assign the mitigation action items which support the multi-hazard mitigation plan purpose and goals. Plan Section 3 entitled "Hazard Vulnerability & Mitigation Actions Summary" provides for a summary of the hazard related vulnerabilities and mitigation action items by hazard name. The "Hazard Vulnerability & Mitigation Actions Summary" section also captures the mitigation actions completed in the past which remain relevant when analyzing hazard risk and community vulnerability to each hazard.

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RESOLUTION

ADOPTING THE 2020 BISMARCK MULTI-HAZARD MITIGATION PLAN FOR THE CITY OF BISMARCK, ND

WHEREAS, the City of Bismarck has been and continues to be committed to the protection of life, property, and the environment from natural, technological, and human-caused hazards; and

WHEREAS, the City of Bismarck recognizes the threat that natural, technological, or human-caused hazards pose to people and property within the City; and

WHEREAS, the 2020 Bismarck Multi-Hazard Mitigation Plan is the result of an extensive planning effort coordinated by Bismarck Emergency Management in cooperation with governmental and non-governmental stakeholders to update the community specific mitigation plan which identifies hazards that have the potential to impact the City and establish mitigation strategies to address these hazards; and

WHEREAS, Bismarck Emergency Management and applicable City departments will coordinate implementation of the plan and continue to engage stakeholders in the review and update of the plan; and

WHEREAS, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple Federal Emergency Management Agency (FEMA) pre and post-disaster mitigation grant programs; and

WHEREAS, City of Bismarck, ND Department of Emergency Services, and Federal Emergency Management Agency Regional VIII officials have reviewed the 2020 Bismarck Multi-Hazard Mitigation Plan and have approved it contingent upon this official adoption of the plan by the Bismarck City Commission; and

NOW, THEREFORE, BE IT RESOLVED by the Board of City Commissioners of the City of Bismarck, North Dakota, a municipal corporation, that the 2020 Bismarck Multi-Hazard Mitigation Plan as approved by ND DES and FEMA is hereby **adopted** by the Bismarck City Commission as the City's Multi-Hazard Mitigation Plan

Adopted this 12th day of January, 2021.

STATE OF NORTH DAKOTA)
)ss
COUNTY OF BURLEIGH)

I, Jason Tomanek, do hereby certify that I am the duly appointed, qualified Assistant City Administrator of the City of Bismarck, North Dakota, and that the foregoing is a full, true and correct

copy of a resolution adopted by the Board of City Commissioners at its regular meeting of January 12, 2021.

IN WITNESS WHEREOF, I have hereunto set my hand and the seal of the City of Bismarck, North Dakota, this 12th day of January, 2021.

(SEAL)

Jason Tomanek
Assistant City Administrator
Bismarck, North Dakota

Introduction

Defining Mitigation
Mitigation is the effort to reduce loss of life and property by lessening the impact of potential disasters. Mitigation is taking action *now*—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk). Effective mitigation requires that we *all* understand local risks, address the hard choices and invest in long-term community well-being. Without mitigation actions, we jeopardize our safety, financial security and self-reliance.

Mitigation: Sustained action taken to reduce or eliminate **long-term** risk. Although actions are taken during the response phase to mitigate hazards, the focus of this multi-hazard mitigation plan focus is to identify mitigation actions taken before the incident occurs.

Purpose
The Bismarck Mitigation Plan has been developed to serve the Bismarck community through mitigation of potential impacts of natural and human caused hazards. By avoiding unnecessary exposure to known hazards, a community may save lives, protect property, and minimize the social, economic, and environmental disruptions that commonly follow hazard events.

The primary purpose of the plan is to identify mitigation strategies. Therefore, in developing the plan, the focus was to identify mitigation strategies based on the significant vulnerabilities identified through the planning process.

The purpose of mitigation planning and implementing the plan is to protect life, property, environment, economy, and quality of life within the City of Bismarck from hazards/disasters.

The purpose of the mitigation plan is to:

- Serve as a consolidated, comprehensive source of hazard information.
- Inform our leaders and the public of our vulnerabilities.
- Prioritize and promote cost-effective mitigation solutions.
- Encourage long-term community sustainability.
- Improve coordination of mitigation efforts.
- Support the "Imagine Bismarck Strategic Plan" (ie: Strategic Focus Area: Government Excellence) and the Bismarck Fire Department Strategic Plan which is aligned with the "Imagine Bismarck Strategic Plan."

Scope
The Bismarck Multi-Hazard Mitigation Plan was prepared to address those hazards identified which pose significant risk to Bismarck. Additional hazards may exist that were not apparent to the mitigation plan stakeholders through the development of this plan, and certainly, disasters can occur in unexpected ways. Future planning efforts may address additional hazards as determined appropriate. Mitigation actions taken during the response phase are not within the scope or purpose of this mitigation plan.

Authority
The North Dakota Century Code, Chapter 37-17.1 Emergency Services, requires cities and to develop and maintain an emergency management program (or participate in a county or regional program).

The Disaster Mitigation Act of 2000 requires local governments to develop and submit mitigation plans as a condition of receiving Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) project grants. The Disaster Mitigation Act of 2000 became law on October 30, 2000, and amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the "Stafford Act") (P.L. 93-288, as amended). Regulations for this activity can be found in 44 CFR, Part 201.

The City of Bismarck Multi-Hazard Mitigation Plan meets the requirements and procedures for a local mitigation plan as found in the Code of Federal Regulations (CFR), Title 44, Chapter 1, Part 201 (44 CFR Part 201). This Bismarck Multi-Hazard Mitigation Plan has been prepared by the Bismarck Emergency Management, a division of the Bismarck Fire Department.

Overview of Bismarck, North Dakota.
See plan section 7: Community Profile.

Plan Format
The plan document is formatted based on the purpose of the plan (ie: mitigation strategy) and also to ensure the document is user-friendly for those who are assigned to implement mitigation action items. Since the mitigation strategies and action items are the *results* of the planning process, the mitigation strategy including action items are the focus of the plan document. The other plan sections which contribute to and inform the mitigation strategy and specific hazard mitigation actions follow.

Plan Organization – Purpose of Plan Sections

Section 1: Introduction explains the purpose, organization, scope, and authority of the plan.
Section 2: Mitigation Strategy Overview identifies the mitigation plan purpose and overarching goals to minimize potential impact from hazards. Sections 3 thru 6 are integrated and outline mitigation strategy detail.
Section 3: Hazard Vulnerability & Mitigation Actions Summary highlights the results of the mitigation planning process to include identification of mitigation actions based on vulnerabilities as well as identifying pre-existing mitigation to assist in the planning efforts by answering the question "what efforts are we already taking to mitigate this hazard?" This section also summarizes vulnerabilities for each hazard based on each hazard profile.
Section 4: Mitigation Implementation Action Plan identifies the mitigation action item assignments and is organized by name of city department. This section will allow for effective tracking of mitigation action items.
Section 5: Mitigation Actions – Prioritizing outlines the priority level of mitigation action items identified.

Section 6: Integration of Plans and Program and Mitigation Capabilities Inventory is an assessment of local mitigation capabilities and identifies the informational resources (ie: plan, programs) that were reviewed and integrated into the plan. Additional hazard specific mitigation capabilities are identified in Section 3 where applicable (see pre-existing mitigation per hazard name).

Section 7: Community Profile provides an overview of the City of Bismarck, ND.

Section 8: Community Assets identifies critical facilities, critical infrastructure, vulnerable populations, and hazardous materials facilities. This inventory is used to assist in the planning efforts in developing each of the hazard profiles (ie: vulnerabilities per hazard).

Section 9: Risk Assessment Overview provides an overview of hazards identified to be addressed in the plan as well as a summary of comparative hazard ranking based on risk (probability) and overall impact. The methodology, including additional considerations for hazard ranking and integration of the Threat and Hazard Identification and Risk Assessment (THIRA) process is explained.

Section 10: Hazard Profiles provides detail on each of the hazards including a hazard description, risk assessment, and vulnerability assessment. Vulnerability summaries (in section 3) are based on the vulnerability assessment within each hazard profile.

Section 11: Plan Maintenance describes the approach to monitoring, evaluating, and updating the plan.

Section 12: Planning Process and Public Input explains who was involved and how the plan was prepared and describes public input opportunity and plan integration.

Appendices include Acronyms used throughout the document and a listing of generator capabilities. Generators within city-owned critical facilities are an asset that minimizes potential impact as a result of power outages that may occur as a result of various hazards addressed in this plan.

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Mitigation Strategy Overview

This mitigation strategy section overview section identifies the community's mitigation **purpose** and **goals.** As part of the mitigation strategy, mitigation action items are identified in these subsequent plan sections:

- Section 3: Hazard Vulnerability & Mitigation Actions Summary
- Section 4: Mitigation Implementation Action Plan
- Section 5: Mitigation Actions - Prioritizing

Purpose: Minimize the vulnerability of the life and health of people, property, environment, and economy of Bismarck from the impacts of natural, technological, and human-caused hazards.

Protection of:

- Life
- Property and Environment
- Economy

Goal 1: Enhance local planning efforts related to hazard understanding and mitigation.
Goal 2: Enhance the public's awareness of hazards and participation in mitigation planning.
Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.
Goal 4: Reduce impacts natural disasters may have on people and property.

- Biological Infestation (pests)
- Communicable Disease
- Drought
- Flood
- Geologic (ie: slope failure)
- Severe Summer Weather
- Tornado
- Wildland Fire (wildland urban interface)
- Winter Storm

Goal 5: Reduce impacts of technological and human-caused disaster may have on people and property.

- Active Threat
- Aircraft Accident
- Civil Disturbance
- Dam Failure (ie: intentional, technological)
- Fire
- Hazardous Materials Release
- Shortage or Outage of Critical Materials
- Train Derailment

The mitigation purpose statement and goals were reviewed and updated during the plan update kick-off meeting. The mitigation purpose and goals are also the result of the hazard identification and hazard profiling planning process (ie: risk and vulnerability assessments).

Methodology:

As part of the hazard mitigation planning kick-off meeting, hazards were identified to be included in the mitigation plan. Also, hazard specific mitigation planning teams made up of various city departments and community stakeholders were established to address each hazard for the purpose of updating or developing hazard profiles, identifying vulnerabilities, and identifying and evaluating mitigation ideas. The results of the hazard specific mitigation planning teams were then reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works for evaluation and consensus.

The mitigation strategy supports the mission and goals of the Bismarck "Imagine Bismarck Strategic Plan" as noted in the Executive Summary. The City of Bismarck Strategic Plan is located on the city's website: https://www.bismarcknd.gov/1360/Strategic-Plan

Mitigation Strategy Continued

Additional plan components make up the "Mitigation Strategy." In addition to this mitigation strategy overview section, the following plan sections illustrate the results of the local mitigation planning process:

- Section 3: Hazard Vulnerability & Mitigation Actions Summary
  - Identifies mitigation action items per hazard name, as well as applicable vulnerabilities and pre-existing efforts to mitigate each hazard.
- Section 4: Mitigation Implementation Action Plan
  - Identifies the mitigation action items per city department assigned primary responsibility for implementation of specific mitigation actions.
  - Identifies the status of mitigation action items identified as part of the 2020 City of Bismarck Multi-Hazard Mitigation Plan.
- Section 5: Mitigation Actions - Prioritizing
  - Identifies priority level of mitigation action items based on methodology as explained within Section 5.

Hazard Vulnerability & Mitigation Actions Summary

- Mitigation Actions Per Hazard
- Vulnerability Summary per Hazard
- Pre-Existing Mitigation per Hazard

This plan section outlines the mitigation actions identified to address each hazard and includes a vulnerability assessment narrative summary for each hazard based on the hazard profiles in Section 10. The identified vulnerabilities validate the need or purpose of the identified mitigation actions. Not all vulnerabilities are addressed by specific mitigation actions. In some cases, mitigation may not be feasible or within the authority or jurisdiction of the city. Regardless, vulnerabilities are identified, even if there is not a current solution or related mitigation action identified.

This plan section also identifies mitigation projects or actions which were completed or were in place prior to the development of this community specific mitigation plan. These "pre-existing" mitigation projects/actions follow the mitigation action and vulnerability summary for each hazard.

The pre-existing mitigation projects/actions are identified to illustrate the existing efforts of the city and stakeholders to mitigate the various hazards prior to the development of this multi-hazard mitigation plan. Identifying the pre-existing mitigation efforts also assists in the planning process to better determine the extent a hazard is mitigated.

This plan section is an overview. More background regarding each hazard including the identification of vulnerabilities is available within Section 10 Hazard Profiles.

Natural Hazards	**Technological/Human Caused/Adversarial**
Biological Infestation	Active Threat
Communicable Disease	Aircraft Accident
Drought	Civil Disturbance
Flood	Dam Failure
Geologic Hazard	Fire
Severe Summer Weather	Hazardous Materials Release
Tornado	Shortage or Outage of Critical Materials
Wildland Fire: Wildland Urban Interface	Train Derailment
Winter Storm	
In some cases, hazards may be the result of natural, technological, and/or human caused. Each hazard is categorized in the above table based on the more likely cause of significant impact.	

A summary of mitigation actions, vulnerabilities, and pre-existing mitigation for each hazard are included alphabetically by hazard name throughout this plan section.

Active Threat

Note: For purposes of safety and security, specific vulnerabilities and mitigation ideas will not be presented in this plan for this hazard. General mitigation recommendations and existing mitigation are identified. A hazard profile for this hazard is included in Section 10 of this plan.

Mitigation Actions

1. Conduct on-going public education regarding Active Shooter hazard.

Existing Mitigation

ck Police Department has developed various crime prevention programs and conducts crime prevention ns for the public upon request.

- **Crime Prevention Programs include** Neighborhood Crime Watch, Operation Identification, Security Surveys, Crime Stoppers, Apartment Association Background Checks, and Safe Rental Housing Program. http://www.bismarcknd.gov/index.aspx?NID=399
- Crime Prevention Presentations topics and descriptions are available on the web at http://www.bismarcknd.gov/index.aspx?NID=398

ck Police Department offers facility security assessments. Upon request, a specially trained officer will ur home or business and make an assessment of your physical security. The officer will then make dations, if needed, on areas where it can be improved.

D, in conjunction with the Bismarck Public School system, has developed a Threat Assessment Team. The des both police and school representatives including investigators, counselors, and applicable parents. analyzed to determine viability or credibility and to determine if prosecution or other action (ie: referral) y.

D conducts lethality assessments to determine the likelihood of domestic violence situations (case by . As part of the lethality assessment protocol, appropriate referrals may be made.

D shares intelligence with ND State and Local Intelligence Center (ND SLIC).

C provides for public education including facility security assessment guidelines.

omotes "If You See Something, Say Something" public education awareness campaign. Signs are osted at the Bismarck Airport ("If You See Something, Say Something").

at Bismarck PD have participated in the ALERRT train the trainer program. http://alerrt.org/

d-States Organized Crime Information Center) alerts are received by Bismarck PD officials which provide n about criminal activity in the upper Midwest.

D coordinates, conducts and participates in applicable training and exercise activities with area schools sses, including recent full scale "active shooter" exercises.

D response capabilities include:

- Bismarck PD Active Threat Response Plan
- SWAT (regional team)
- Bomb Team (FBI Certified)
- Mutual Aid with other law enforcement agencies

Mitigation Recommendations

Building Security Risk Mitigation Recommendations (ie: Active Shooter Hazard)

Procedures:

- Conduct a realistic security assessment to determine the facility's vulnerability to an active shooter attack.
- Identify multiple evacuation routes and practice evacuations under varying conditions; post evacuation routes in conspicuous locations throughout the facility; ensure that evacuation routes account for individuals with special needs and disabilities.
- Designate shelter locations with thick walls, solid doors with locks, minimal interior windows, first-aid emergency kits, communication devices, and duress alarms.
- Designate a point-of-contact with knowledge of the facility's security procedures and floor plan to liaise with police and other emergency agencies in the event of an attack.
- Incorporate an active shooter drill into the organization's emergency preparedness procedures.
- Vary security guards' patrols and patterns of operation.
- Limit access to blueprints, floor plans, and other documents containing sensitive security information, but make sure these documents are available to law enforcement responding to an incident.
- Establish a central command station for building security.

Systems:

- Put in place credential-based access control systems that provide accurate attendance reporting, limit unauthorized entry, and do not impede emergency egress.
- Put in place closed-circuit television systems that provide domain awareness of the entire facility and its perimeter; ensure that video feeds are viewable from a central command station.
- Put in place communications infrastructure that allows for facility-wide, real-time messaging.
- Put in place elevator systems that may be controlled or locked down from a central command station.

Training:

- Train building occupants on response options outlined by the Department of Homeland Security in "Active Shooter: How to Respond" when an active shooter is in the vicinity.
    - **Evacuate**: Building occupants should evacuate the facility if safe to do so; evacuees should leave behind their belongings, visualize their entire escape route before beginning to move, and avoid using elevators or escalators.
    - **Hide**: If evacuating the facility is not possible, building occupants should hide in a secure area (preferably a designated shelter location), lock the door, blockade the door with heavy furniture, cover all windows, turn off all lights, silence any electronic devices, lie on the floor, and remain silent.
    - **Take Action**: If neither evacuating the facility nor seeking shelter is possible, building occupants should attempt to disrupt and/or incapacitate the active shooter by throwing objects, using aggressive force, and yelling.
- Train building occupants to call 911 as soon as it is safe to do so.
- Train building occupants on how to respond when law enforcement arrives on scene: follow all official instructions, remain calm, keep hands empty and visible at all times, and avoid making sudden or alarming movements.

Aircraft Accident

Mitigation Actions

2. Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."

Vulnerability Summary

1. The city of Lincoln, as it continues to grow, will be within the air traffic pattern of the Bismarck Airport (within the Accident Potential Zone).
2. The highest population and number of properties within 15,000 feet (within the Accident Potential Zone (APZ)) of the Bismarck Airport are northwest of the airport based on the alignment of the runway running NW/SE. Properties and populations within that distance include CHI St. Alexius Health, Sanford Health, the State Capitol, five mobile home parks, twelve schools, and Bismarck critical facilities including Bismarck Police Department, the City/County Building and Bismarck Burleigh Public Health.
3. The most vulnerable population are the crew members and frequent travelers based on extensive use of aircraft (higher use equals higher risk or probability).

Pre-Existing Mitigation: Aircraft Accident Hazard

1. The City of Bismarck utilizes ordinances to control land use and building height, as well as minimize or eliminate lighting, radio or wildlife interference with airport operations. See Title 10-09 (airport zoning regulations) and Title 14 (zoning). http://www.bismarcknd.gov/index.aspx?NID=90
2. The Bismarck Airport maintains the following Hazard Mitigation and Emergency Response Plans and Programs:
   - Airport Certification Manual
   - Airport Emergency Plan
   - Airport Security Program
   - Wildlife Hazard Management Plan
   - Environmental Assessments
   - Wetland Mitigation
   - Spill Prevention Control and Countermeasure (SPCC)
   - Bismarck Airport Master Plan Update: https://www.bismarckairport.com/143/2019-Airport-Master-Plan

The Airport Certification Manual (ACM) provides direction and lines of responsibility in the day-to-day operation of the Bismarck Airport. Various other plans including the Airport Emergency Plan, Hazardous Materials, Wildlife Hazard Management Plan, are found in the ACM. The ACM outlines specifically the duties and responsibilities of individuals responsible for meeting the requirements set forth in the various manuals.

The Airport Emergency Plan Assigns responsibility to organizations and individuals for carrying out specific actions at projected times and places in responding to an emergency. As a requirement of the Airport Emergency Plan the airport must conduct on a triennial basis a "Full Scale Emergency Exercise." The purpose of the exercise is for local emergency organizations to gain practice and preparedness for a response in the event of a major aircraft disaster.

The Airport Security Program outlines specific guidelines to ensure security. The security program includes not only airport personnel but Transportation Security Administration and Security Personnel. This includes but is not limited to access control systems, background checks for hiring employees, identification systems, TSA screening, as well as response procedures for emergencies such as a civil disturbance, hijacking, bomb threat and other situations that may occur at the Bismarck Airport.

The wildlife hazard management plan developed in conjunction with the USDA is a plan to mitigate hazards before they occur and to respond to wildlife hazards whenever they are detected or reported. The plan spells out duties and responsibilities of personnel responsible for mitigating wildlife hazards. The plan established responsibilities such as a wildlife coordinator, a wildlife hazard committee that meets annually to discuss current wildlife issues, update permits, as well as changes in ongoing actions that result in preparedness and reduction of wildlife hazards. It also established a wildlife hazard patrol and spells out ongoing mitigation steps for airport staff.

Spill Prevention Control and Countermeasure provides a plan for discharge reporting procedures, containment, inspection and testing, personnel training, and security at the oil storage facilities located on site. The Airport also has a Storm Water Pollution Plan to comply with environmental laws and to protect storm water from contaminants and procedures in the event of storm water pollution. Environmental Assessments are done whenever a project could potentially impact the environment. They provide the airport with information about the impact of the project on the environment and what needs to be done in order to disturb the environment the least.

Biological Infestation

(Urban Forest Damaging Pests)

Mitigation Actions

1. Continue programs to monitor existing and future forest damaging pests.
2. Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.
3. Continue existing mitigation efforts including the systematic approach to removing ash trees in decline and replant with a different species to increase the diversity of our urban forest.
4. Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.

Vulnerability Summary

1. Currently, Dutch Elm Disease is the most prevalent disease impacting trees in Bismarck on an annual basis. Approximately twenty Elm trees are removed in Bismarck each year due to Dutch Elm Disease.
2. The most significant risk and vulnerability to our city urban forest is the potential for Emerald Ash Borer.
3. When Emerald Ash Borer impacts Bismarck's urban forest, extensive resources will be required to combat the spread of the disease, compromising capabilities to address Dutch Elm Disease. The two diseases combined have potential to reduce our tree population by 50%.
4. Infested firewood may be transported by campers/travelers.

Pre-Existing Mitigation: Biological Infestation

1. The City of Bismarck has developed an Emerald Ash Borer Response Plan:
   Plan Purpose: By implementing this plan, the City is attempting to lessen the impact and disruption to its urban forestry program caused when Emerald Ash Borer (EAB) is introduced to Bismarck and the surrounding area. Taking a proactive approach to this threat enables the City to address public and private needs in an efficient and effective manner.
   http://www.bismarcknd.gov/DocumentCenter/Home/View/2124
2. Bismarck has a Dutch Elm Disease control program consisting of firewood inspections in March to identify properties that have Elm firewood. Bismarck has forestry staff that monitors the city looking for symptoms of DED. Positive identification of infected Elms are abated for private trees and public trees are promptly removed if tested positive for DED.
3. The City has ordinances and policies that affect the City's urban forest. The City Forester does have the authority to abate "nuisance" trees on private property:
   13-01-01 (16). Definitions. "Public nuisance" means any dangerous or unsafe trees or portions thereof; any trees encroaching on public sidewalks or impeding vehicular travel on the streets in violation of standards set by the City Forester pursuant to Section 13-02-01(3); any trees located in the sight triangle in violation of Section 14-03-05(3); and any tree harboring insect or disease organisms of a contagious and fatal nature which pose a serious threat to surrounding trees if not immediately removed and disposed of, or treated with proper arboricultural procedure.

13-02-08 (4). Removal, Planting and Replacement. "If any part or the whole of any tree on private premises is found after proper investigation to be dangerous or unsafe, or otherwise constitute a public nuisance, the city forester shall declare the tree or portion thereof a public nuisance and cause the nuisance to be abated pursuant to Section 13-02-14."

The Forestry Advisory Board (FAB) made a motion and approved to include EAB into this "nuisance" tree category at the February 2010 meeting. The Forestry Advisory Board also approved a "Structured Removal Plan". This will address removal of ash trees that are in the "poor and severe decline" condition class, ash trees impacted by water service construction projects, or needing cabling and bracing before EAB arrives. The intent is to slow the spread of EAB by reducing host trees, and gaining time in future removals.

4. Bismarck has a Forest Advisory Board to provide direction and recommendations to the City Forester regarding the health of the urban forest.
   http://www.bismarcknd.gov/index.aspx?nid=929
5. Bismarck participated in a USDA Forest Service/APHIS EAB EOC response exercise.
6. Bismarck has participated in the EAB Awareness week for the last 9-10 years.
7. Bismarck also has participated in the EAB trapping program with the ND Dept. of Agriculture.
8. Public Education is provided via City Forestry web pages regarding biological infestations.
   http://www.bismarcknd.gov/index.aspx?NID=1399
   http://www.bismarcknd.gov/DocumentCenter/Home/View/2697
9. Several organizations and agencies are currently involved in various preparation activities, including: NDSU Extension, ND Department of Agriculture, ND Forest Service, ND Game and Fish Department, ND Parks and Recreation Department, ND Urban and Community Forestry Association, USDA-APHIS, USDA-NRCS, and others. Most of these organizations are represented in the ND EAB Response Committee, chaired by the ND Department of Agriculture. Given that EAB has not yet arrived in North Dakota, each organization currently has similar roles – prepare their own employees, their customers and additional natural resource professionals.
   http://www.ag.ndsu.edu/programplanning/program-teams/horticulture-forestry/documents/eabactionplan.pdf
   http://www.bismarcknd.gov/DocumentCenter/Home/View/2697

Civil Disturbance

Mitigation Actions

1. Bismarck Police Department staff meet with event organizers (primary points of contact) prior to events to learn of event size (expected total participants), event location, time and date and other event specifics. A permitting process is established and permits are encouraged to be completed, but cannot be mandated based on United States case law.

Pre-Existing Mitigation: Civil Disturbance

1. Bismarck Police Department staff meet with event organizers (primary points of contact) prior to events to learn of event size (expected total participants), event location, time and date and other event specifics. A permitting process is established and permits are encouraged to be completed, but cannot be mandated based on United States case law.

Communicable Disease

(Includes Pandemic Influenza, Bioterrorism, and other infectious disease)

Mitigation Actions

1. Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.
2. Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.
3. Identify appropriate locations for isolation or quarantine.
4. Continue Existing Mitigation Efforts (See pre-existing mitigation section)
5. Provide education when conducting food service inspections.
6. Provide mosquito control & surveillance services.
7. Increase Immunizations rates through grants opportunities and QI projects.
8. Increased opportunities to receive Hepatitis B vaccine to high risk individuals.
9. Provide breastfeeding education to increase breastfeeding in the community for higher rates of baby immunity.
10. Provide Narcan training opportunities to the community to help with the emerging substance abuse threat.
11. Ongoing education of staff for better response to an outbreak.
12. Provide website and social media means to educate the public during an event.
13. Engage and support local healthcare providers in an active preparedness coalition.

Vulnerability Summary

1. If other areas of the North Dakota (or neighboring states) are impacted, our medical facilities could be overwhelmed due to demands placed on our facilities. *The same facilities would be overwhelmed by a locally affected population as well.*
2. Although all people are vulnerable, the elderly population and the population with underlying medical conditions or suppressed immune systems are more vulnerable.
3. Common social practices such as community cup or exchange of peace at area churches (and regionally) enhance the vulnerability to communicable diseases.
4. Bismarck has many facilities and other venues that are primarily an asset to the community, but also create vulnerability to the spread of communicable disease within our community:
    a. Bismarck Airport
    b. Bismarck Civic Center
    c. MDU Community Bowl at BSC
    d. Schools
    e. Shopping Centers
    f. Churches
    g. Long term care centers
    h. Hospitals
5. Jurisdictions with the higher populations are at greatest risk from communicable diseases. Bismarck is the 2nd most populated community in ND.
6. Universities located in Bismarck are particularly vulnerable as their student populations often live and study in close quarters, thus heightening the probability of transmission.
7. Almost any highly contagious, incapacitating disease that enters the North Dakota population would quickly overwhelm local and state health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.
8. Communicable diseases are most likely to spread quickly in institutional settings such as dormitories, long-term care facilities, day care facilities, schools, correctional institutions, etc.

9. Those in who live or work in close proximity – within institutional settings are at higher risk.
    a. Our cold winter season promotes vulnerability as people spend more time indoors. In some cases, heating systems may promote the circulation of contaminants.
10. Not all parents choose to vaccinate their children. Consequently, parents who don't vaccinate their children are in essence depending on the vaccination of other children to protect their child from getting vaccine preventable diseases.
11. The percentage of uninsured North Dakotans for 2016 was 7% compared to 8.6% nationally according to the U.S. Census Bureau (U.S. Census Bureau, 2017).
12. Bismarck, including the Bismarck Airport, does not have authority to quarantine without sufficient supporting information.
13. Foodborne illnesses have the greatest impact on the young, elderly and people who may be immune-compromised or have other existing health conditions.
14. Anyone who swims in man-made or natural bodies of water is susceptible to recreational water illness.
15. Anyone living in an area where West Nile virus is present in mosquitoes can get infected. West Nile virus has been detected in all lower 48 states (not in Hawaii or Alaska). The risk of infection is highest for people who work outside or participate in outdoor activities because of greater exposure to mosquitoes. People with certain medical conditions, such as cancer, diabetes, hypertension and kidney disease are also at greater risk for serious illness.

Pre-Existing Mitigation: Communicable Disease
(Includes Pandemic Influenza, Bioterrorism, and other infectious disease)

1. Hand-sanitizers and masks are available to clients to prevent spread of disease.
2. Surveillance is done at the state level and communicated to local public health. Local public health monitors and provides case management of communicable disease.
3. Medical assets exist to appropriately respond. NDDoH and its medical partners have most of the anticipated materials needed for biological response. These materials are stored in a warehouse supported by an internal transportation which can be supplemented by contract or by assistance request to DES. Some materials are pre-deployed around the state and additionally local public health units have medical assets stored in their health units.
4. Annual flu clinics are held at the BBPH Office.
5. Immunization clinics are held at BBPH Office.
6. Emergency Preparedness SWC Regional Coordinator updates plans on communicable disease, isolation and quarantine and bioterrorism.
7. N95 fit-testing is completed for nursing staff at local public health units, as well as for long-term care facilities.
8. Bismarck/Burleigh Public Health maintains emergency preparedness plans and conducts training and exercising of those plans.
9. Bismarck/Burleigh provides on-going public education efforts to help individuals protect themselves and the community from the spread of communicable diseases.
10. Specific diseases that are primarily mitigated through on-going routine vaccination programs include *diphtheria, tetanus, and polio.*
11. Continuity of Operations Plans have been developed by Bismarck and by Bismarck/Burleigh Public Health. The plans include orders of succession for purposes of sustaining leadership and critical functions (ie: emergency services).
12. The USPS has a bio-detection system in place at the sorting facility to detect anthrax.

13. It is required to inform the ND Department of Health regarding incidence of reportable diseases per statutory authority NDCC 23-07-01. Reportable disease are listed at http://www.ndhealth.gov/disease/disease%20reporting/diseasecall.htm
14. A regional Healthcare Preparedness Advisory Coalition is established with the goal to provide information/education and support to healthcare facilitates, private industry and the community so they can prepare for emergency situations by developing plans and creating awareness.
15. All food establishments in Bismarck are inspected once every six months to verify that they are operating in compliance with the food code.
16. The ND Department of Health (NDDoH), Division of Disease Control monitors and investigates Foodborne illnesses.
17. Diagnosed foodborne illness is mandatory reporting to the NDDoH.
18. Food employees who are symptomatic with vomiting or diarrhea must be excluded from work until they are asymptomatic for 24 hours.
19. All public and semi-public pools are inspected annually by Bismarck's Environmental Health Division.
20. All public and semi-public pools are tested once a month for bacteriological analysis.
21. All public and semi-public pools are required to have a pool operator that is certified by the National Swimming Pool Foundation.
22. The North Dakota Department of Health (NDDoH), Division of Disease Control monitors and investigates all Recreational Water Illnesses.
23. Bismarck currently has a vector control program that performs mosquito surveillance, educates residents on how to avoid getting bitten by mosquitoes, fogs public parks and walking paths and treats standing water with larvacide.
24. The North Dakota Department of Health monitors West Nile surveillance throughout the state.

Dam Failure

(Garrison Dam)

Mitigation Actions

1. Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.
2. Develop an Emergency Action Plan for Jackman Coulee Dam #2. (Tom O'Leary Golf Course)
3. Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.

Vulnerability Summary (based on catastrophic dam failure)

1. The City of Bismarck has a significant investment in a number of critical facilities within the inundation area as mapped including the Water Treatment Plant, Wastewater Treatment Plant, Police Department, South Fire Station, Airport, Northern Plains Commerce Centre, and Event Center.
2. Continuity of Government and Continuity of Operations capability would be compromised as a result of personal impact to city staff as well as direct impact to an extensive number of critical facilities as noted above in #1.
3. The city's water and waste-water treatment plants are a significant vulnerability to a dam failure. Impact to these critical facilities / critical infrastructure utilities would have an adverse impact to the entire community, including the properties and population not directly flooded.
4. The most vulnerable population would be those within the inundation area who are non-ambulatory and require evacuation assistance. There is a limited amount of time to identify those persons and ensure assistance is provided after notification of a dam failure.
5. The population of those within the hospitals and other institutions requiring evacuation are highly vulnerable. Evacuation requirements for facilities and populations outside of the inundation area would depend on impact to the water treatment plant and other utility lifelines.
6. The population of the ND State Penitentiary is of high vulnerability due to limited time to evacuate.
7. Both the BNSF railroad and the DMVRR railroad are within the mapped inundation area for dam failure.
8. Structural mitigation to minimize or eliminate the inundation threat for the city is not feasible or practical; therefore, all critical facilities, property, structures, and critical infrastructure within the inundation area are vulnerable.

Pre-Existing Mitigation: Dam Failure

1. Dam owners are responsible for maintenance of their dams, so their commitment is essential to reducing the risk of dam failures. (2018 ND DES Enhanced Mitigation Plan)
2. Pursuant to North Dakota Century Code, the North Dakota State Engineer and the North Dakota State Water Commission have the power, authority and general jurisdiction to regulate, control, and supervise the construction and operation of dams within the State of North Dakota. As such, the Dam Safety Program is administered by the North Dakota State Water Commission.
3. The purpose of North Dakota's Dam Safety Program is to minimize the risk to life and property associated with the potential failure of dams in the State. Functions of the Dam Safety Program include conducting dam inspections, making recommendations to dam owners regarding necessary maintenance and repairs, and maintaining an inventory of dams in North Dakota. There are currently 130 high and medium hazard dams in the State, including 24 federally owned dams. Dam Safety Program staff conduct full inspections of the 106 non-federally owned high hazard and medium hazard dams on a rotational basis. High hazard dams are currently scheduled for inspection at least once every four years. Medium hazard dams are currently scheduled for inspection at frequencies varying up to once every ten years. The Dam Safety Program is managed by the NDSWC. Source: (2018 ND DES Enhanced Mitigation Plan)
4. Although North Dakota has very low risk to seismic activity, the U.S. Army Corps of Engineers has strong motion sensors installed at the Garrison Dam site near Riverdale that measure intense ground movement. There are an additional three seismic monitoring stations throughout the State. One is located south of Bismarck near Huff, another in the Red River Valley just northwest of Fargo, and the third southeast of Devils Lake near Maddock. (Source: 2018 ND DES Enhanced Mitigation Plan).
5. The US Army Corp of Engineers (USACE) maintains an extensive dam safety program to ensure the integrity of Garrison Dam. The USACE has a system of; relief wells, instrumentation (for monitoring water pressures and movement within the embankment), and a comprehensive inspection system. As part of the inspection program, the USACE conducts formal annual inspections and more comprehensive periodic inspections every five years. All of these steps are taken to help insure the integrity of the Garrison Dam to allow the USACE to continue to operate for the eight authorized purposes of; flood control, navigation, irrigation, hydropower, water supply, water quality, recreation and fish & wildlife.
6. The USACE updated the Dam Failure Inundation Map (January 2015) regarding the Garrison Dam Project. The inundation maps are made available to approved Emergency Action Plan holders.
7. The USACE has an Emergency Action Plan that would be followed in any event where the USACE's ability to operate as designed would be in jeopardy.

    - Dam Safety Program Information: http://www.usace.army.mil/Missions/CivilWorks/DamSafetyProgram/ProgramActivities.aspx
    - Garrison Dam and Lake Sakakawea Information: http://www.nwo.usace.army.mil/Missions/DamandLakeProjects/MissouriRiverDams/Garrison.aspx

Drought

Mitigation Actions: No new mitigation actions. In addition to local response capabilities, the pre-existing mitigation identified below adequately address vulnerabilities identified.

Pre-Existing Mitigation

1. The City of Bismarck water treatment plant has two water intake systems.
   - A new Horizontal Collector Well intake was placed in operation in November 2014. This water intake is 80 feet below the river's surface and collects ground water that is recharged from the river bed. This intake has a capacity of 34 MGD (million gallons per day) and is not impacted by fluctuations in river levels or short term changes in river water quality.
   - The intake constructed in the 1950's provides direct withdrawal of the river via four 20 inch diameter pipes. The quality and quantity of water from this intake is potentially impacted by changes in the river's level and the migration of sandbars. This intake will be maintained as a backup to the horizontal collector well intake.
2. The Bismarck Code of City Ordinances uses Chapter 2-08-03 to give the President of the Board of City Commissioners the power to issue an emergency or disaster declaration and to utilize twenty-three specific emergency powers. These powers include…
   - Require the continuation, termination, disconnection, limitation, or suspension of natural gas, electrical power, water, sewer, or other public utilities or services.
   - Control, restrict, allocate, or regulate the use, sale, production, or distribution of food, water, fuel, clothing, and/or other commodities, materials, goods, services, and resources.

Vulnerability Summary

In the United States, a well-developed economy and agricultural system generally protect citizens from the most critical effects of drought such as shortages of food and water. However, drought still causes extreme hardship for farm and ranch families, and individual wells may run dry.
Source: National Drought Mitigation Center

1. Typically, the most profound impact of drought is to the economy:
   a. Farm and ranching community
   b. Impact to local businesses (and employees) associated with the agricultural industry
   c. Economically disadvantaged – increased cost of food
   d. Tourism / recreation
2. Economically disadvantaged may be vulnerable due to the likelihood of increased cost of food during extended drought conditions regardless of geographic area impacted by severe drought conditions.
3. Heat waves associated with droughts create additional risk for vulnerable populations such as the elderly, young, and those required to work outdoors including first response community.
4. Drought increases fire risk. See Fire and Wildland Fire hazards for information regarding vulnerabilities and mitigation ideas.
5. The environment is vulnerable to drought:
   a. Air quality
   b. Loss of wetlands
   c. Insect infestations
   d. Invasive vegetative species (ie: leafy spurge)

Fire

Mitigation Actions

1. Continue to update and enforce zoning, building and fire code regulations.
2. Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.

Public Education topics:

3. Provide public education to the community at large.

Vulnerability Summary

1. Occupancies that do not have working smoke detectors are at risk. Statistics indicate a higher fatality rate in fires that occur in occupancies without working smoke detectors.
2. Non-sprinklered property is at a higher risk of sustaining more damage or life loss compared to property that is protected by sprinkler systems.
3. The young (ie: Daycare) and elderly population is more vulnerable for several reasons. Age, mental state and physical limitations may make it difficult to evacuate a building involved in fire or they can become confused and not be able to take the correct actions. Many daycares and schools do not have fire sprinkler systems.
4. Some mobile homes are vulnerable due to their construction materials and close proximity to each other.
5. Apartment houses without sprinkler systems or working alarm systems are also at higher risk.

Pre-Existing Mitigation: Fire

1. Fire stations are strategically located throughout the city for optimum response times.
2. All fire stations are adequately staffed to provide response capability for fires that may range from a single-family dwelling to a large commercial property.
3. The city has a modern dispatch center with many capabilities.
4. Fire hydrants are spaced throughout the city for uniform coverage.
5. Fire hydrants are flow tested to assure adequate water supply. Water Modeling is used to provide a more current and comprehensive assessment of the water supply.
6. A fire inspection program is in place. All commercial properties and larger multi-family residential rental properties are inspected annually to identify and reduce fire hazards.
7. Fire and Building codes have been adopted to ensure fire and life safety requirements are met for new and existing buildings. The following codes are currently enforced by the City of Bismarck, Fire Department:
    - International Building Code – 2018
    - International Fire Code - 2018
    - International Residential Code - 2018
    - International Mechanical Code - 2018
    - International Fuel Gas Code - 2018
    - North Dakota State Plumbing Code - 2009
    - National Electrical Code - 2011

- Laws, Rules, and Wiring Standards of North Dakota - 2011
- NFPA 13 Installation of Sprinkler Systems - 2010
- NFPA 13R Installation of Sprinkler Systems in Residential Occupancies up to and including 4-stories in height - 2010
- NFPA 14 Installation of Standpipe Systems - 2010
- NFPA 72 National Fire Alarm Code - 2010

8. Sprinkler requirements are in place to increase the level of life safety in certain buildings as well as to control fires that do occur.
9. Zoning and other regulations are in place to reduce the risk of fire exposure through orderly development of the community.
10. A permitting process is in place for suppression systems, alarm systems, fireworks displays and building construction.
11. Public education programs are provided to the youth in the school system.

Flood

Mitigation Actions

1. Bismarck is currently rated at Class 8 within the Community Rating System. Pursue Class 7 status when likely to qualify as Class 7 based on current activities.
2. Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.
3. Provide protection to the wastewater treatment plant outfall: Place control structures along the wastewater treatment plant outfall near the Tavis structure and the river to protect the wastewater treatment plant from inundation when river levels at Bismarck gage station rise to 13'.
4. Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"

Public Education Topics:

5. Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.
6. Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.

Vulnerability Summary

1. Although flood protective measures including levee structures are in place to protect south Bismarck, those protective measures are not certified by FEMA. There are also required response actions to fill gaps. Properties, population, and infrastructure within the 100 Year and 500 Year flood plains remain vulnerable to those flood events.
2. Vehicles and occupants may inadvertently enter a flooded underpass at the 7th Street or 9th Street location following an urban flooding event. There is pumping capability at the 7th Street underpass location (replaced in 2019). The 9th street location is drained via gravity flow.
3. Vulnerabilities regarding lack of access following an urban ponding event include:
    - Airport and Skyway Village
    - 12th Street (from University Drive to Bismarck Expressway)
    - Bismarck Expressway from 7th to 12th Street
    - South 3rd Street – from Arbor Avenue to Bismarck Expressway
    - Broadway Avenue – from 12th to 14th Street
    - Washington Street and Bowen Avenue
    - 2nd Street and Arbor Avenue
4. Waste Water Treatment Plant operations are affected by the elevation of the river (ie: 500 year flood event or ice jam). Pumping may be required for effluent discharge depending on the river elevation.
5. The South Fire Station is vulnerable to urban flooding (street access).
6. An emergency action plan has been developed (2020) for the Jackman Coulee High Hazard Dam on the Tom O'Leary Golf Course. Through the breach analysis, a breach during the Inflow Design Event (0.5PMP) would result in 35 structures being impacted by flood waters.
7. Stormwater management infrastructure may be impacted by more frequent heavy rain events as a result of climate change impacts.

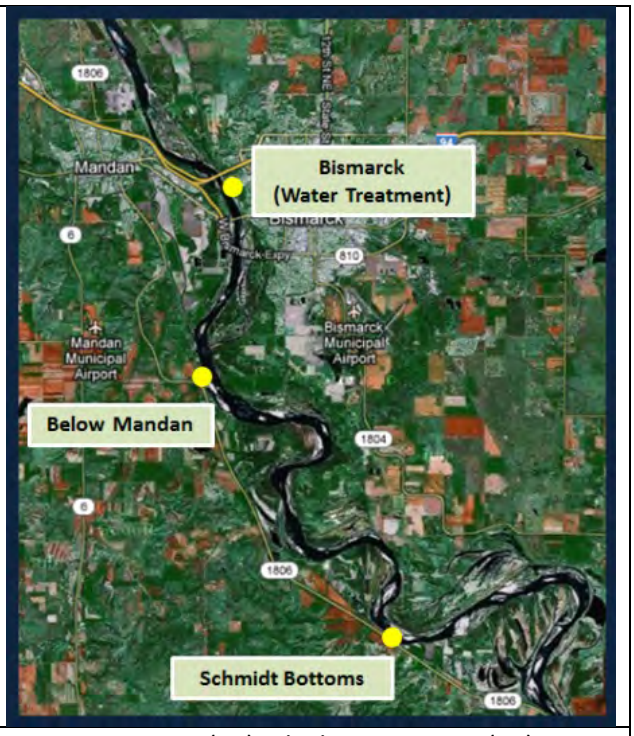
Pre-Existing Mitigation: Flood

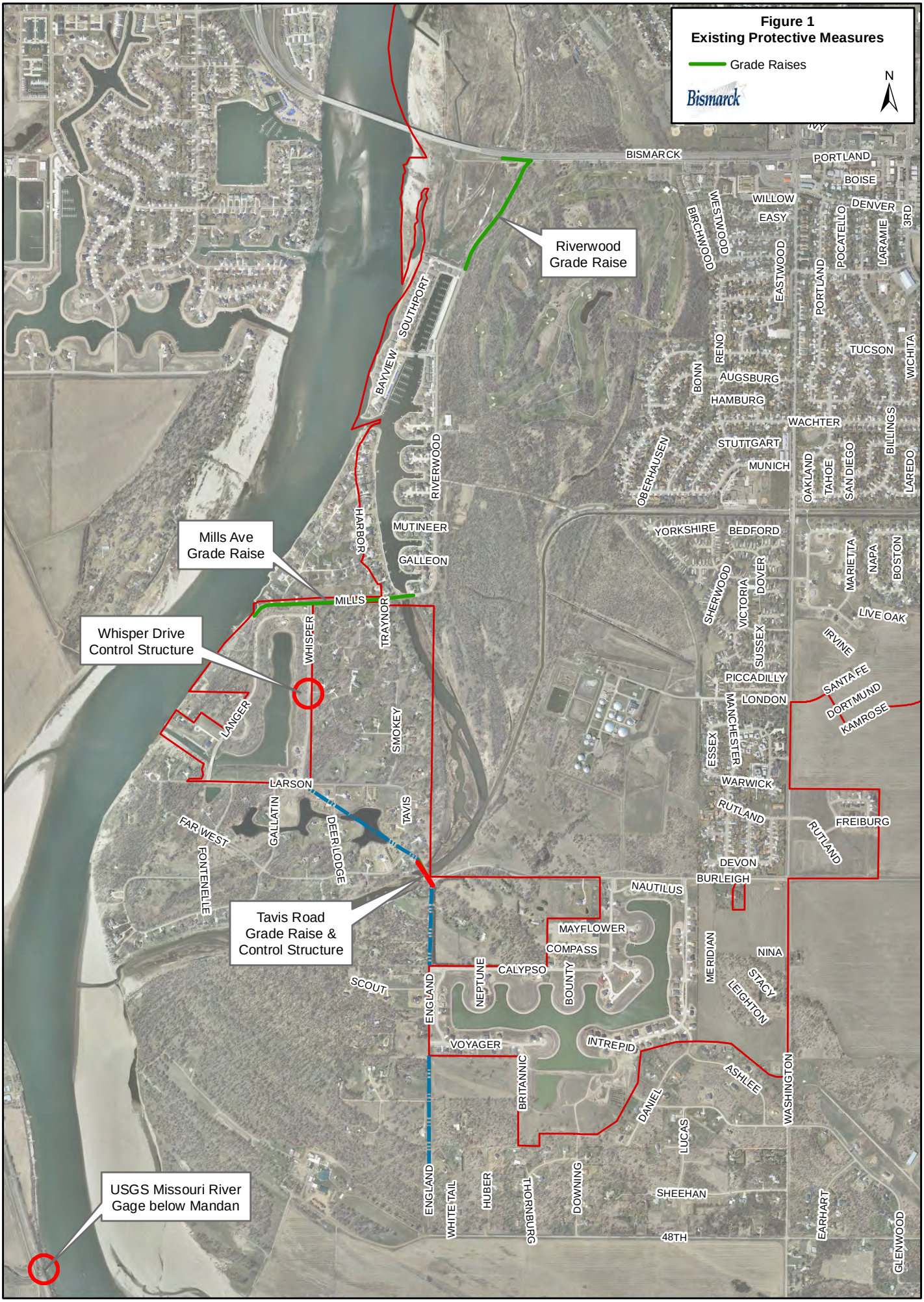
Existing Protective Measures
(post 2011 Flood Event Mitigation Activities)

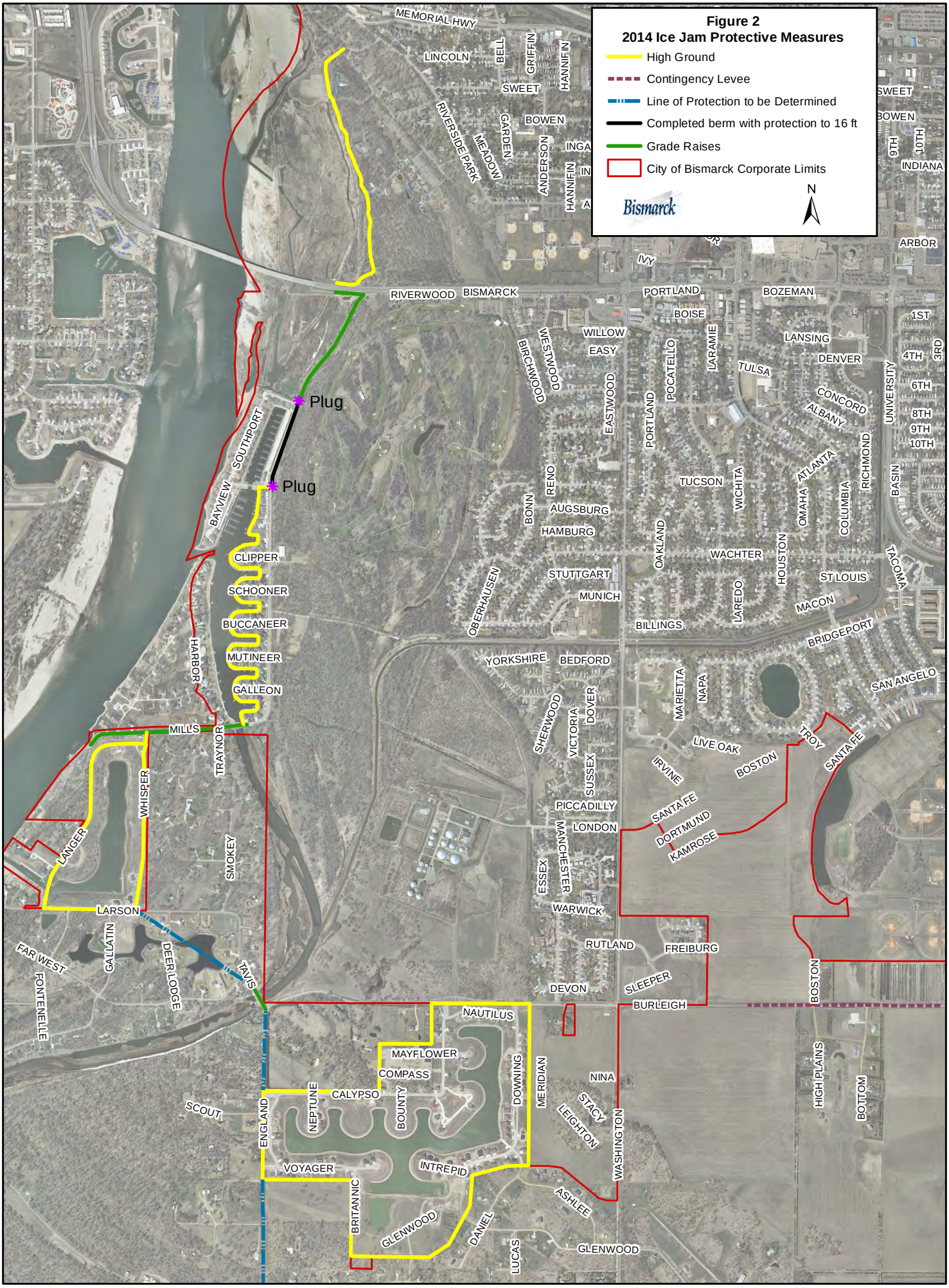
Also see applicable maps (figures 1 through 5) following this table

1. The Tavis Road flood gate control structure and pumping station have been installed and are operational. Closing the flood gate control structure prevents flood waters from back-flowing into and elevating the drainage ditch level. Additionally, the pumping station establishes the capability of reducing the drainage ditch level to maximize its storage capacity and minimize the potential for flash flood impacts.
2. The floodgate at Washington Street takes properties east of Washington Street out of the 100-Year floodplain. This structure was repaired following the 2011 flood and is fully operational.
3. The grade of Tavis Road has been raised to a flood stage of 20 feet.
4. Following the 2011 flood event, the City of Bismarck installed flood gates on stormwater outfalls. See letter "C" on Figure 5 map.
5. The pumping capability at #8 is permanent. The other locations require response action to set up temporary pumping. See applicable map - Figure 5.
6. Additional ice jam protection measures were installed in 2012 by Burleigh County.
7. In 2013, the City of Bismarck completed the Riverwood Drive and Mills Ave reconstruction projects. These projects included grade raises of the existing roadways to a flood stage of 20-feet. Riverwood Drive was completed from Expressway Ave to the north entrance of Southport Loop. The grade raise portion of Mills Avenue was completed and paved in 2014. The project included several control structures with sluice gates located on the storm water outfalls and a control structure on the Mills Avenue causeway. The new sluice gates and control structure are operation and ready to be manually closed during a flood event.
8. Burleigh County completed a grade raise project in the Fox Island area which protects Bismarck from flooding. The grade raise extends from Tavis Road to Far West Drive to Gallatin Dr to Gallatin Loop, Gallatin Loop to offroad to Missouri River bank, north to Whisper Bay channel to Whisper Bay bridge. See #21 Levee Construction"



River Gage Locations: See map on right. 9. A new river gaging station has been installed by the USGS to collect river elevation data for both open water and ice covered periods on the Missouri River. The USGS installed the stage gage near Fort Lincoln on the west side of the river: USGS 06349070, Missouri River below Mandan, ND. This gage will provide timely stage information for South Bismarck.	
Open Space Deed Restrictions in place:	1. Lot Twenty Four (24), Block Tweny Nine (29), Stein's Fourth Addition to the City of Bismarck. This property was sold to the City of Bismarck in 2002, and must remain compliant with open space regulations in perpetuity.


Figure 1
Existing Protective Measures
Grade Raises
Bismarck
N
Riverwood Grade Raise
Mills Ave Grade Raise
Whisper Drive Control Structure
Tavis Road Grade Raise & Control Structure
USGS Missouri River Gage below Mandan
BISMARCK
PORTLAND
BOISE
DENVER
WILLOW
EASY
BIRCHWOOD
WESTWOOD
EASTWOOD
POCATELLO
LARAMIE
3RD
SOUTHPORT
BAYVIEW
RENO
TUCSON
WICHITA
BONN
AUGSBURG
HAMBURG
WACHTER
STUTTGART
MUNICH
OBERHAUSEN
OAKLAND
TAHOE
SAN DIEGO
BILLINGS
LAREDO
RIVERWOOD
HARBOR
MUTINEER
GALLEON
YORKSHIRE
BEDFORD
SHERWOOD
VICTORIA
DOVER
MARIETTA
NAPA
BOSTON
LIVE OAK
IRVINE
SUSSEX
PICCADILLY
SANTA FE
LONDON
DORTMUND
KAMROSE
MANCHESTER
ESSEX
WARWICK
RUTLAND
FREIBURG
DEVON
BURLEIGH
NAUTILUS
MILLS
WHISPER
TRAYNOR
LANGER
SMOKEY
LARSON
TAVIS
FAR WEST
GALLATIN
DEER LODGE
FONTENELLE
MAYFLOWER
COMPASS
CALYPSO
NEPTUNE
BOUNTY
MERIDIAN
NINA
STACY
LEIGHTON
SCOUT
ENGLAND
VOYAGER
INTREPID
ASHLEE
WASHINGTON
BRITANNIC
DANIEL
LUCAS
WHITE TAIL
HUBER
THORNBURG
DOWNING
SHEEHAN
48TH
EARHART
GLENWOOD


Figure 2
2014 Ice Jam Protective Measures
High Ground
Contingency Levee
Line of Protection to be Determined
Completed berm with protection to 16 ft
Grade Raises
City of Bismarck Corporate Limits
Bismarck
N
Plug
Plug
MEMORIAL HWY
LINCOLN
BELL
GRIFFIN
HANNIFIN
SWEET
BOWEN
RIVERSIDE PARK
MEADOW
GARDEN
ANDERSON
INGA
IN
A
ARBOR
IVY
RIVERWOOD
BISMARCK
PORTLAND
BOZEMAN
BOISE
1ST
WILLOW
EASY
WESTWOOD
BIRCHWOOD
LANSING
DENVER
4TH
3RD
TULSA
LARAMIE
POCATELLO
EASTWOOD
PORTLAND
CONCORD
ALBANY
UNIVERSITY
6TH
8TH
9TH
10TH
RICHMOND
BASIN
ATLANTA
OMAHA
COLUMBIA
TUCSON
WICHITA
RENO
BONN
AUGSBURG
HAMBURG
OAKLAND
WACHTER
HOUSTON
ST LOUIS
TACOMA
LAREDO
MACON
BILLINGS
BRIDGEPORT
OBERHAUSEN
STUTTGART
MUNICH
SOUTHPORT
BAYVIEW
CLIPPER
SCHOONER
BUCCANEER
HARBOR
MUTINEER
GALLEON
YORKSHIRE
BEDFORD
MARIETTA
NAPA
SAN ANGELO
SHERWOOD
VICTORIA
DOVER
SUSSEX
LIVE OAK
TROY
SANTA FE
IRVINE
BOSTON
PICCADILLY
LONDON
MANCHESTER
ESSEX
WARWICK
MILLS
TRAYNOR
WHISPER
LANGER
SMOKEY
LARSON
FAR WEST
GALLATIN
DEER LODGE
TAVIS
FONTENELLE
RUTLAND
FREIBURG
DEVON
SLEEPER
BURLEIGH
NAUTILUS
MAYFLOWER
COMPASS
CALYPSO
BOUNTY
NEPTUNE
ENGLAND
SCOUT
VOYAGER
INTREPID
DOWNING
MERIDIAN
NINA
STACY
LEIGHTON
WASHINGTON
ASHLEE
BRITANNIC
GLENWOOD
DANIEL
LUCAS
HIGH PLAINS
BOTTOM

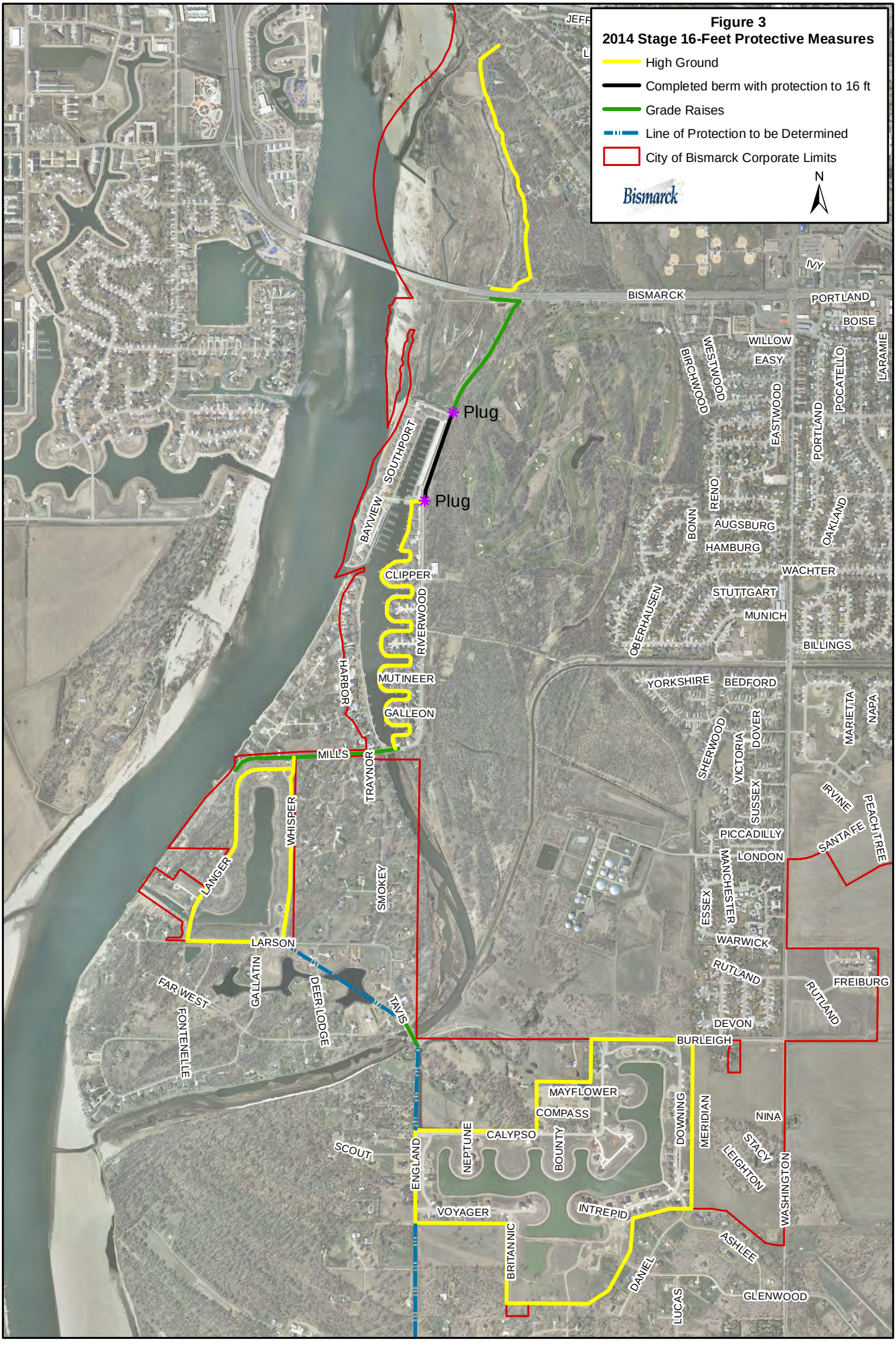
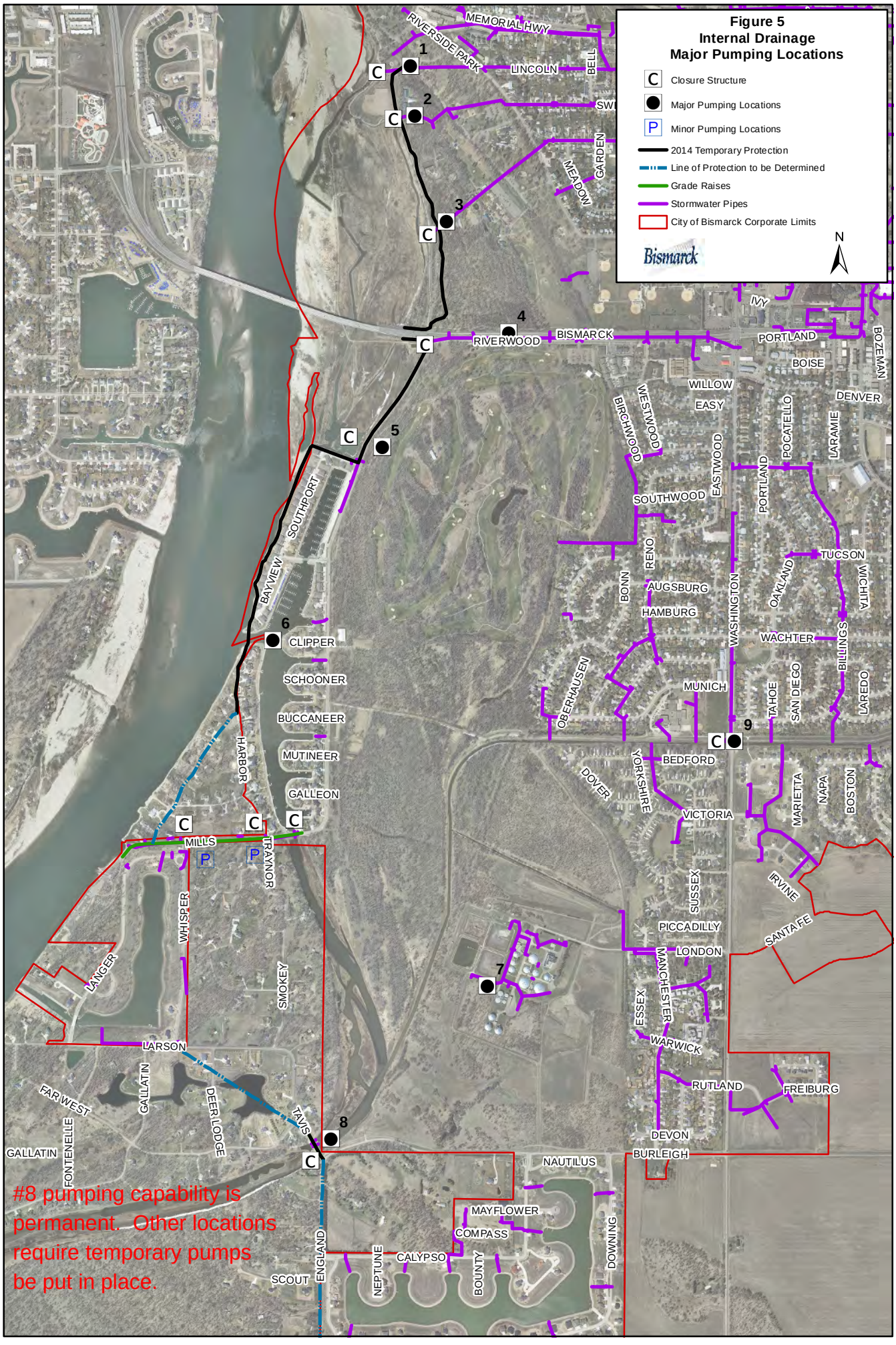

Figure 3
2014 Stage 16-Feet Protective Measures
High Ground
Completed berm with protection to 16 ft
Grade Raises
Line of Protection to be Determined
City of Bismarck Corporate Limits
Bismarck
N
Plug
Plug
SOUTHPORT
BAYVIEW
CLIPPER
RIVERWOOD
HARBOR
MUTINEER
GALLEON
MILLS
TRAYNOR
WHISPER
LANGER
SMOKEY
LARSON
GALLATIN
DEER LODGE
TAVIS
FAR WEST
FONTENELLE
SCOUT
ENGLAND
NEPTUNE
CALYPSO
VOYAGER
BRITANNIC
MAYFLOWER
COMPASS
BOUNTY
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MERIDIAN
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STACY
LEIGHTON
WASHINGTON
ASHLEE
GLENWOOD
LUCAS
DANIEL
INTREPID
BURLEIGH
DEVON
RUTLAND
FREIBURG
WARWICK
ESSEX
MANCHESTER
LONDON
PICCADILLY
SANTA FE
PEACHTREE
IRVINE
SUSSEX
VICTORIA
DOVER
SHERWOOD
NAPA
MARIETTA
YORKSHIRE
BEDFORD
BILLINGS
MUNICH
STUTTGART
WACHTER
OBERHAUSEN
OAKLAND
AUGSBURG
HAMBURG
BONN
RENO
EASTWOOD
PORTLAND
BIRCHWOOD
WESTWOOD
WILLOW
EASY
POCATELLO
LARAMIE
BOISE
PORTLAND
BISMARCK
IVY


Figure 4
2014 Stage 20-Feet Protective Measures
Line of Protection to be Determined
2014 Temporary Protection
Grade Raises
City of Bismarck Corporate Limits
Bismarck
N
ARBOR
IVY
RIVERWOOD
BISMARCK
BISMARCK
WILLOW
EASY
WESTWOOD
BIRCHWOOD
EASTWOOD
SOUTHWOOD
PORTLAND
SOUTHPORT
BAYVIEW
RENO
BONN
AUGSBURG
HAMBURG
WACHTER
WASHINGTON
CLIPPER
SCHOONER
BUCCANEER
MUTINEER
GALLEON
OBERHAUSEN
MUNICH
OAKLAND
HARBOR
DOVER
YORKSHIRE
BEDFORD
MARIETTA
VICTORIA
MILLS
TRAYNOR
IRVINE
SUSSEX
WHISPER
PICCADILLY
LONDON
LANGER
SMOKEY
MANCHESTER
ESSEX
LARSON
WARWICK
RUTLAND
FAR WEST
DEER LODGE
TAVIS
DEVON
GALLATIN
FONTENELLE
BURLEIGH
NAUTILUS
MAYFLOWER
COMPASS
CALYPSO
BOUNTY
DOWNING
ENGLAND
NEPTUNE
SCOUT


Figure 5
Internal Drainage
Major Pumping Locations
Closure Structure
Major Pumping Locations
Minor Pumping Locations
2014 Temporary Protection
Line of Protection to be Determined
Grade Raises
Stormwater Pipes
City of Bismarck Corporate Limits
Bismarck
N
MEMORIAL HWY
RIVERSIDE PARK
LINCOLN
BELL
MEADOW
GARDEN
RIVERWOOD
BISMARCK
IVY
PORTLAND
BOZEMAN
BOISE
WILLOW
EASY
DENVER
BIRCHWOOD
WESTWOOD
EASTWOOD
POCATELLO
LARAMIE
SOUTHWOOD
RENO
BONN
AUGSBURG
HAMBURG
WASHINGTON
OAKLAND
TUCSON
WICHITA
WACHTER
BILLINGS
OBERHAUSEN
MUNICH
TAHOE
SAN DIEGO
LAREDO
BEDFORD
DOVER
YORKSHIRE
VICTORIA
MARIETTA
NAPA
BOSTON
IRVINE
SUSSEX
PICCADILLY
SANTA FE
LONDON
MANCHESTER
ESSEX
WARWICK
RUTLAND
FREIBURG
DEVON
BURLEIGH
NAUTILUS
MAYFLOWER
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CALYPSO
NEPTUNE
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MUTINEER
GALLEON
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FAR WEST
FONTENELLE
DEER LODGE
TAVIS
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#8 pumping capability is permanent. Other locations require temporary pumps be put in place.

Pre-Existing Mitigation Continued: Flood

10. The Bismarck 100-Year and 500-Year Floodplain Maps (Flood Insurance Rate Map) are both updated as of 2014.
11. Bismarck is a participating community in the National Flood Insurance Program. (CID#380149). Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives, which are: New buildings must be protected from flooding damages that occur as a result of the 100-year flood, and new development must not cause an increase in flood damages to other property.
12. Bismarck became a Community Rating System (CRS) community in 2017, entering the program with a Class 8 rating. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions that meet the goals of the CRS.
13. **Floodplain Ordinance:** The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations. More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
14. Floodplain management is addressed through our Floodplain Administrator and Community Development via regular planning meetings where storm water management and floodplain issues are addressed.
15. As part of the 2014 Growth Management Plan as Amended, the future land use plan (FLUP) identifies an urban service area boundary (USAB). The USAB identifies the area within which the City of Bismarck can reasonably provide municipal infrastructure services (water, stormwater, sanitary sewer and transportation). As a secondary benefit, maintaining infrastructure development within the USAB helps to limit potential impact to the City of Bismarck following any future flood events.
16. Stormwater Management Program – Mitigation Capabilities: Bismarck has a Stormwater Management Program implemented jointly by Community Development, Engineering, and Public Works and a Stormwater Program Coordinator within the Public Works Department. Mitigation capabilities of the Stormwater Management program are identified through Community Development via City Ordinance Title 14.1 (Zoning Ordinance). The city has authority to regulate and enforce stormwater management requirements to promote health, safety, and welfare of the people and property within Bismarck and its extraterritorial jurisdiction. The requirements, permitting and detailed review process are in place to mitigate the impacts of development and land disturbance, protect natural resources, maintain water quality, and minimize stormwater runoff, erosion, and urban flooding issues. More Information: https://www.bismarcknd.gov/190/Stormwater
17. Flood Insurance Study: The special flood hazard areas are identified by the Federal Emergency Management Agency (FEMA) in a scientific and engineering report titled "The Flood Insurance Study for Burleigh County, North Dakota and Incorporated Areas", revised August 4, 2014, with an accompanying flood insurance rate map (FIRM), and as subsequently updated by any Letter of Map Amendment (LOMA), Letter of Map Revision (LOMR) and/or Letter of Map Revision Based on Fill (LOMR(f)) issued by the Federal Emergency Management Agency (FEMA). The Flood Insurance Study (FIS) is on file in the office of the Floodplain Administrator. Special flood hazard areas may also be designated in a storm water management plan prepared for a development, plat or watershed. Flood Insurance Study and Flood Insurance Rate Maps are available via FEMA: https://msc.fema.gov/portal/home

18. The National Weather Service issues warnings, watches, and advisories for flooding.

Additional completed and on-going flood mitigation (pre-existing).

19. Apex Engineering completed a study to identify solutions to reduce urban ponding in south Bismarck in the Expressway and South 12th Street area. Identified actions have been completed.
20. The 7th Street underpasses has permanent pumping capability to address urban flooding events. The pump was replaced in 2019. The 9th Street location relies on gravity flow.

21. Commitment to Stormwater Management :

Throughout its existence Bismarck has devoted considerable resources to ensuring the safe and adequate discharge of stormwater within the community.

A number of diversified watersheds within and adjacent to our city, such as the Apple Creek watershed, the Hay Creek watershed, the Jackman Coulee watershed, and the Tyler Coulee watershed, has resulted in the need for a proper stormwater management planning to minimize the potential for damages to already developed downstream properties as development and growth continued. Early solutions to stormwater issues tended to deal mainly with accommodating runoff volume and provided little else as far as erosion control or water quality. Stream channelization was viewed as an acceptable solution. For a more complete listing of the stormwater projects completed in Bismarck over the years, please consult the City of Bismarck Stormwater Management Plan, dated April 1, 1997.

Since the passage and adoption of the City of Bismarck Stormwater Management Ordinance in 1997 with an implementation date of January 1, 1998 (updated and effective January 1, 2018), increased emphasis has been placed on requiring developers to properly control stormwater runoff from their property so that post development runoff is equal to, or less than, predevelopment runoff. This has typically been accomplished through an extensive network of detention ponds, some of a local nature meaning the pond detains runoff from a limited area, and some of a regional nature where the pond collects runoff from a larger area involving multiple property owners and neighborhoods.

Working collectively with developers and grant monies obtained from federal, state, and local sources, recent projects have resulted in stormwater systems that more closely resemble natural stream streambeds and ponds. Recreational trails have been constructed adjacent to and within some stormwater areas. For example, the restoration of the Hay Creek Greenway, complete with a shared use path, now serves as an asset to our community and has generated appreciative comments from our citizens.

Stormwater management, both nationwide and in Bismarck, is a much more complex matter than it was even a half century ago. Through continued proper planning, design, construction, operation and maintenance, our stormwater resources can provide safe, reliable protection for our community and residents for years to come.

National Flood Insurance Program Compliance
(NFIP Compliance)

Bismarck is a participating community in the National Flood Insurance Program. (CID#380149). Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives, which are: New buildings must be protected from flooding damages that occur as a result of the 100-year flood, and new development must not cause an increase in flood damages to other property.

Bismarck has procedures implemented to address and maintain NFIP compliance.

1. A floodplain ordinance has been adopted and remains in effect. The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations.
   More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
   See ordinance – next page.
2. Residents are provided information on flood hazards, floodplain map data, and availability of flood insurance.
3. An interactive floodplain map is available on the city's website: https://arcg.is/1zqDTH0
4. Floodplain management is addressed through our Floodplain Administrator and Community Development via regular planning meetings where storm water management and floodplain issues are addressed.
5. Mitigation Actions highlighted below illustrate commitment to maintain NFIP compliance. These mitigation actions are also identified in Section 4: Mitigation Implementation Action Plan.
   - Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).
   - Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.
   - Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.
6. Additional actions supporting NFIP compliance are noted in within this plan section (ie: Flood Hazard mitigation actions and pre-existing mitigation)

National Flood Insurance Program (NFIP)

The Federal Disaster Protection Act of 1973 requires state and local governments to participate in the NFIP as a condition to the receipt of any federal loan or grant for construction projects in flood prone areas. Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives. The first objective is that new buildings must be protected at a 100-year flood level. The second objective is that new development must not cause an increase in flood damage to other property. In 2012, the Biggert-Waters Reform Act was signed and contains many reforms that will impact the NFIP moving forward. These changes include the phasing out of subsidies, new insurance policies to be issued at full-risk rates, and grandfathered rates being phased out over five years. Communities have been provided assistance through the North Dakota Floodplain Management Act of 1981 which directs the state engineer to aid local governments in reducing flood damages through sound floodplain management. The state legislature provided the state engineer with an appropriation to be used in assisting communities to obtain base flood (100-year) elevation data.

Floodplain Ordinance
NFIP Compliance Continued

Floodplain Ordinance: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962

14-04-19. FP Floodplain District. In any FP floodplain district, the following regulations shall apply:

1. Statement of purpose. It is the purpose of this section to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:
    a. To protect human life and health;
    b. To minimize expenditure of public money for costly flood control projects;
    c. To minimize the need for rescue and relief efforts associated with flooding, generally undertaken at the expense of the general public;
    d. To minimize prolonged business interruptions;
    e. To minimize damage to public facilities and utilities located in special flood hazard areas such as water and gas mains, electric, telephone, and sewer lines, streets, and bridges;
    f. To help maintain a stable tax base by providing for the use and development of special flood hazard areas so as to minimize future flood blight areas;
    g. To ensure that potential buyers are notified that property is located in a special flood hazard area;
    h. To ensure that those who occupy the special flood hazard areas assume responsibility for their actions; and
    i. To provide an increased level of protection in anticipation of future increases in the base flood elevation (BFE).
2. Methods of reducing flood losses. In order to accomplish its purposes, this section includes methods and provisions for:
    a. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion, flood water elevations or flow velocities;
    b. Requiring that uses vulnerable to flooding, including attendant utilities and facilities which serve such uses, be protected against flood damage at the time of initial construction;
    c. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or convey flood waters;
    d. Controlling filling, grading, dredging, and other development which may increase flood damage; and
    e. Preventing or regulating the construction of flood barriers or obstructions which will unnaturally divert flood waters or which may increase flood hazards in other areas.

Geologic Hazard

Mitigation Actions

1. Develop a remediation to buttress the active geological slide occurring on River Road north of I94 Grant March Bridge.
2. Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.

Public Education topics:

3. Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.
4. Do Not stockpile snow or other material within any geological sensitive areas.

Vulnerability Summary

1. The properties along Burnt Boat Drive are built on backfill. Backfill is more prone to failure or settling if not compacted properly. Numerous properties in northwest Bismarck were constructed on extensive backfill along steep topography.
2. The DMVW railroad tracks run adjacent to Hay Creek through much of Bismarck. Hay Creek crosses under the tracks at five locations between 57th Street and Divide Avenue. The DMVW tracks run adjacent to Hay Creek for a distance of approximately 25,000 feet (4.7 miles) through Bismarck. The vulnerability of concern is the potential washout of the track bed and stability of the slope adjacent to the tracks.
3. Burnt Boat Drive is vulnerable (potential loss of street) based on adjacent slopes. Burnt Boat Drive provides critical access to residential properties and to River Road in north Bismarck.
4. Land disturbance control lines were established for the Promontory Point developments and other areas surrounding the Tyler Coulee. Promontory Points I, II and III had no land disturbance control lines when they were developed. The platting of Promontory Point IV established a 50 ft development control line for those lots adjacent to the bluff, but there wasn't a geotechnical determination to support this requirement.
5. The platting of the bluffs adjacent to Hay Creek, such as the Pebble Creek Developments and the Edgewood Developments, did not establish any land disturbance control lines.
6. River Road from Highway 1804 to Fraine Barracks is vulnerable due to the adjacent bluffs / slopes.
7. Property owners may not be aware of easements and setback requirements or other property geologic issues. Lack of awareness may potentially cause problems as a result of over-watering or overloading unstable areas.
8. Area along River Road north of I94 Grant Marsh Bridge - active geological slide in 2020.

Pre-Existing Mitigation: Geologic Hazard

1. The city has completed the Ash and Ward Coulee Storm Water Master Plan. As one component of the plan, areas that are potentially geographically vulnerable and should be preserved are identified. This storm water master plan was started in 2013 and identifies soil types, soil data, and soil stress based on a range of storm events such as the 2-year and 100-year event. The plan has been approved.
2. The Tyler Coulee Storm Water Master Plan prepared in 2002 and updated in 2007 establishes setback lines to limit development in areas with steep slopes.
3. A report entitled "Geologic and Hydrogeologic Conditions Affecting Land Use in the Bismarck-Mandan Area" via Department of Mineral Resources ND Geologic Survey includes maps intended to provide geologic and hydrogeologic technical input as an aid to future planning. https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/RISeries/RI-70.pdf
4. Bismarck's "2014 Growth Management Plan as Amended" includes a Future Land Use Plan (FLUP) which illustrates the anticipated and desirable land uses in the potential growth areas of the city. One of the assumptions in developing the concept is that "Streams, slopes, and other significant constraining factors are left as open space, although they may be incorporated as open space owned by public entities or within private development."

Hazardous Materials Release

See Also "Train Derailment"

Mitigation Actions

1. Consider permitting occupancies in accordance with codes.
2. Develop preplans specific to hazardous materials fixed facilities.

Public Education topics:

3. Continue Public Education regarding Shelter In Place and Evacuation procedures

Vulnerability Summary

1. Hospital locations: Both are in close proximity to truck routes (hazmat trucks). Both hospitals could potentially be impacted as a result of an incident because of hospital proximity to each other.
2. Critical facilities in close proximity (< ¼ mile) to pipeline, truck route, or fixed facilities include Public Works, Police Department, South Fire Station, Sanford Health, CHI St. Alexius Health, Fraine Barracks, Metro Area Ambulance South, State Penitentiary, Burleigh Morton Detention Center, and Public Health.
3. The Water Treatment plant and Wastewater treatment plant are critical facilities which must utilize hazardous materials (ie: chlorine).
4. There are eighteen schools and daycares in close proximity (< ¼ mile) to truck (hazmat) routes. Impact to more than one school based on any transportation incident is not likely.
5. A low income extended stay motel is located across the street from Ferrelgas (Bismarck Motor Motel).
6. Vulnerable Populations in close proximity to the WBI natural gas pipeline in NW Bismarck include Bismarck State College, Centennial Elementary, Horizon Middle School, Pinehurst Shopping Center, Touchmark Assisted Living, Horizon Care Home, and Primrose Assisted Living.
7. Vulnerable populations adjacent to truck (hazmat) routes include Primrose Assisted Living, Maple View and Kirkwood Mall. Numerous churches are adjacent to designated truck routes as well.
8. Montessori Daycare is adjacent to I-94. This may be perhaps the most vulnerable special population along I-94 should an incident occur near that location or directly impact that location. The daycare is approximately 200 feet from the interstate. The slope from the interstate to Montessori school is relatively steep. One factor reducing the likelihood of an incident at this location is the fact there is no curvature to I-94 at this location or in the general approach of this location.

Pre-Existing Mitigation: Hazardous Materials Release

1. Annual Inspections of all Fixed Facilities are conducted by the Bismarck Fire Department.
2. Zoning: Title 14 (14-03-08) identifies permitted zoning areas (industrial and agricultural) for special use bulk storage plants with the purpose of storage and distribution of flammable, combustible, or hazardous materials and identifies installation requirements to limit impact to waterways, drainage ways, and residential areas.
3. International Fire Code is adopted by Bismarck. Mitigation examples of the code include:
    - Regulations regarding quantity and type of materials stored.
    - Separation of incompatible materials is required.
    - Multiple control areas must be established in some cases based on quantity and type of material.
    - Suppression systems must be in place.
4. The City of Bismarck (ie: Fire Department) is aware of hazardous materials used and stored within Bismarck:
    - Tier II Reports are submitted to Bismarck Fire by local facilities (requirement).
    - Railroad hazmat shipments are shared by the railroad industry
    - 2012 Burleigh County Hazmat Flow Study identifies hazardous materials transported through the community. The flow study was conducted to assist in emergency planning. This study may be updated as needed via the Local Emergency Planning Committee (LEPC).
    - Crews document hazardous materials within RMS (including non-reportable quantities) Data within RMS includes documenting the location or storage area within the facility
    - Hazardous Materials facilities are mapped via Bismarck GIS division for planning and response purposes.
5. Bismarck has a year-round household hazardous waste and electronics recycling program via the Public Works Department.
6. The Bismarck Water and Wastewater Treatment Plants have both developed and implemented Risk Management Plans as required by Federal Regulations (Chemical Accident Prevention Rule under the Clean Air Act). These plans cover risk assessment, chemical handling and operating procedures, training, equipment inspection and maintenance, and emergency response procedures. The Plans also include periodic audits.
7. Bismarck Fire Department firefighters are trained to the hazmat technical level.
8. Bismarck Fire Department has strong working relationships with ND National Guard Civil Support Team, ND regional response partners, and mutual aid with neighboring jurisdictions.
9. Bismarck Fire and Emergency Management conduct on-going public education to promote “shelter-in place” and evacuation planning.
10. Shelter in place brochures are distributed throughout community.
    a. Shelter-in-Place brochures developed, printed, and mailed to local citizens and businesses in 2003 and 2006 (mass mailing).
    b. Shelter-In-Place public education remains on the city’s emergency management website.

Severe Summer Weather

See Also "Tornado"

Mitigation Actions

See Tornado Hazard Mitigation Actions which address the similar vulnerabilities noted below.

Public Education topics:

1. Continue participating in the Severe Summer Weather Awareness campaign.
2. Extreme Heat: Do not leave children or pets in the unattended vehicle. Heat is the #1 killer for all weather related hazards (year 2013 nationwide).

Vulnerability Summary

Note: See Flood hazard for vulnerabilities relating flash flood.

1. Those caught outdoors during a severe thunderstorm are at higher risk.
    a. High wind related injuries/deaths are caused by flying debris.
    b. Those taking shelter under or near tall trees are vulnerable to lightning strikes.
    c. Potential injury from large hail stones
2. Mobile homes are impacted (damaged) at lower winds speeds compared to typical "stick construction" homes and other building types.
3. Those who do not have access to warning or alert systems are at risk. Lack of access or availability to hear or monitor warnings/alerts would compromise the individual's ability to take appropriate actions.
    a. A low percentage of the population own NOAA All Hazards Weather Radios:
        i. NOAA Weather Radio is one of the best indoor warning systems available. Unfortunately, studies have show that only 5-10 percent of the population owns a weather radio (Wolf, 2009). 2015 Source: http://www.crh.noaa.gov/dmx/?n=preparesvrwarning
4. Many residents mistakenly expect to hear "outdoor" warning sirens indoors.
5. As Bismarck expands, the existing outdoor warning system (sirens) may not provide adequate coverage for outdoor recreational areas, residential areas, etc.
6. Overhead power lines, especially those near trees, are vulnerable to high wind events.
    a. Children and others who may first come across downed power lines are vulnerable.
7. Overhead lines impacted create some fire risk (ie: nearby trees, homes, etc).
8. Those who are most vulnerable to extreme heat include elderly persons, small children, those with disabilities, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions. Others vulnerable to extreme heat are those who must work outdoors, including first responders (ie: Fire, Law, EMS).
    a. Those who do not have access to air-conditioned rooms.
    b. Short term power loss is more likely to occur during heat waves as a result of high energy demands.

Pre-Existing Mitigation: Severe Summer Weather

1. MDU manages tree trimming services (via local tree services contractor) to avoid power pole and power line damages.
2. The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety.
3. Bismarck has 20 outdoor warning sirens within city limits.
4. NWS provides alerts/warnings and activates both EAS and NOAA All Hazards Weather Radio.
5. Schools and City Government buildings utilize the NOAA All Hazards Weather Radio.
6. Bismarck is recognized as a "Storm Ready" community.
7. Public education: Severe Weather Awareness Campaign
8. Bismarck has adopted the International Building Code. Chapter 16 is applicable, however, mobile homes are governed by HUD are not required to comply with the International Building Code.

International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:

1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

2015 Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm
Information regarding wind speeds is derived from the link above.

Shortage or Outage of Critical Materials or Infrastructure

Mitigation Actions

1. Identify critical facilities and infrastructure having or needing back-up generators or upgrades (ie: critical facilities and shelter locations).
2. Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.
3. Develop an Emergency Agreement with private vendors for delivery of fuel for generators.
4. Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)

Vulnerability Summary

1. The Bismarck Community is reliant on private industry for most critical infrastructure and key resources including energy resources, food supplies, medicines, medical equipment, communications, transportation, and fuel for heating and transportation. Water, Wastewater, and storm drain infrastructure are provided by the City of Bismarck. See "Existing Mitigation" plan section for information regarding critical facility and critical infrastructure generator capabilities.
2. According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).
3. The vast majority of local citizens do not have back-up power (generator) capability in the event of an extended power outage. Since power outages in Bismarck are repaired quickly (typically within 2 to 3 hours or less), local citizens are likely not prepared for extended power outages (ie: several days or weeks).
    a. Our winter season poses additional challenges with any extended power outages, especially for the more vulnerable populations.
4. The use of portable generators pose risks for those using them as well as for utility line workers if not used or connected correctly. Risks include electrocution, fire, and carbon monoxide poisoning.
5. The Bismarck Community is reliant on mitigation stakeholders to deter, prevent, and mitigate the impacts of an electro-magnetic pulse (EMP) attack or other intentional attacks on utility infrastructure. Stakeholders include state and federal government as well as the utility industry and scientific community.
6. The electric utility industry on a nationwide basis is not hardened against the electro-magnetic pulse threat. In turn, communities nationwide including Bismarck are vulnerable.
    a. Assuming a significant EMP event would impact the transportation infrastructure, our population would be vulnerable due to lack of deliveries: food, medicines, fuel, etc.
7. Maintenance of inventory (ie: critical supplies of food, medicines, fuel, etc) requires consistent deliveries. Inventories are generally "just in time" inventories to minimize need for storage and to maximize efficiencies.
8. In general, our society has become reliant on the electric utility industry to maintain operations for other critical infrastructure, and to sustain life and quality of life. Additionally, other critical infrastructures are reliant on computer and other sophisticated electronics which are very susceptible to the effects of an EMP attack.

Pre-Existing Mitigation:
Shortage or Outage of Critical Materials or Infrastructure

1. The Bismarck Code of City Ordinances uses Chapter 2-08-03 to give the President of the Board of City Commissioners the power to issue an emergency or disaster declaration and to utilize twenty-three specific emergency powers. These powers include…
    - Prohibit or limit the sale of gasoline or other flammable liquids.
    - Require the continuation, termination, disconnection, limitation, or suspension of natural gas, electrical power, water, sewer, or other public utilities or services.
    - Control, restrict, allocate, or regulate the use, sale, production, or distribution of food, water, fuel, clothing, and/or other commodities, materials, goods, services, and resources.
2. The City of Bismarck has two water intake systems.
    - A New Water Intake system with **a** Horizontal collector well water intake was placed in operation November 2014. The water intake is 80 feet below the river's surface.
    - An upgrade of main water pumping station located near BSC is in progress.
3. Bismarck has both MDU and Capital Electric Coop Inc. utility service areas mapped via GIS.
4. Public Works has back-up power capabilities to maintain traffic signals (partial).
5. Back-up generators are in place within city-owned critical facilities and infrastructure. See Appendix B.
6. ND State Energy Assurance Plan
   http://www.communityservices.nd.gov/renewableenergyprograms/EnergyAssurance/
   Preparation Strategies for Possible Electrical Supply Shortage Balancing Authorities:
   a. North Dakota has two Balancing Authorities within the state; these are Otter Tail Power and the Western Area Power Administration (WAPA) Upper Great Plains East These balancing authorities are required to maintain load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.
   b. The Balancing Authorities will follow their procedures to comply with regulations for meeting customer load. Some of these actions could include adjusting generation, purchasing additional imports, or utilizing the NERC Energy Emergency procedures for bulk electrical system reliability.
   Source: ND Energy Assurance Plan
7. Century Code Chapter 37-17.1 Emergency Services:
   "…In addition to any other powers conferred upon the governor by law, the governor may: Make provisions for the control, allocation, and the use of quotas for critical shortages of fuel or other life and property sustaining commodities….
   ARTICLE III - PARTY STATE RESPONSIBILITIES
   1. It shall be the responsibility of each party state to formulate procedural plans and programs for interstate cooperation in the performance of the responsibilities listed in this article. In formulating such plans, and in carrying them out, the party states, insofar as practical, shall: Protect and assure uninterrupted delivery of services, medicines, water, food, energy and fuel, search and rescue, and critical lifeline equipment, services, and resources, both human and material."

Private Utility (ie: electricity) Pre-Existing Mitigation – Shortage of Critical Materials:

1. Montana Dakota Utilities (MDU) receives alerts regarding potential GMD (solar flare events with a K7 or higher rating).
2. MDU conducts six drills per year to switch controls from Bismarck/Mandan and vice versa.
3. Bismarck/MDU has three system inputs (redundancies): Garrison, Heskett and WAPA.
4. Bismarck is strategically located for power restoration based on logistics/proximity to power generation and distribution.
5. MDU has mutual aid assistance agreements with other utility companies.
6. MDU has pre-determined priority considerations including hospitals, police station, etc.
7. MDU Electric System Compliance Manager serves as a liaison between MDU and the North American Electric Reliability Corporation (NERC).

8. Materials needed by MDU are readily available per MDU plans/agreements with their vendors.
9. Central Power Electric Cooperative (CPEC), formerly Capital Electric Cooperative, has assistance agreements with other utility companies (mutual aid).
10. CPEC utilizes multiple contractors for restoration which provides for a force multiplier and quicker response.
11. CPEC has two system inputs: Heskett and WAPA.
12. CPEC has capability to monitor individual meters to determine if a facility or home is receiving power.
13. CPEC has generator power to sustain operations at its facility.
14. CPEC has the ability to redirect existing power through its distribution system.
15. CPEC ownership of transmission lines will transfer to Central Power of Minot in 2014. Central Power will then oversee preparedness requirements set by the Federal Energy Regulatory Commission (FERC).

Tornado

Mitigation Actions

1. Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.
2. Explore potential for developing a city ordinance to require tornado shelter construction at any newly developed mobile home parks and encourage construction absent city ordinance.
3. Replace outdoor warning siren activation controller system.
4. Outdoor Warning Sirens - identify need as city grows.
5. Install Outdoor Warning Sirens as city grows per identified need.
6. Ensure NOAA All Hazards Weather Radios are located in all city owned buildings.

7. Public Education topics:
    - Safe Room construction and protecting property from high winds
    - Encourage mobile home owners and park owners to conduct joint shelter planning
    - Encourage mobile home owners to explore potential sheltering options (agreements) with area facilities (such as place of employment, membership, etc).
    - Continue existing public education efforts

Vulnerability Summary

1. Most tornado injuries/deaths are caused by flying debris. Those caught outdoors during a tornado event are at higher risk.
    a. Loose debris
    b. Outdoor items not anchored
    c. Construction sites may contain unsecured construction materials (ex: plywood) and debris
    d. Trees are impacted at lower wind speeds (small branches – flying debris).
2. Mobile homes are impacted (damaged) at lower winds speeds compared to typical "stick construction" homes and other building types. Occupants of mobile homes during a tornado event are at higher risk. Bismarck has several mobile home park neighborhoods. The vast majority of mobile home parks within Bismarck do not have designated storm shelters on site.
3. Bismarck does not restrict future development of mobile home parks. This allows for more affordable housing, however, future construction of mobile home parks would create additional vulnerability.
4. Those who do not have access to warning or alert systems are at risk. Lack of access or availability to hear or monitor warnings/alerts would compromise the individual's ability to take appropriate actions.
5. A low percentage of the population own NOAA All Hazards Weather Radios:
    i. NOAA Weather Radio is one of the best indoor warning systems available. Unfortunately, studies have shown that only 5-10 percent of the population owns a weather radio (Wolf, 2009).
    Source 2015: http://www.crh.noaa.gov/dmx/?n=preparesvrwarning
6. Some residents expect to hear "outdoor" warning sirens indoors, which is not the purpose of the outdoor warning sirens.
7. As Bismarck expands, the existing outdoor warning system (sirens) may not provide adequate coverage for outdoor recreational areas, residential areas, etc.
8. Not all tornadoes are able to be detected by Doppler radar – especially if the tornado forms over the top of the radar and over the city itself.

9. The two hospitals are in close proximity. Depending on the event, if one hospital is impacted, both could potentially be within the same tornado path.
10. There are no community (public or private) tornado shelters identified.
11. Who's Most at Risk:
    - People in mobile homes
    - The elderly, very young, and the physically or mentally impaired
    - People who may not understand the warning due to a language barrier
    - People in an unfamiliar place such as tourists
    - People that are outdoors
    - Those in automobiles

Pre-Existing Mitigation: Tornado

1. Bismarck has 20 outdoor warning sirens within city limits.
2. NWS provides alerts/warnings and activates both EAS and NOAA All Hazards Weather Radio.
3. Schools and City Government buildings utilize the NOAA All Hazards Weather Radio.
4. Bismarck is recognized as a "Storm Ready" community.
5. Many traditional construction homes within Bismarck have basements.
6. Public education: Severe Summer Weather Awareness Campaign
7. Bismarck has adopted the International Building Code. Chapter 16 is applicable, however, mobile homes are governed by HUD are not required to comply with the International Building Code.

International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:
1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

2015 Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm

8. Public Education:
    - Severe Weather Spotter Training
    - Promote NOAA All Hazards WX Radio
    - Severe Summer Weather Awareness Campaign

9. 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 1 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 and severe thunderstorms 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.

Train Derailment

Mitigation Actions

1. Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.
2. Public Education: Evacuation and Shelter-In-Place Emergency Preparedness

Vulnerability Summary

Note: The vulnerability statements below do NOT imply likelihood or high probability of a significant train derailment incident involving fire, hazardous materials, and/or explosion.

1. Hospital locations: Both major hospitals are in close proximity to the BNSF railroad. A significant incident (ie: fire, hazmat, explosion) could potentially affect both hospitals depending on the location of incident occurrence.
2. Continuity of Government Operations: City owned critical facilities in very close proximity to either railroad line include the Water Treatment Plant, Public Health, and Public Works. City facilities, if impacted as a result of a significant incident (ie: fire, hazmat, explosion), would create challenges to sustain continuity of operations. The City/County Building is also within close proximity. There are several additional critical facilities within ½ mile of railroad lines including city, county, state (ie: State Emergency Operations Center), federal, and emergency service facilities. Of note: Public Works is in close proximity to Praxair, which could expand the magnitude of a significant train derailment incident near that location.
3. County, State, and Federal facilities may also be impacted, such as the State EOC at Fraine Barracks. An incident impacting county, state, or federal government facilities may impact the ability to provide assistance while re-establishing continuity of operations.
4. There are nineteen schools and daycares within ½ mile proximity to the railroad. Schools and daycares are widely dispersed along the rail lines, therefore, at least one school is likely to be involved following a significant derailment incident (ie: fire, hazmat, explosion). Depending on time of day of a potential incident, elementary school population may be outdoors.
5. Vulnerable populations within ½ mile of the railroad lines and vulnerable properties based on topography include various assisted living and nursing homes, the Elks Pool, Bismarck Community Bowl, Front Street Plaza (based on proximity and topography), and the ND State Penitentiary.
6. Due to evacuation challenges, the ND State Penitentiary is a very vulnerable special population.
7. Based on a relatively even distribution of various facilities and populations, a significant train derailment incident (ie: fire, hazmat, explosion) would likely include impact to several properties and populations including the following categories: critical facilities, critical infrastructure, waterways (Missouri River, Hay Creek, or storm water drainage system), schools, hazmat fixed facilities, and/or special populations. This would overwhelm local response capabilities. Additional resources would be requested including mutual aid, private, state and federal assistance. However, response times of support agencies may not support the immediate incident needs of evacuation and rescue efforts.
8. Based on potential impact to local communications critical infrastructure, emergency messaging capability via radio and television may be diminished, creating a higher vulnerability for those citizens who primarily get their emergency messages from local radio and television.

Pre-Existing Mitigation: Train Derailment

1. Maximum Speed Limits:
    a. 35 MPH – BNSF Line
    b. 10 MPH – DMVW
2. Maximum speed and inspection requirements are regulated by the Federal Railroad Administration.
3. Railroad Crossings and improvement projects per Quiet Rail Zone approved at 3rd, 5th, and 12th Street railroad crossing locations are completed.
4. Bismarck Fire is aware of the hazardous materials transported by rail through Bismarck via reports shared by railroad industry.
5. Bismarck Fire Department continues to enhance training efforts as it relates to the various types of train cars, hazardous materials response, and also participates in training and exercise activities with mutual aid partners and stakeholders including the railway industry.
6. 7th and 9th Street locations are railroad overpasses are DOT ownership. DOT inspects the structures on a three-year rotation.
7. On August 2, 2013 the FRA issued an Emergency Order and Safety Advisory regarding the movements of flammable liquids, which includes crude oil and ethanol.
    a. The FRA Emergency Order contained requirements for unattended trains carrying hazardous material such as chlorine that is classified as Toxic by Inhalation (TIH) or 20 or more loads of certain flammable liquids like crude oil and ethanol.
    b. Trains may not be left unattended per BNSF communications.
8. New tank cars (DOT-117) constructed after 10/1/2015 must feature a 9/16-inch shell, 11-gauge jacket, one-half-inch, full-height head shield, thermal protection, and improved pressure-relief valves and bottom outlet valves. Existing tank cars must be retrofitted with the same key components based on a "prescriptive, risk-based" retrofit schedule, according to the USDOT. The final rule required replacing DOT-111 tank cars for Packing Group I, which covers most crude shipped by rail, within three years (2018 timeframe).

BNSF mitigation and safety measures summary (source: BNSF representative):

9. BNSF inspects tracks in Bismarck four times per week. The FRA requirement is two times per week. Inspections of all BNSF bridge structures are performed at least once annually. BNSF has a staff of trained bridge inspectors, as well as structural engineers, consultants and specialized contractors.
10. Rail Industry (BNSF) voluntarily adopted stronger tank car standards in October 2011 and November 2013. The "new" car has ½" or 7/16" jacketed shell (versus 7/16 only), a ½" protective head shield, roll over protection (top fitting protection), larger pressure release valve, and approximately 47-77% better crashworthiness. BNSF makes available the "System Emergency Response Plan" via BNSFHazmat.com as well as other training, preparedness/planning materials.
11. Additional BNSF Prevention Measures include:

Human Factor	Equipment/Mechanical	Track/Signal	Miscellaneous
• Training • Remote Monitoring • Positive Train Control • Self-reporting protocol	• Ultrasonic inspection • Detector Network, such as Dragging Equipment • Technology including force-based/strain gage systems • Thermal/infrared scanning for warm bearing detection	• Enhanced track inspection training • Continued elimination of jointed rail • Strong capital program for tie renewal • Technology including ground penetrating radar and enhanced geometry testing	Operating Practices/Alerts: • High Wind: staging and/or speed requirements • Tornado: requirements to stop, inspect trains • Flood: speed restrictions, additional inspections • Cold weather: speed restrictions

Wildland Fire:
Wildland Urban Interface

Mitigation Actions

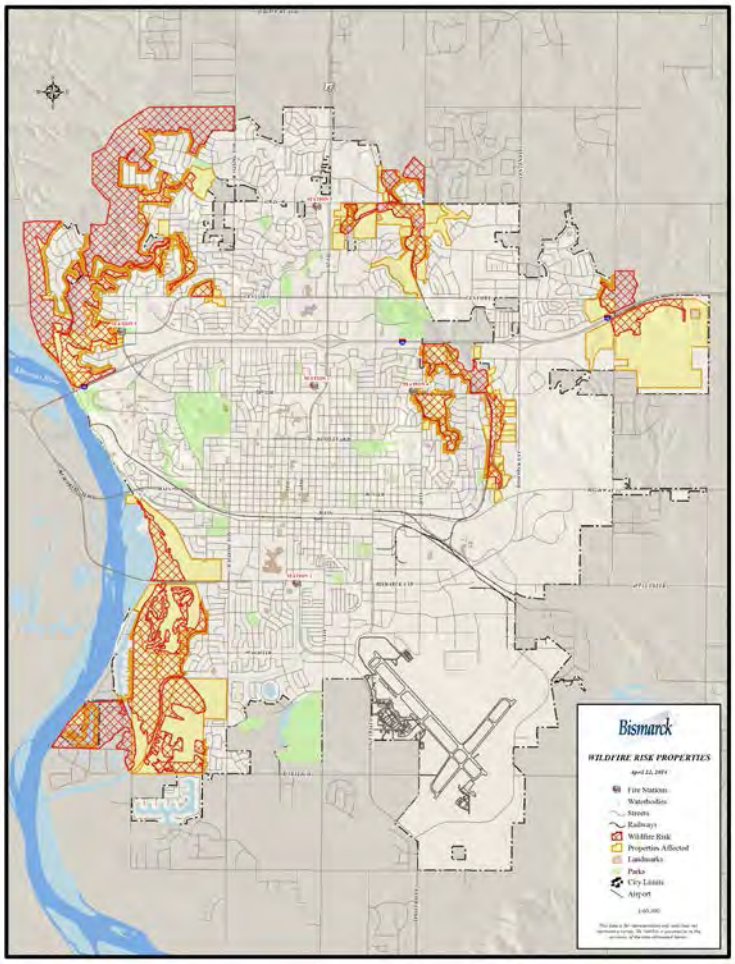
1. Maintain Wildland Fire-Break Trail in Southwest Bismarck.
2. Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.
3. Share Firewise landscaping concepts with developers and Community Development.

Vulnerability Summary

1. Homes and other structures located in wildland risk areas as mapped are vulnerable to wildland fire due to the proximity to wildland vegetation and relatively steep slopes which can increase the rate of spread of fire. The likelihood of a wildland fire being a high magnitude event is low.

2. Areas within Bismarck that may have more exposure potential compared to other areas include the northwest portion of the city that is adjacent to undeveloped property and the southwest portion of the city that is adjacent to more heavily forested areas.

The map at right illustrates the wildland urban interface areas (red hatch areas).



Pre-Existing Mitigation: Wildland Fire (WUI)

1. Fire Trail – Fuel Mitigation Project – completed 2002. A Fire break was created to reduce vulnerability to homes in southwest Bismarck as illustrated by the map on right. This fire trail/ fire break proved to be beneficial during a fire fight event in April 2005.



2. The bike/walking path west of Solheim to Riverwood Drive serves as a fire break. See map below.



3. Public Education: Public Education materials were distributed in the spring of 2014 to inform property owners adjacent to the wildland risk areas (wildland urban interface) of recommendations as described by the Firewise Program. www.firewise.com

4. Bismarck Fire has completed the activities noted below, some of which are on-going.
   - Created a public education flyer which was handed out door to door in our higher risk areas in the spring of 2014
   - Participated in creating a fire break in the forested area in the southwest part of town
   - Perform Fire Safety Inspections of all local businesses
   - Our firefighters train in the latest methods of fighting all types of fire
   - Bismarck Fire continues public education efforts including:
     - Presentation to grade schools
     - Demonstrations in a smoke trailer that gives kids skills to get out of a home on fire
     - Tours of fire stations to civic groups
     - Safety tips to the public through local media
5. Response Capabilities: The City of Bismarck is protected by a full-time fire department including 5 fire stations. We have 2 fully equipped wild-land firefighting apparatus able to access remote areas within the city limits. Many of our Wild-land Urban Interface (WUI) areas border Bismarck City and Burleigh County properties. We have mutual aid agreements with the Bismarck Rural Fire Department, Mandan Fire Department, and ND Forest Service. Not only does this aid in fighting fires in the WUI but we can also call on them to assist firefighting efforts within the city limits.

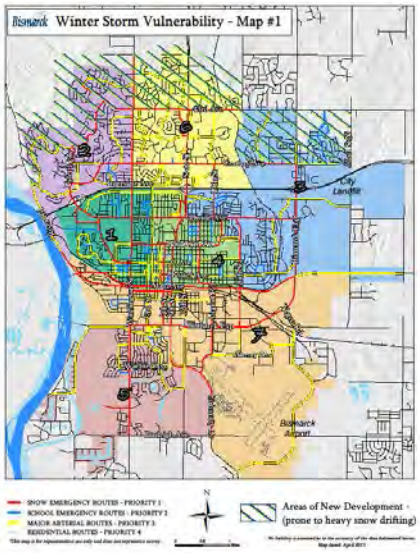
Winter Storm

Mitigation Actions

1. Evaluate need and opportunity for snow fences.
2. Coordinate school/city/business closure communications/decisions.
3. Downed Power Line Safety Training
4. Public Information and Warnings (NWS) - continue
5. Public Education - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.
6. Public Education: Participate in the Severe Winter Weather Awareness Campaign (on-going).

Vulnerability Summary

1. Areas of new development are prone to experience heavy snow drifting due to the limited number of mature trees or other vegetation. The hatched areas within the snow emergency route map illustrate the new development areas currently prone to heavy snow drifting. This vulnerability will continue to migrate north and east as the city grows. See hatched area, map on right. A full size map is included in Section 10.
2. As noted on the snow emergency route map, residential areas are the last priority in terms of clearing streets during and after a winter storm event. During a winter storm event, crews focus on keeping the high priority emergency routes and major arterials clear. Therefore, residential areas are more vulnerable (ie: lack of ingress/egress) during, and for several hours following a major snowfall event. However, existing response plans are in place to re-route snow plows for emergency situations. See map on right or web link: http://www.bismarcknd.gov/index.aspx?NID=249

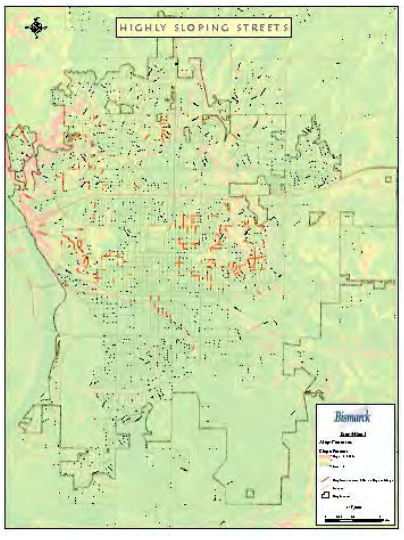


3. Some areas of Bismarck more vulnerable as a result of icy conditions due to a relatively significant slope. These areas are mapped (see right). A full size map is included in Section 10.

   Streets with greater than a 14% slope:

   - 500 Block of S 11TH ST – up to 19.9%
   - 1500-1600 Block of Northview Ln – up to about 16.5%
   - 2300 Block of Pointe Lp – up to 14.8%
   - 800-900 Block of N Mandan St – up to 14.8%
   - 1600 Block of N 35TH ST – up to 14.5%
   - 2900 Block of E C Ave – up to 14.5%
   - 700-800 Block of N 27TH ST – up to 14.5%
   - 2400 Block of Laforest Ave – up to 14.4%
   - 2900 Block of E B Ave – up to 14.3%
   - 1200-1300 Block of Crestview Ln – up to 14%

   Burnt Boat Drive has 10% slope, but is curvy, narrow, and has steep slopes adjacent.



4. Private streets within Bismarck are not cleared by Bismarck Public Works. These areas may or may not be more vulnerable (ie: ingress/egress) depending on the quality and timeliness of private snow clearing services. See map at right. A full-size map is located in Section 10.



5. Many of the older developed areas within Bismarck have overhead power lines. These areas are more vulnerable during an ice storm to experience power loss and/or a downed power-lines. See map on right. A full-size map is included in section 10.
6. Overhead power-lines intersecting trees create a vulnerability. However, local utility companies proactively trim the trees to mitigate the hazard. See map on right. A full-size map is included in section 10.



7. Snow plows in operation are likely to be hit by other vehicles during conditions of low visibility. The snow plow operator is at risk, however, the operator of the vehicle is at higher risk for injury/death.
8. Traffic accidents, which may involve hazardous materials in some cases, are more likely to occur as a result of slippery street conditions and/or poor visibility. First responders are more vulnerable during response efforts because of the weather elements.
9. Emergency response times may be delayed as a result of snow and/or ice conditions.
10. Downed power lines as a result of ice storms and/or heavy snow pose a serious life safety risk, especially for children who may come across a downed power line.
11. Power lines near trees (ie: evergreen trees or other trees not trimmed) are vulnerable following an ice storm or heavy snow event. Homeowners are responsible for trimming trees from the transmission line to the home itself.
12. Among the most vulnerable population during winter storm events are the elderly and those with medical conditions (ie: heart). A heavy snow event may delay emergency response to 911 calls.
13. Those who require medications may not be able to fill prescriptions during a winter storm event.
14. Loss of power for a few hours (or longer) poses additional risk to those who require power for life support. Back-up battery or generator power may be needed.
15. Food and medical supplies may be delayed due to highway and interstate conditions and road closures.
16. Those required to work outdoors or student population walking to and from school are highly vulnerable to frost bite or hypothermia as a result of extreme cold temperatures and wind chill.
17. Populations of higher vulnerability include tourists, homeless, and those who've recently moved to North Dakota with no previous experience with the more harsh winter season.

18. Those travelling during winter storm events may become stranded or become involved in a traffic accident due to visibility and/or road conditions. There is also a higher vulnerability for those traveling within the city during any power outages affecting traffic signal lights.
19. Potential roof collapse as a result of heavy snow load, especially on wide span flat roofs such as gymnasiums or auditoriums.
20. Sewer vents may freeze up, creating vulnerability to the occupants (ie: illness).
21. Occupants of homes / facilities without carbon monoxide detectors are vulnerable if venting is blocked or if the occupants are using improper alternative heating sources or using them improperly.
22. Traffic accidents may occur as a result of power loss to traffic signal lights (ie: ice storm impacting power lines)

Pre-Existing Mitigation: Winter Storm

1. Snow Emergency Routes are designated, signed, and communicated to the public via the city's website. Snow Emergency Routes are designated in City Ordinances 10-02-01 and 10-02-02.
2. City Ordinance 10-02-03 provides for capability to issue a "snow emergency declaration" which allows for prohibition of parking on designated (or all) snow emergency routes.
3. Although Bismarck utilizes snow gates on the plows, City Ordinance 10-02-05 allows for snow plow operations to discontinue the use of the snow gates when a snow emergency is declared. The same city ordinance also allows for taking certain actions when necessary including posting no parking signs to aid in snow removal and hiring of temporary personnel for snow removal. Ordinance 10-05-05 addresses placement of mail boxes to avoid the mailboxes becoming snow removal obstacles.
4. Ordinance 12-13-23 provides officers with authority to remove illegally stopped or parked vehicles when the vehicle is parked on a posted "snow emergency" route during a declared snow emergency.
5. City sanding operations may start before, during, after, or independently of other plowing operations, as appropriate. Public works strives to obtain an 8% salt content within this sand to prevent the sand from freezing/clumping. Public Works also has liquid brine applicators. Applying liquid brine prevents ice from sticking to the streets. This is applied sparingly to minimize environmental impacts.
6. Local utility companies trim trees around their power poles and power lines to minimize risk of utility infrastructure damage following events that may severely impact trees and/or limbs. The current pruning area for MDU is from the East and West Avenue A up to Boulevard and from Washington to 3rd. This pruning is does not include the house connections (main transmission line to the house), this falls on the responsibility of the home owner.
7. Bismarck has adopted the International Building Code which identifies construction requirements relating to heavy snow loads.
8. Public Education is conducted in concert or partnership with the National Weather Service as well as many other departments at the local, state, and federal government level as well as volunteer agencies promoting emergency preparedness, such as the American Red Cross.
    a. Severe Winter Weather Awareness Campaign – annual
    b. Installation of carbon-monoxide detectors
9. Public Information and Warnings are issued via the National Weather Service (see next page).
10. Emergency Alert System in place
    a. Public Information and Warnings via the National Weather Service
11. NOAA Weather Radio in all Bismarck Public Schools – in place

    National Weather Service - "Storm Ready" recognition – Recertified / approved in 2012

12. A Living Snow Fence was put in place (1990s) to prevent the drifting of snow across Yegan Road to the south and east. Due to the airport chain-link perimeter fence creating a drifting problem, the three rows of shrubs were installed to help drop the snow blowing from across the airport property, potentially blocking Yegan Road. The shrubs planted do NOT attract birds to reduce the possibility of bird strikes on airplanes.



Response Phase Mitigation – Winter Storm:

1. Public Works maintains its Snow and Ice Control Plan. The plan identifies snow removal priorities which are publicized on the city's website.
2. The Bismarck Emergency Operations Plan outlines task force operations for Winter Storm Emergency Response.
3. Bismarck and Burleigh have an agreement with the local Roughrider Snowmobile Club to serve as a resource for critical transportation needs.
4. Public Works has emergency generators and connectivity to maintain functioning of traffic signals following power outages.
5. Existing shelter sites (with generators) may be used as warming sites.

National Weather Service Provides Forecast and Warning Services		
Product Type	**Description**	**When Issued**
Hazardous Weather Outlook	Designed to outline anticipated weather hazards for the next seven days and provide the first heads up to any possible severe winter weather.	At least once per day
Watch	Issued when the confidence level for severe winter weather is at least 50% (uncertainty remains in exact timing and location of the storm).	Normally issued 36-48 hours prior to the event
Warning	Issued when there is a direct threat to life and property from severe winter weather that has a high probability of occurrence (80% or higher), or is imminent or occurring.	Normally issued 12-24 hours prior to the event
Advisory	Issued for winter weather conditions that have a high probability of occurrence, are imminent or already occurring, that may cause an inconvenience. If precautions are NOT taken, a situation may develop that may threaten life.	Normally issued 12-24 hours prior to the event

Product Type	**Description**
Blizzard Warning	When sustained or frequent wind gusts of 35 mph or greater with visibilities of less than one quarter mile for at least three hours are expected.
Winter Storm Warning	When six inches of snow in 12 hours or 8 inches in 24 hours are expected and/or 1/2 inch of sleet accumulation (mixed precipitation and blowing snow may also be possible).
Ice Storm Warning	When 0.25 inches or more of ice accumulation is expected.
Wind Chill Warning	When wind chill values of -40 F or less are expected.

https://www.weather.gov/bis/winter_weather_awareness_1

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Mitigation Implementation Action Plan

1. Mitigation Action items will be monitored and evaluated for progress by the applicable city department or division as assigned.
2. Mitigation action items will be incorporated by the applicable department/division into existing annual strategic or work-plans at the department level. Bismarck Emergency Management will also review the status of mitigation action items with the applicable city departments/divisions.
3. City Administration will coordinate with the applicable city department to integrate the requirements of the mitigation plan into other plans and funding mechanisms (ie: annual budgeting process, capital improvement program, growth management plan, future land use plan, plat review process, site plan review process) when appropriate.

Administration							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Dam Failure	**Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.**		Planning Function No cost	2015		Yes	**Complete** and On-going See status update below.
	The City of Bismarck and Burleigh County, in partnership with Dakota Carrier Network (DCN) built a new public safety communications center and emergency operations center connected to the DCN facility. The constructed addition is hardened, built to withstand natural and manmade disasters and to ensure maximum uptime in the most adverse conditions. The facility was completed in the fall of 2020. This is an example of mitigation action item described above. Fire Station #4 on Miriam Avenue was also built outside of Flood and Dam Failure inundation zones.						

Administration							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Shortage or Outage of Critical Materials	**Encourage the state to enhance the "Energy Assurance Plan" to acknowledge and address the EMP threat.**		None	2015	2015		**Complete**
Shortage or Outage of Critical Materials	**Encourage state involvement in electric utility hardening against EMP attack.**		None	2015	2015		**Complete**
Train Derailment	**Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.**		Planning Function No cost	2015		Yes	**Complete** and On-going See comment below.
	Both the new CenCom/EOC facility and the new Fire Station #4 meet the mitigation recommendation above.						
Train Derailment	**Clarify bridge ownership and responsibilities for maintenance and inspections.**		Staff Time	2015	2015		**Complete** See comment below.
	7th and 9th Street locations are railroad overpasses are DOT ownership. DOT inspects the structures on a three-year rotation						
Train Derailment	**Determine if there are reporting requirements regarding track/bridge inspections.**		Staff Time	2015	2015		**Complete**
Winter Storm	**Develop City Office closure policy based on imminent or current conditions.**		Staff Time	2015	2016		**Complete** and On-going
Winter Storm	**Coordinate school/city/business closure communications/decisions.**	Bismarck Public Schools	Staff Time	2015		Yes	**Complete** and On-going

Airport							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Aircraft Accident	**Recommend Burleigh County and city of Lincoln adopt city of Bismarck aeronautical zoning where applicable based on the city of Lincoln growing nearer to the Airport.**	Burleigh County City of Lincoln	NA	2015	2019	Yes	**Complete** See comment below.
	Recommended changes provided to Community Development for ordinance changes. (2019)						
Aircraft Accident	**Completed the current Wildlife Hazard Assessment. This plan is a year-long study on the wildlife around the airport. The final assessment will provide recommendation on how to reduce the wildlife present on and around the airport.**		Already Funded	2014	2015	Yes	**Complete** See comment below.
	Assessment completed in 2015. Mitigation Plan developed – Phase V to be done Summer 2020.						
Aircraft Accident	**Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."**		Staff time	2015		Yes	**Complete** and on-going

Community Development							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Flood	**Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).**	Building & Inspections	Staff Time	2015	2020	Yes	**Complete** Annual recertification required
Flood	**Bismarck is currently rated at Class 8 within the Community Rating System. Pursue Class 7 status when likely to qualify as Class 7 based on current activities.**	Building & Inspections	Staff Time	2023	2025	Yes	**New**
Tornado	**Explore potential for developing a city ordinance to require tornado shelter construction at any newly developed mobile home parks and encourage construction absent city ordinance.**	Building & Inspections	Staff Time	2021	2025	No	**New**
Public Education							
Tornado	**Encourage Wind-Resistant Building Techniques**	Building & Inspections	Staff Time	2015		Yes	**Complete** and On-going
Flood	**Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.**	Emergency Management	Staff Time	2015		Yes	**Complete** and On-going

Emergency Management							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Tornado	**Install Outdoor Warning Sirens as city grows per identified need.**	Administration, Finance	$25,000 Each City Funds	2015		Yes	**Complete** and On-going
Tornado	**Increase frequency of Outdoor Warning Siren Test – 2 per month (May thru August)**	CenCom	$5,000 Utility Expense	2015	2016	Yes	**Reject** See next action item.
Tornado All	**Replace outdoor warning siren activation controller system.**		180,000 City Funds	2020	2021	No	**New** In Progress
Tornado	**Identify Community Planning Group to study/identify Community Tornado Shelter(s) Location - existing facilities**		NA Planning Function	2015		Yes	**Reject**
Tornado	**Explore Mobile Home Skirting Mitigation Landscaping to Eliminate wind access to reduce uplift. This may be a research question for NWS and/or FEMA (any potential benefit would be limited to F0 or F1 (most frequent tornado intensities).**	NWS FEMA	None	2015	2015		**Complete**
Tornado	**Recommend via Local NWS that NOAA ensure multiple language / language selection option is available for the NOAA All Hazards WX Radio**	NWS	None	2015	2015		**Complete**
Public Education							
All Hazards	**Promote NOAA All Hazards WX Radio (existing mitigation)**	NWS	Staff Time EM Budget	2015		Yes	**Complete** and On-going
All Hazards	**Promote mitigation and emergency preparedness for all hazards.**		Staff Time EM Budget	2015		Yes	**Complete** and On-going
All Hazards	**Automatic Notification System (Code Red) – promote opt-in.**	CenCom	Staff Time EM Budget	2020		Yes	**New**
Flood	**Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.**	Building & Inspections	Staff Time EM Budget	2015		Yes	**Complete** and On-going
Hazmat	**Continue Public Education regarding Shelter In Place and Evacuation procedures**		LEPC Funds $2,000	2015		Yes	**Complete** and On-going
Severe Summer Weather	**Continue participating in the Severe Summer Weather Awareness campaign.**		Staff Time EM Budget	2015		Yes	**Complete** and On-going

Emergency Management

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Severe Summer Weather	**Extreme Heat: Do not leave children or pets in the unattended vehicle.**	NWS	Staff Time	2015		Yes	**Complete** and On-going
Tornado	**Protect property from high winds (FEMA website)**		Staff Time	2015		Yes	**Complete** and On-going
Tornado	**Severe Summer Weather Awareness (existing mitigation)**		Staff Time	2015		Yes	**Complete** and On-going
Tornado	**Public Information - NWS Warnings (existing mitigation)**	NWS	Staff Time EM Budget	2020			**New**
Tornado	**Safe Rooms**		Staff Time EM Budget	2015		Yes	**Complete** and On-going
Tornado	**Mobile Home owners / Park Owner - joint shelter planning**		Staff Time EM Budget	2020			**New**
Tornado	**Mobile Home owners /area facilities shelter agreements (pre-planning)**		Staff Time EM Budget	2020			**New**
Shortage or Outage of Critical Materials	**Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)**		Staff Time EM Budget	2015		Yes	**Complete** and On-going
Winter Storm	**Public Education (on-going) - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.**	Public Works	Staff Time EM Budget	2015		Yes	**Complete** and On-going
Winter Storm	**Participate in the Severe Winter Weather Awareness Campaign (on-going).**		Staff Time EM Budget	2015		Yes	**Complete** and On-going
Winter Storm	**Public Information and Warnings (via NWS) - continue**	NWS	Staff Time EM Budget	2020		Yes	**New**

Engineering							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Geologic	**Develop a remediation to buttress the active geological slide occurring on River Road north of I94 Grant March Bridge.**		Already Funded	2020	2021	No	**NEW**
Geologic	**Finalize and approve the Ash and Ward Coulee Stormwater Master Plan.**		Already Funded	2014	2015		**Complete**
Geologic	**Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.**		NA Planning Function	2015		Yes	**Complete** and On-going
Public Education							
Geologic	**Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.**		TBD based on method of public education	2015		Yes	**No Action** See comment below
	Additional geologic hazards potentially affecting private property have not been identified which would promote the need for communicating the hazard to respective landowners.						

Environmental Health							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Communicable Disease	**Provide education when conducting food service inspections.**		Staff Time	2015		Yes	
Communicable Disease	**Implement risk-based inspection frequency for food establishments.**	NDDoH	Staff Time	2015	2015	Yes	**Complete** See comment below.
	Risk based food inspections have been implemented. Continuing to perform risk-based inspections.						
Communicable Disease	**Require bi-monthly water analysis for pools and recommend superchlorination if chlorine levels are observed to be low when collecting water samples.**		Staff Time	2015		Yes	**Complete** See comment below.
	Pools are now required to submit monthly water sampling.						
Communicable Disease	**Provide mosquito control & surveillance services.**	NDDoH	$76,000 annual budget	2015		Yes	**Complete** and On-going

Fire Department							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Fire	**Continue to update and enforce zoning, building and fire code regulations.**		Staff Time Fire Dept Budget	2015		Yes	**Complete** and On-going
Fire	**Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.**		Staff Time	2015		Yes	**Complete** and On-going
	This has not been well received by local developers due to added cost of construction of spec homes. Home builders could share this option with those designing/contracting construction of a custom home.						
Hazmat	**Develop preplans specific to hazardous materials fixed facilities.**		Staff Time	2015		Yes	**Complete** and On-going
Hazmat	**Identify Hazmat Routes within Bismarck**		Staff Time	2014			**Reject** See comment below.
	This was reviewed and was determined that existing identified truck routes are adequate.						
Hazmat	**Identify "higher risk" inspections to be designated to Fire Marshals for in-depth code enforcement and increased inspection frequency.**		Staff Time	2015	2015		**Complete**
Hazmat	**Consider permitting occupancies in accordance with codes.**		Staff Time	2015	2015		**Reject** See comment below.
	It was determined to not be feasible at this time but will continue to be considered for the future.						
Wildland Fire	**Maintain Wildland Fire-Break Trail in Southwest Bismarck.**	Forestry	Staff Time	2015		Yes	**Complete** and On-going
Public Education							
Fire	**Provide Fire Safety public education to the community at large.**		Staff Time Fire Dept Budget	2015		Yes	**Complete** and On-going

Fire Department							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Wildland Fire	**Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.**		Staff Time Fire Dept Budget	2015		Yes	**Complete** and On-going
	We are prepared to provide public education in the future, should we have drought conditions again. Since initiating this mitigation action item, we have not had to implement it since we did not have dry conditions to the point of concern.						
Wildland Fire	**Share Firewise landscaping concepts with developers and Community Development.**		Staff Time Fire Dept Budget	2015		Yes	**Complete** and On-going

Forestry							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Biological Infestation	**Continue existing mitigation efforts including the systematic approach to removing ash trees in decline** and **replant with a different species to increase the diversity of our urban forest.**		Staff Time Public Works / Forestry Budget	2015		Yes	**Complete** and On-going See comment below
	Forestry division performs risk assessments annually to aid in identifying declining ash trees						
Biological Infestation	**Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.**		Staff Time Public Works / Forestry Budget	2015		Yes	**Complete** and On-going
Public Education							
Biological Infestation	**Continue programs to monitor existing and future forest damaging pests.**		Staff Time	2015		Yes	**Complete** and On-going See comment below
	Ongoing annual monitoring by seasonal Dutch Elm Disease crew and forestry staff.						
Biological Infestation	**Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.**		Staff Time	2015		Yes	**Complete** and On-going See comment below
	Ongoing public education efforts through Partners in Planting Program and public outreach.						

GIS

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Train Derailment	**Inversion - mapping based on hazardous materials releases (risk area) for airborne gases**		Staff Time	2015	2015		**Completed** July 2015
Train Derailment	**Flow analysis from the tracks**		Staff Time	2015			**Complete**

Human Resources

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Winter Storm	**Downed Power Line Safety Training**	WSI	HR City-Wide Training Budget	2015		Yes	**Complete** and On-going See comment below
	Annual event for Forestry staff.						

Police							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Active Threat	**Conduct on-going public education regarding Active Threat hazard.**		Department Budget	2015		Yes	**Complete** and On-going
Civil Disturbance	**Bismarck Police Department staff meet with event organizers (primary points of contact) prior to events to learn of event size (expected total participants), event location, time and date and other event specifics. A permitting process is established and permits are encouraged to be completed, but cannot be mandated based on United States case law.**		Department Budget	2020	2025	Yes	**New**

Public Health							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Communicable Disease	**Identify appropriate locations for isolation or quarantine.**		Staff Time	2015	2015	Yes	**Complete** and On-going Annual review necessary
Communicable Disease	**Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.**		Planning Function No cost	2015	2015	Yes	**Complete** and On-going On-going public education and assessment
Communicable Disease	**Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.**		On-going annual maintenance costs	2014	2014	Yes	**Complete** and On-going See comment below
	On-going staff time to complete sterilization process and maintain autoclave.						
Communicable Disease	**Continue Existing Mitigation Efforts (BBPH)**		Staff Time Dept Budget	2015		Yes	**Complete** and On-going
Communicable Disease	**Standard Awareness Training: Course covering bio-terrorism and terrorism information including agents with signs and symptoms.**	Medical Providers, EMS, Fire, PD	Funded by NDDES or NDDoH	2015		Yes	**Reject** This course is not funded by NDDoH.
Communicable Disease	**Increase Immunizations rates through grants opportunities and QI projects.**		Grants and staff time	2019		Yes	**NEW** See comment below
	On-going staff working to increase immunization rates.						

Public Health							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Communicable Disease	**Increased opportunities to receive Hepatitis B vaccine to high risk individuals.**		Grants and staff time	2019		Yes	**NEW** See comment below
	On-going staff working to increase immunization rates.						
Communicable Disease	**Provide breastfeeding education to increase breastfeeding in the community for higher rates of baby immunity.**		Grants and staff time	2019		Yes	**NEW**
	On-going staff time to education on breastfeeding.						
Communicable Disease	**Provide Narcan training opportunities to the community to help with the emerging substance abuse threat.**		Grants and staff time	2019		Yes	**NEW**
	On-going staff time to education on Narcan.						
Communicable Disease	**Ongoing education of staff for better response to an outbreak.**		PHEP and Staff time	2019		Yes	**NEW**
	On-going recent tabletop on Measles.						
Communicable Disease	**Provide website and social media means to educate the public during an event.**		PHEP and staff time	2019		Yes	**NEW**
Communicable Disease	**Engage and support local healthcare providers in an active preparedness coalition.**		PHEP and staff time	2019		Yes	**NEW**
	On going and lead by EPR coordinator.						

Public Works							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Dam Failure	**Develop an Emergency Action Plan for Jackman Coulee Dam #2. (Tom O'Leary Golf Course)**		Staff Time	2015	2020		**Complete**
Flood	**Provide protection to the wastewater treatment plant outfall: Place control structures along the wastewater treatment plant outfall near the Tavis structure and the river to protect the wastewater treatment plant from inundation when river levels at Bismarck gage station rise to 13'.**		State Water Commission & City of Bismarck 1M	2020	2021		**New**
Flood	**Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"**	PW Service Ops and PW Utilities	PW Utility Funding and Staff Time	2012		Yes	**Complete** and On-going See comment below
	All gates are inspected and operated Bi-annually.						
Flood	**Apex Engineering has been contracted to conduct a preliminary investigation into solutions to reduce urban flooding in south Bismarck in the Expressway and South 12th Street areas. (current mitigation activity)**		Already funded	2014	2015		**Complete** Re-evaluated in 2019
Flood	**Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.**	Community Development, Engineering	Staff Time	2015		Yes	**Complete** and On-going
Dam Failure	**Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.**	PW Utilities	PW Utilities Funding	2015		Yes	**Complete** and On-going See comment below
	Public Works completes inspections and maintenance annually.						
Shortage or Outage of Critical Materials	**Identify critical facilities and infrastructure having or needing back-up generators or upgrades. (ie: critical facilities and shelter locations). Gap Analysis**		Staff Time	2015	2015	Yes	**Complete** and On-going

Public Works							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Shortage or Outage of Critical Materials	**Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.**		TBD based on generator needs	2015	2017	Yes	**Complete** and On-going
Shortage or Outage of Critical Materials	**Develop an Emergency Agreement with private vendors for delivery of fuel for generators.**		Planning Function No Cost	2015	2016		**Complete** (established internal capability)
Shortage or Outage of Critical Materials	**Explore use of Natural Gas based on generator size needed - natural gas is a more reliable source of fuel**		Staff Time	2015	2017		**Complete** Efficiency depends on size of building.
Shortage or Outage of Critical Materials	**Conduct an assessment of back-up power capabilities for traffic signals.**	PW Service Ops: Streetlights & Traffic Signals	Staff Time	2015	2016		**Complete** Map available showing existing signals with back-up power capabilities
Tornado	**Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.**	Public Works Facility Mgmnt	Project Specific	2015		Yes	**Complete** and On-going
	New facilities: CenCom/Emergency Operations Center Facility and Fire Station #4 have included Tornado Safe Rooms within construction design.						
Tornado	**NOAA All Hazards Weather Radios in all city owned buildings**	Facilities Mgmt.	Individual City Departments $50 per radio	2015	2021	Yes	**Not Complete** Assessment needed.
Winter Storm	**Ensure Back-up generators exist for critical facilities, infrastructure, and shelter locations.**	Emergency Management	Funding Source TBD based on facility owner (ie: shelters)	2015	2020	Yes	**Complete** and On-going
	New facilities: CenCom/Emergency Operations Center Facility and Fire Station #4 have established generator capability.						

Public Works							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Winter Storm	**Evaluate need and opportunity for snow fences.**	PW Service Ops: Forestry	Staff Time	2015		Yes	**Complete** and On-going
Public Education							
Geologic	**Do NOT stockpile snow (or other material) within any geological sensitive areas.**	PW Service Ops, Roads & Streets, Engineering	Staff Time Dept Budget	2015		Yes	**Complete** and On-going

Mitigation Actions – Prioritizing

New mitigation actions were scored and prioritized during the hazard specific mitigation planning team meetings and reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works. In ranking new and on-going mitigation action items as "high," "moderate," or "low," the hazard specific planning teams and CERC reviewed the considerations outlined on the next page as well as the score made up of "STAPLEE" criteria (see below), expected benefit/cost, and benefit to life safety and/or property protection.

Public Education mitigation actions are integrated into position job descriptions within various departments and are generally on-going or routine activities. These mitigation actions are grouped as "Public Education" rather than ranked as high, moderate, or low. However, they are listed based on the hazard ranking.

STAPLEE Criteria	
Criteria	**Considerations**
Social	Community Acceptance Effects on Segment of Population
Technical	Technical Feasibility Long-Term Solution Secondary Impacts
Administrative	Staffing Funding Allocated Maintenance/Operations
Political	Political Support Local Champion or Proponent Public Support
Legal	Local Authority Subjectivity to Legal Challenges
Economic	Benefit of Action Cost of Action Contribution to Economic Goals Outside Funding Requirement
Environmental	Effects on Land/Water Bodies Effects on Endangered Species Effects on Hazardous Material and Waste Sites Consistency with Community Environmental Goals Consistency with Federal Laws
Source (STAPLEE): Federal Emergency Management Agency	
STAPLEE Scoring Criteria: 1= highly effective, feasible 0= Neutral -1 = Ineffective or not feasible	

Mitigation Action Item Prioritizing			
The STAPLEE score in conjunction with additional considerations below were applied to determine the ranking for each mitigation action item.			
High	**Moderate**	**Low**	**Deny**
• Needs attention or participation from department heads, authorities, officials • Requires Funding support (ie: grants) • Required to address significant vulnerability • Needs urgent attention (not necessarily short term completion) • Higher hazard rank	• Other entities have lead role – Bismarck is supporting role in mitigation • Not fully within city authority – but city voice may be effective	• Routine or part of city position job description • Can be completed by one individual – minimal coordination • Minimal funding challenges • On-going / routine mitigation	• Not effective (ie: not likely to meet cost/benefit ratio of 1:1) • Not feasible, or practical – or may have other more effective solutions

Note: All Mitigation Action items are important, regardless of ranking of high, moderate or low. "Low" priority mitigation action items are important mitigation action items. Also, the rank does not imply a sequence or priority order for initiating or completing mitigation action items.

Mitigation Action "STAPLEE" Evaluation and Priority Level

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Winter Storm	High	**Coordinate school/city/business closure communications/decisions.**	1	1	1	1	1	1	1	1	-1	1	**8**	Administration	**High**
Winter Storm	High	**Downed Power Line Safety Training.**	1	1	1	1	1	1	1	1	1	1	**10**	Human Resources	**High**
Winter Storm	High	**Ensure Back-up generators exist for critical facilities, infrastructure, and shelter locations.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Winter Storm	High	**Evaluate need and opportunity for snow fences.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Works	**High**
Tornado	High	**Replace outdoor warning siren activation controller system.**	1	0	1	1	1	1	0	0	1	1	**7**	Emergency Management	**High**
Tornado	High	**Explore potential for developing a city ordinance to require tornado shelter construction at any newly developed mobile home parks and encourage construction absent city ordinance.**	1	0	1	1	1	1	1	1	0	1	**8**	Community Development	**High**
Tornado	High	**Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.**	1	1	0	1	1	1	1	1	0	1	**8**	Public Works Facility Mgmnt	**High**
Flood	Moderate	**Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**

Hazard	Hazard Ranking	Mitigation Action	Lead Agency	Priority
		Life Safety / Property Protection / Benefit vs. Cost / Social / Technical / Administrative / Political / Legal / Economic / Environmental / **Score**		
Flood	Moderate	**Provide protection to the wastewater treatment plant outfall: Place control structures along the wastewater treatment plant outfall near the Tavis structure and the river to protect the wastewater treatment plant from inundation when river levels at Bismarck gage station rise to 13'.**	Public Works	**High**
		1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / **10**		
Shortage or Outage of Critical Materials	Moderate	**Identify critical facilities and infrastructure having or needing back-up generators or upgrades (ie: critical facilities and shelter locations). Gap Analysis**	Public Works	**High**
		1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / **10**		
Shortage or Outage of Critical Materials	Moderate	**Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.**	Public Works	**High**
		1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / **10**		
Train Derailment	Moderate	**Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.**	Administration	**High**
		1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / **10**		
Communicable Disease	Moderate	**Provide education when conducting food service inspections.**	Environmental Health	**High**
		1 / 0 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / **9**		
Communicable Disease	Moderate	**Provide mosquito control & surveillance services.**	Environmental Health	**High**
		1 / 0 / 1 / 1 / 1 / 0 / 1 / 1 / 0 / 0 / **6**		
Fire	Low	**Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.**	Fire	**High**
		1 / 1 / 1 / 0 / 1 / 1 / 0 / 1 / 1 / 1 / **8**		

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Geologic	Low	**Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.**	0	1	1	1	1	1	0	1	1	1	**8**	Engineering	**High**
Geologic	Low	**Develop a remediation to buttress the active geological slide occurring on River Road north of I94 Grant Marsh Bridge.**	1	1	1	1	1	1	1	1	1	1	**10**	Engineering	**High**
Tornado	High	**Install Outdoor Warning Sirens as city grows per identified need.**	1	0	1	1	1	1	1	1	0	0	**7**	Emergency Management	**Moderate**
Tornado	High	**NOAA All Hazards Weather Radios in all city owned buildings**	1	0	1	1	1	1	1	1	1	0	**8**	Public Works	**Moderate**
Flood	Moderate	**Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Moderate**
Flood	Moderate	**Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Moderate**
Flood	Moderate	**Bismarck is currently rated at Class 8 within the Community Rating System. Pursue Class 7 status when likely to qualify as Class 7 based on current activities.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management & Community Development	**Moderate**
Communicable Disease	Moderate	**Identify appropriate locations for isolation or quarantine.**	1	0	0	1	1	1	0	0	1	1	**6**	Public Health	**Moderate**
Communicable Disease	Moderate	**Increase Immunizations rates through grants opportunities and QI projects.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Moderate**
Communicable Disease	Moderate	**Increased opportunities to receive Hepatitis B vaccine to high risk individuals.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Moderate**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Communicable Disease	Moderate	**Engage and support local healthcare providers in an active preparedness coalition.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Moderate**
Fire	Low	**Continue to update and enforce zoning, building and fire code regulations.**	1	1	1	1	1	1	0	1	1	1	**9**	Fire	**Moderate**
Winter Storm	High	**Public Information and Warnings (NWS) - continue**	1	1	1	1	1	1	1	1	1	1	**10**	National Weather Service	**Low**
Hazmat	Moderate	**Develop preplans specific to hazardous materials fixed facilities.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Low**
Civil Disturbance	Moderate	**Bismarck Police Department staff meet with event organizers (primary points of contact) prior to events to learn of event size (expected total participants), event location, time and date and other event specifics. A permitting process is established and permits are encouraged to be completed, but cannot be mandated based on United States case law.**	1	1	1	1	1	1	1	1	1	1	**10**	Police	**Low**
Communicable Disease	Moderate	**Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Continue Existing Mitigation Efforts (BBPH)**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Ongoing education of staff for better response to an outbreak.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Provide website and social media means to educate the public during an event.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Biological Infestation	Low	**Continue programs to monitor existing and future forest damaging pests.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**
Biological Infestation	Low	**Continue existing mitigation efforts including the systematic approach to removing ash trees in decline and replant with a different species to increase the diversity of our urban forest.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**
Biological Infestation	Low	**Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**
Dam Failure	Low	**Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Low**
Aircraft Accident	Low	**Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."**	1	1	1	1	1	1	1	1	1	1	**10**	Airport	**Low**
Wildland Fire	Low	**Maintain Wildland Fire-Break Trail in Southwest Bismarck.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Low**

Public Education – Mitigation Activities

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Winter Storm	High	**Public Education (on-going) - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Winter Storm	High	**Participate in the Severe Winter Weather Awareness Campaign (on-going).**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Public Information - NWS Warnings (existing mitigation)**	1	0	1	1	1	1	1	1	1	1	**9**	NWS	**Public Education**
Tornado	High	**Encourage Wind-Resistant Building Techniques**	1	1	1	1	1	1	1	1	1	1	**10**	Building & Inspections	**Public Education**
Tornado	High	**MH owners / Park Owner - joint shelter planning**	1	1	1	1	1	1	0	1	1	1	**9**	Emergency Management	**Public Education**
Tornado	High	**MH owners /area facilities shelter agreements (pre-planning)**	1	0	1	1	1	1	0	1	1	1	**8**	Emergency Management	**Public Education**
Tornado	High	**Promote NOAA All Hazards WX Radio (existing mitigation)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Protect property from high winds (FEMA website)** http://www.fema.gov/media-library/assets/documents/13270?id=3263	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Safe Rooms** http://www.fema.gov/media-library/assets/documents/2009?fromSearch=fromsearch&id=1536	1	0	1	1	1	1	0	1	0	0	**6**	Emergency Management	**Public Education**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Tornado	High	**Severe Summer Weather Awareness (existing mitigation)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Severe Summer Weather	Moderate	**Public Education regarding Extreme Heat: Do not leave children or pets in the unattended vehicle.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Severe Summer Weather	Moderate	**Continue participating in the Severe Summer Weather Awareness campaign.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Flood	Moderate	**Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.**	1	1	1	1	1	1	1	1	1	1	**10**	Community Development	**Public Education**
Flood	Moderate	**Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Hazmat	Moderate	**Continue Public Education regarding Shelter In Place and Evacuation procedures**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Shortage or Outage of Critical Materials	Moderate	**Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Train Derailment	Moderate	**Evacuation and Shelter-In-Place Emergency Preparedness**	1	0	1	1	1	1	1	1	1	1	**9**	Emergency Management	**Public Education**
Communicable Disease	Moderate	**Provide breastfeeding education to increase breastfeeding in the community for higher rates of baby immunity.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Public Education**
Communicable Disease	Moderate	**Provide Narcan training opportunities to the community to help with the emerging substance abuse threat.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Public Education**

Hazard	Hazard Ranking	Mitigation Action											Lead Agency	Priority
		Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score		
Active Shooter	Moderate	**Conduct on-going public education regarding Active Shooter hazard.**											Police	**Public Education**
		1	0	1	1	1	1	1	1	1	1	**9**		
Fire	Low	**Provide Fire Safety public education to the community at large.**											Fire	**Public Education**
		1	1	1	1	1	1	1	1	1	1	**10**		
Geologic	Low	**Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.**											Engineering	**Public Education**
		0	1	1	1	1	1	1	1	1	1	**9**		
Wildland Fire	Low	**Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.**											Fire	**Public Education**
		1	1	1	1	1	1	1	1	1	1	**10**		
Wildland Fire	Low	**Share Firewise landscaping concepts with developers and Community Development.**											Fire	**Public Education**
		1	1	1	1	1	1	1	1	1	1	**10**		
Biological Infestation	Low	**Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.**											Forestry	**Public Education**
		0	1	1	1	1	1	1	1	1	1	**9**		
Geologic	Low	**Do Not stockpile snow (or other material) within any geological sensitive areas.**											Public Works	**Public Education**
		0	1	1	1	1	1	1	1	1	1	**9**		
All Hazards		**Promote mitigation and emergency preparedness for all hazards.**											Emergency Management	**Public Education**
		1	1	1	1	1	1	1	1	1	1	**10**		

Integration of Plans and Programs & Mitigation Capabilities Inventory

This section provides a summary of community mitigation capabilities and identifies the plans, programs, and other capabilities integrated throughout the development of this mitigation plan. Additional capabilities specific to each hazard are identified as "pre-existing" mitigation within Section 3 of the Multi-Hazard Mitigation Plan where applicable.

City Administration will coordinate with the applicable city department to integrate the requirements of the mitigation plan into other plans and funding mechanisms (ie: annual budgeting process, capital improvement program, growth management plan, future land use plan, plat review process, site plan review process) when appropriate.

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below. This updated 2020 Multi-Hazard Mitigation Plan will be used to inform these mechanisms.	
Imagine Bismarck Strategic Plan	The City of Bismarck developed a Strategic Plan dated June 25, 2019. The plan identifies enhancing public safety through proactive measures across the organization (Objective 6.2, page 27). The plan also identifies strengthening collaboration with partners, stakeholders, the development community, and the public to understand and cost effectively maximize quality of life and the long- term value of properties in the community (Objective 5.2, page 23). More Information: http://www.bismarcknd.gov/index.aspx?NID=1360
Bismarck Emergency Operations Plan	The hazard profiles (ie: risk and vulnerability assessment components) contained with this mitigation plan may be referenced to enhance the Emergency Operations Plan and department specific standard operating guides/procedures. The Emergency Operations Plan informs the mitigation planning development through reviews of the Emergency Operations Plan which may identify response capability gaps and opportunities for mitigation.
Bismarck Continuity of Operations Plan	Through the development of this mitigation plan, vulnerabilities are identified and mitigation projects to enhance continuity of operations capabilities may be introduced. Reviews of the Continuity of Operations Plan may identify additional mitigation opportunities to enhance capability to sustain city operations.
Bismarck Rapid Damage Assessment Plan	The Rapid Damage Assessment Plan includes mapping of critical infrastructure, critical facilities, vulnerable populations, schools, and hazardous materials sites including Tier II sites. This community information is integrated into the mitigation planning process and the mitigation plan itself.

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below. This updated 2020 Multi-Hazard Mitigation Plan will be used to inform these mechanisms.	
2014 Growth Management Plan as Amended	The purpose of the 2014 Growth Management Plan as Amended is to provide a policy and planning guide that helps the City to: • Manage growth through a collaborative process with landowners and developers to achieve attractive and sustainable land and infrastructure development. • Encourage orderly development of unique new neighborhoods, commercial and industrial areas, and redevelopment of existing neighborhoods. • Preserve unique environmental features. • Develop and support an efficient transportation system to serve future circulation and access needs. • Provide attractive and accessible recreation resources to residents and visitors. • Encourage a variety of housing types and support reinvestment in the existing housing stock. • Maintain existing infrastructure, schools, and police and fire services, and expand in growth areas in a cost effective and efficient manner that supports land use, transportation and growth management goals of this plan. More Information: https://www.bismarcknd.gov/DocumentCenter/View/22126/2014-Growth-Management-Plan-Final_022818?bidId=
Stormwater Management Program	Bismarck has a Stormwater Management Program implemented jointly by Community Development, Engineering, and Public Works and a Stormwater Program Coordinator within the Public Works Department. Mitigation capabilities of the Stormwater Management program are identified through Community Development via City Ordinance Title 14.1 (Zoning Ordinance). The city has authority to regulate and enforce stormwater management requirements to promote health, safety, and welfare of the people and property within Bismarck and its extraterritorial jurisdiction. The requirements, permitting and detailed review process are in place to mitigate the impacts of development and land disturbance, protect natural resources, maintain water quality, and minimize stormwater runoff, erosion, and urban flooding issues. More Information: http://www.bismarcknd.gov/index.aspx?nid=190
Bismarck Airport Master Plan **and** **Airport Mitigation and Response Plans**	The Bismarck Airport through its various plans and manuals has specific guidelines and procedures for mitigating hazards. The plans include but are not limited to: Airport Certification Manual, Airport Emergency Plan, Airport Security Program, Spill Prevention Control and Countermeasure Plan (SPCC), Wildlife Hazard Management Plan, Wetland Mitigation and Environmental Assessments. The airport in on-going operations strives to ensure safety and security and mitigate any hazards that could arise. By following procedures set forth, continuous retraining and improvements the airport mitigates hazards.

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below. This updated 2020 Multi-Hazard Mitigation Plan will be used to inform these mechanisms.	
Public Health Programs	Public Health programs include Emergency Preparedness and Response, Home Health Services, Disease Prevention and Control, Women's Way, Environmental Health and other health services. Bismarck also provides public health services to Burleigh County (via contract).
Board of Health	The board of city commissioners constitutes the City Board of Health. *Reference: N.D.C.C. 23-35-03. (Ord. 5660, 05-13-08)*
Emergency Operations Center (EOC) Facility	The City of Bismarck and Burleigh County, in partnership with Dakota Carrier Network (DCN) are building a new public safety communications center and emergency operations center connected to the DCN facility. The constructed addition is hardened, built to withstand natural and manmade disasters and to ensure maximum uptime in the most adverse conditions. The facility was construction was completed in the fall of 2020.
Central Dakota Communications Center (CenCom)	In 2016, the City of Mandan joined with the City of Bismarck and Burleigh County and reorganized into the Central Dakota Communications Center, serving Bismarck, Mandan, Burleigh County and the SE portion of McLean County to include the City of Wilton. This has enabled better information sharing and coordination amongst agencies. It has reduced the necessity of transferring calls, resulting in a more efficient response in the served communities.
Statewide Interoperable Radio Network (SIRN)	SIRN has begun implementation in 2019 with the CenCom coverage area included in the early adopter buildout for 2020. This provides for better coverage, interoperability and in-building communications within a system built to leverage new technology over the next 20-25 years.
Transportation Improvement Program (TIP)	The annually developed Transportation Improvement Program (TIP), produced by the Bismarck-Mandan Metropolitan Planning Organization (MPO), identifies federally funded transportation improvements in the area over a four year time frame. The TIP is developed on an annual basis in cooperation with the MPO area member jurisdictions, transit provider, and the North Dakota Department of Transportation. The MPO utilizes its Public Participation Plan and coordinates the TIP with its Long Range Transportation Plan (LRTP). https://www.bismarcknd.gov/1109/Transportation-Improvement-Program
Long Range Transportation Plan (LRTP)	The 2009-2035 Long Range Transportation Plan (LRTP), is a guide for the development of the area's transportation system over the next 20+ years. Maintaining a relevant LRTP allows the Bismarck-Mandan area to be eligible for federal transportation dollars for transportation improvements. The LRTP was developed by the MPO with stakeholder input including a "Community Committee" made up of area residents, business groups, bike groups, transit users/representatives, and community agency representatives. http://www.bismarcknd.gov/index.aspx?nid=1226

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below. This updated 2020 Multi-Hazard Mitigation Plan will be used to inform these mechanisms.	
Fringe Area Road Master Plan	In 2014, the MPO adopted a new Fringe Area Road Master Plan to address the growing Bismarck-Mandan Metropolitan Fringe Areas. The plan serves as a framework for a suitable future roadway network and will also help guide land use planning for the future. http://www.bismarcknd.gov/index.aspx?NID=134
Capital Improvement Program	The Capital Improvement Program is managed by the Finance Department. A department may place capital improvement projects over $50,000 (for non-special assessment district projects) on the Capital Improvement Plan which are evaluated by the Budget Committee. The Budget Committee makes recommendations to the City Commission regarding approvals/adjustments to the Capital Improvement 5-year and annual plans. The City Commission adopts the 5 year plan and approves the annual plan. Projects under $50,000.00 follow the purchasing ordinance. The Engineering Department may submit a request to the City Commission to create a special assessment district to assess benefiting properties. The city commission calls for a public hearing regarding those projects.
State and County Mitigation Plans	The 2018 State of North Dakota Multi-Hazard Mitigation Plan and the Burleigh and Morton County Multi-Hazard Mitigation Plans were reviewed by Bismarck Emergency Management and integrated into this plan and planning process.
Missouri River 2015 Flood Response and Action Plan	The Apex Engineering Missouri River 2015 Flood Response and Action Plan was reviewed and integrated into the Bismarck Multi-Hazard Mitigation Plan. The plan addresses both Ice Jam and Flood protection.

Codes, Permitting and Inspections The following mitigation capabilities are reviewed and incorporated into the mitigation plan and planning process.	
Building Ordinance and Codes	The Building Inspections Division of Community Development enforces various building codes per Title-4 Building Ordinance. The building codes ensure construction standards to address life safety and quality construction issues. The ordinance establishes processes for permitting and inspections managed by the Building Inspections Division of Community Development. The jurisdiction of the division includes Bismarck and Burleigh ETA mapped : https://bismarck.maps.arcgis.com/home/webmap/viewer.html?webmap=d714ee6df3254526902e66baa926c42e More information: https://www.bismarcknd.gov/DocumentCenter/View/151/Title-04---Building-Regulations?bidId=
Fire Codes	The Bismarck Fire Department enforces Fire Codes per Title-4 Building Ordinance in cooperation with the Building Inspections and Planning Divisions of Community Development. The Fire Department issues permits for licensed daycare facilities, exhaust hood system installations, sprinkler systems, fire alarm systems, and professional firework displays. Bismarck Fire conducts annual inspections of all commercial and public facilities to ensure sustained compliance with fire codes and to promote safety and mitigation practices. Within the incorporated limits of the City of Bismarck, the ISO Public Protection Classification is 1. More information: https://bismarcknd.gov/479/Permits-Code-Compliance

Land Use Planning and Ordinances The following land use planning capabilities and ordinances are incorporated into the mitigation plan or planning process.	
Zoning	Zoning authorities are established by Bismarck City Ordinance Title 14. The zoning ordinance provides for the concept of a "Master Plan" which is a compilation of adopted street, road, land use, water, sanitary sewer and drainage plans. The Planning Division administers land use regulations and coordinates the development application process for City Planning & Zoning Commission, the County Planning Commission: https://www.burleighco.com/board/planning/ and the Board of Adjustment. 14-02-01. Intent. It is the intent of the board of city commissioners to promote the health, safety and general welfare by guiding the development of the city by means of a comprehensive land use plan which is in part carried out by the provisions of this ordinance. It is the intent of this ordinance to provide regulations, standards and guides for the city's development which will: a) Lessen congestion in the streets; b) Secure safety from fire, panic and other dangers; c) Promote the health and general welfare; d) Prevent the overcrowding of land; e) Provide adequate light and air; f) Avoid undue concentration of population; g) Facilitate adequate provision for transportation, water, sewerage, schools, parks and other requirements. More Information: http://www.bismarcknd.gov/index.aspx?nid=138
Floodplain Ordinance	The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations. More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
Flood Insurance Study and Flood Insurance Rate Maps	Flood Insurance Study and Flood Insurance Rate Maps: https://www.bismarcknd.gov/1466/Flood-Resources
Snow Emergency Ordinance	City Ordinance Title 10 established snow emergency routes and outlines the process to issue a snow emergency declaration. A snow emergency declaration allows for the public works director to take specific actions such as allow for the discontinued use of snow plow "snow gates" to more efficiently remove snow. Title 12 (traffic code) and Title 14 (Zoning) also support snow emergency preparedness, mitigation, and response efforts. Title 12 authorizes the removal of parked vehicles located on a posted snow emergency routes during a declared snow emergency or otherwise impeding efficient snow removal or obstructing normal traffic flow. Title 14 requires available snow storage via islands, medians, and adjacent parking areas. More information (title 10): https://www.bismarcknd.gov/DocumentCenter/View/157/Title-10---Public-Places-and-Property-Franchises?bidId=

Land Use Planning and Ordinances The following land use planning capabilities and ordinances are incorporated into the mitigation plan or planning process.	
Drought – City Ordinance	Title 2 (Chapter 2-08) of the Bismarck City Ordinance provides authority to restrict the use of water and other utilities during a drought or other emergency following a declaration of emergency. More information: https://www.bismarcknd.gov/DocumentCenter/View/149/Title-02--Administration-and-Governmental-Organiz?bidId=
Neighborhood Parks and Open Space	The Neighborhood Parks and Open Space ordinance and policy were both adopted by the City Commission in October 2013. More Information: http://www.bismarcknd.gov/index.aspx?nid=1474

Administration Administration capabilities integrated within mitigation planning are noted below.	
Planning and Zoning Commission	The Bismarck Planning and Zoning Commission hears requests for major and minor subdivision plats, zoning changes, zoning ordinance text amendments, annexations, special use permits and rural lot splits. The City of Bismarck has zoning and subdivision authority within the corporate limits and the extraterritorial area. The Planning and Zoning Commission meets monthly. More information: https://www.bismarcknd.gov/1037/Planning-Zoning-Commission
Metropolitan Planning Organization	The Metropolitan Planning Organization (MPO) provides a forum for public officials, citizens, and other interested groups to establish policies and plans for effectively addressing various metropolitan transportation issues. The MPO is comprised of five jurisdictions including: Bismarck, Lincoln, Mandan, and portions of Burleigh and Morton counties. More information: http://www.bismarcknd.gov/index.aspx?nid=133

Department/Staff Mitigation Capabilities The following department/staff mitigation capabilities are integrated into the mitigation planning process.	
Building Official	Also see "Building Ordinance and Codes." Bismarck has a full-time Building Official and additional full-time Building Inspections staff to enforce ordinances and building codes including building regulations, floodplain administration, addressing, and zoning administration and enforcement. The Building Inspections Division is within Community Development Department. More information: https://www.bismarcknd.gov/111/Building-Inspections
Environmental Health	Bismarck has a Environmental Health Division within the Public Health Department. The Environmental Health Division is comprised of an Environmental Health Administrator and three Environmental Health Specialist. The Environmental Health Division enforces ordinances governing health and sanitation. The Environmental Health Division license and inspects the following business types in Bismarck: food service, lodging, body art, public and semi-public swimming pools, tanning. Other Environmental Health activities include: investigation of public health nuisances, special pet licensing, issuing noise permits and mold consultation.
Floodplain Administrator	The Building Official for Bismarck is designated as the Floodplain Administrator. The Floodplain Administrator (Building Official) administers the city's floodplain regulations. The duties and responsibilities of the Floodplain Administrator are outlined in Title 14 Zoning (14-04-19). More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962

Department/Staff Mitigation Capabilities The following department/staff mitigation capabilities are integrated into the mitigation planning process.	
Community Development: Planning Division	The Planning Division within Community Development is responsible for: • Administering land use regulations for the City of Bismarck and portions of Burleigh County. • Coordinating the development application process for zoning changes, major and minor subdivision plats, annexations, special use permits, variances, lot modifications, plat modifications (right-of-way vacations, easement releases, street name changes), site plan review and downtown design review • Administering HUD Grant Programs (CDBG and HOME) for the City • Administering Downtown Programs (Renaissance Zone and CORE) for the City • Providing staff support to the City Planning & Zoning Commission, the Burleigh County Planning and Zoning Commission (https://www.burleighco.com/board/planning/), , the Board of Adjustment and the Renaissance Zone Authority. • Plat Reviews More Information: https://www.bismarcknd.gov/138/Planning
Engineering Department	The Engineering Department monitors contracted construction projects and permits by private contractors in the City of Bismarck streets, rights of way, and public easements. The Engineering Department also provides guidance and information relating to land development, stormwater and floodplain management, traffic matters (including parking, street signs, road closures and pavement markings), property boundaries, water distribution, sanitary sewer collection, transportation network master planning, records of public infrastructure (including water, sewer, road, lighting, and service lines to private buildings). The Engineering Department works in conjunction with the Public Works Department which is responsible for operations and maintenance of water utility services, streets/lights, waste and recycling, and city forestry. More Information: https://www.bismarcknd.gov/17/Engineering
Geographic Information Systems	The GIS Division is capable of producing maps, graphs, tables, images, and applications using geographic data to support operational and planning functions, including support to mitigation planning efforts.
Forestry	Bismarck has a Forestry Division (within Public Works Department). Mitigation capabilities of the Forestry Division are identified in City Ordinance Title 13 providing the City Forester with authority to regulate/enforce forestry standards which govern planting, maintenance, removal, fertilization, pruning, and bracing of trees to minimize interference with utility lines and support public safety (ie: maintain visibility, public safety access, wildland/urban interface). Through promotion of the urban forestry program, stormwater run-off reduction is achieved as well with an estimated annual benefit of $500,000.00. More information: http://www.bismarcknd.gov/index.aspx?nid=163

Department/Staff Mitigation Capabilities The following department/staff mitigation capabilities are integrated into the mitigation planning process.	
Southwest Central Emergency Preparedness Regional Coordinator	The Southwest EPR Coordinator develops plans and capabilities to address public health (and all hazard) emergencies. Public Health Emergency Operations Plans address Points of Distribution, Mass Vaccination, Strategic National Stockpile, Mass Fatality, Mental Health, Family Reunification, and Pandemic Influenza.
Emergency Manager	Bismarck established an emergency management program at the city level in 2003 and employs a full-time city emergency manager partially funded by the Emergency Management Performance Grant. Alternate Emergency Managers are identified in the Continuity of Operations Plan. More information: https://www.bismarcknd.gov/495/Emergency-Management

Technical Mitigation Capabilities	
Warning Systems & Services	There are 24 outdoor warning sirens in Bismarck and surrounding area. Twenty of them are within city of Bismarck. The sirens are activated via the Central Dakota Communications Center (CenCom). CenCom also has emergency notification system technology to activate personnel and to notify a select area of the community of an impending or current situation. Notification/alerts may be sent out via land-line phone, cell phone, text, etc.
Grant Writing	All Departments have grant writing capability. Bismarck also has a Grants Coordinator position to assist with grants management including grant compliance.

Financial Mitigation Capabilities	
Financial capabilities - various	-Capital Improvement project funding is approved annually via the city commission. See *Capital Improvement Program* under *Plans and Programs* above. -Bismarck City Commission has the authority to levy taxes. -Bismarck City Commission approves and may amend the city's budget. -Bismarck may incur debt through general obligation bonds. However, funds are more typically raised via taxes such as hotel/motel, liquor, sales tax, and car rental taxes. -Community Development Block Grant funds are utilized by Bismarck annually.

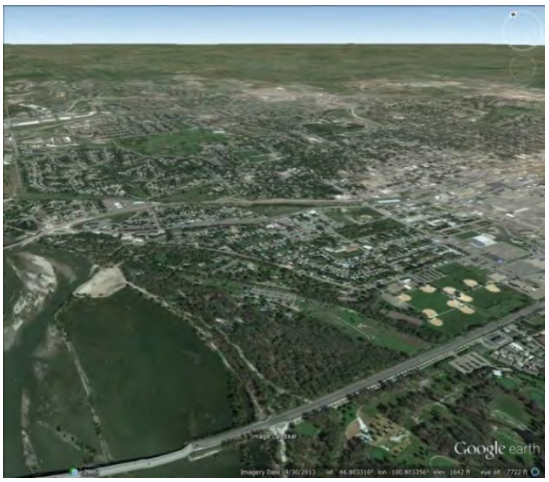
Education and Outreach Mitigation Capabilities and Plan Integration	
Public Education: Mitigation and Emergency Preparedness	Various departments have capability and do conduct safety, mitigation, and emergency preparedness public education and outreach activities. City departments include Public Works, Public Health, Fire, Police, as well as Emergency Management. Other community partners also have this capability and conduct public education activities for the benefit of local citizenry including the business community. Other community partners include the American Red Cross, National Weather Service, Burleigh County, North Dakota Department of Health and ND Department of Emergency Services.

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Community Profile

Geography

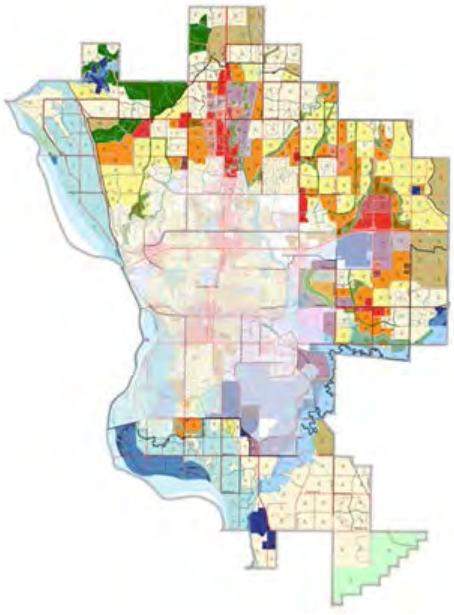
Bismarck, the county seat and State capital, is in the southwestern part of Burleigh County. Bismarck measures 34.71 square miles (November 2019), about 2% of the 1,668 square miles of Burleigh County. Within the past 5 years, the city expanded by 1.85 square miles. The Missouri River, flowing in a southerly to southeasterly direction, forms the western boundary of Bismarck. Bismarck lies within the eastern margin of the Great Plains, which is defined by gently rolling hills and wide expanses of prairie.



The north side of Bismarck is of higher elevation with a gently rolling terrain. The highest elevation in Bismarck is 1,973 near the Ash Coulee Drive water tower. There are relatively steep slopes adjacent to the Missouri River on the east side of River Road. The south side of Bismarck is of lower elevation and generally flat. The "gage 0" datum level is 1618.28 at the river gage near the water treatment in west Bismarck. 1630 is the typical lower elevation in southwest Bismarck.

Interstate 94 and US 83 are major transportation routes, and both bisect the city of Bismarck.

At Bismarck-Mandan the Missouri River Valley is only about two miles wide where Interstate Highway 94 crosses the river. On the south side of Bismarck the valley broadens to about six miles wide. The reason for this widening is that, prior to glaciation, the Heart and Little Heart rivers, which today flow into the Missouri River (the Heart River enters the Missouri River at Mandan; the Little Heart enters about ten miles south of Mandan), joined a few miles east of Bismarck. The old, combined valley of the Heart-Little Heart rivers still exists as the broad lowland south of Bismarck - a wide spot in the Missouri River valley.



The latitude of Bismarck is 46.808N. The longitude is -100.783W. Elevation varies from 1,600 to 1,973. Population of Bismarck in 2018 was 73,112, which is latest estimate by the U.S. Census Bureau. The City of Bismarck's form of government is a five-member city commission, elected at-large, of which the president is also the Mayor of the city.

Sources: City of Bismarck, Google Maps, Bismarck Growth Management Plan as Amended

Community Changes Overview:

Since 2015 (date of previous Mitigation Plan), Bismarck has gained 476 acres added to the city limits through numerous annexations. The location of the annexations since 2015 are shown on page 3.

Since May, 2015, the city of Bismarck issued a total of 1,236 new permits (each with a unique address). The map showing permits issued illustrates the extent of growth and the locations of new construction. See page 4.

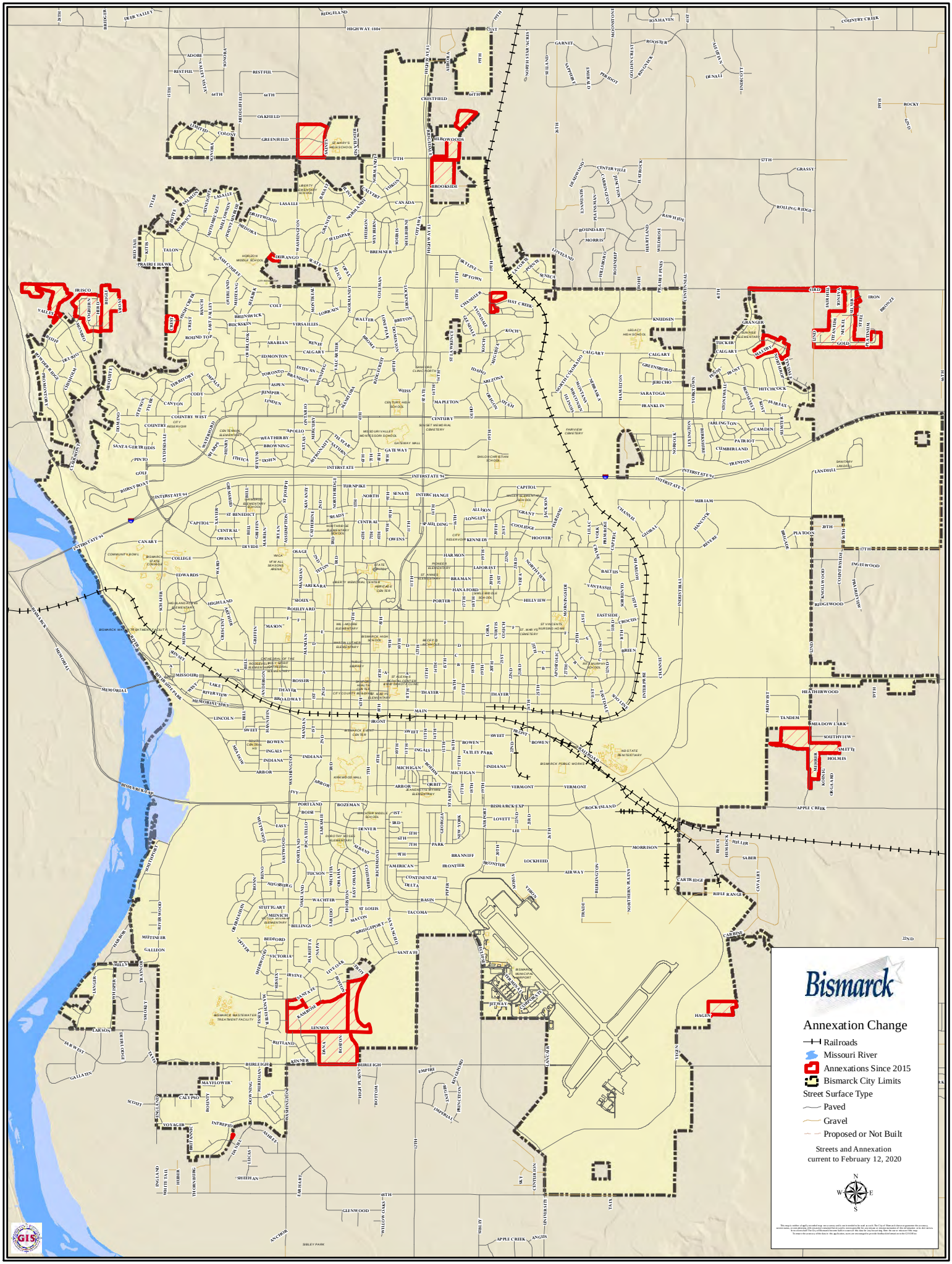
Since 1990, Bismarck has shown steady growth in population. The approximate percentage increase per decade since 1990 is 12%, 10% and 15% based on the 2017 estimated population. The 2010 to 2017 estimated population increase of 15% exceeds the two previous decades (based on only 7 years). The population has also become more diverse, with a younger population reversing the "aging population" trend somewhat. The population of the public school system has been seeing steady growth. The per capita and median household income have declined slightly since 2014, however persons below the poverty level remains consistent (9.5% in 2018 vs. 9.7% in 2012).

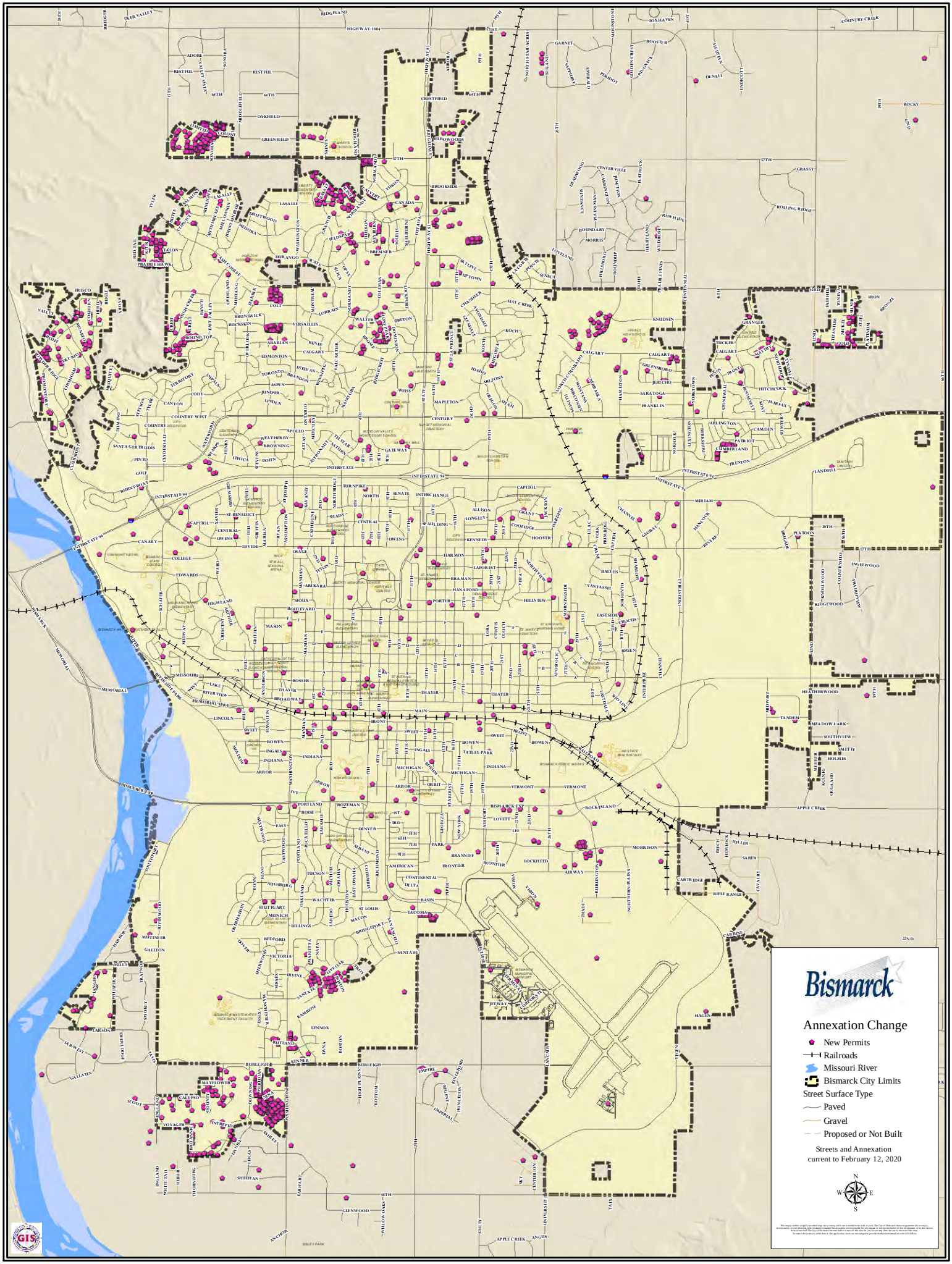
A review of the climate data within this community profile section illustrates consistency with climate change information as outlined in Section 9: Risk Assessment.

As a result of community growth (geographic and population), the vulnerability to hazards and potential for impact may be considered to be somewhat elevated compared to previous years and the importance of mitigation, public education, and communication (including foreign language communications) becomes elevated as well. However, community changes have not required significant updates to the hazard profiles (ie: identification of vulnerability and potential impact) or modifications to hazard ranking overall.

Based on current review of the Flood Plain for Burleigh County, it is anticipated there will be changes required as it relates to the Flood Hazard. The floodplain and relevant mitigation actions will likely be identified prior to the 2025 Bismarck Multi-Hazard Mitigation Plan update.

A new facility for the Emergency Operations Center (EOC) and Central Dakota Communications Center (CenCom) has been completed. The new location and the method of construction (ie: hardened facility) significantly minimizes risk to the EOC and CenCom facility for those hazards identified within this mitigation plan.


Bismarck
Annexation Change
Railroads
Missouri River
Annexations Since 2015
Bismarck City Limits
Street Surface Type
Paved
Gravel
Proposed or Not Built
Streets and Annexation
current to February 12, 2020
N
W
E
S
GIS


Bismarck
Annexation Change
New Permits
Railroads
Missouri River
Bismarck City Limits
Street Surface Type
Paved
Gravel
Proposed or Not Built
Streets and Annexation
current to February 12, 2020
N
W
E
S
GIS

Community Profile – Additional Resources:

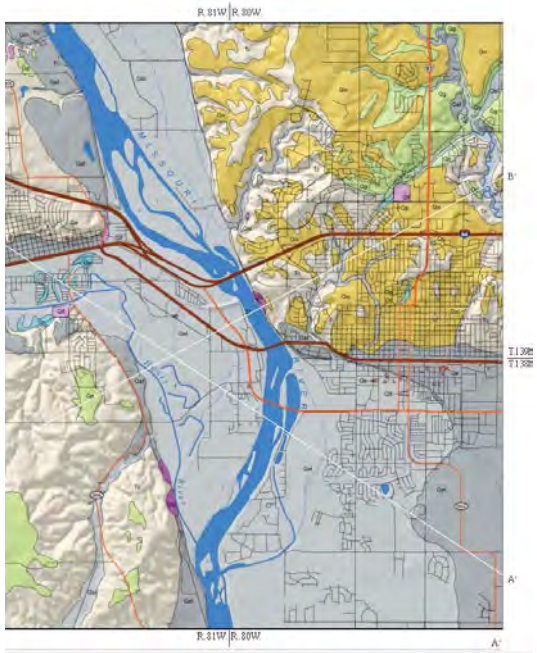
- The Metropolitan Planning Organization (MPO) mains a community "Monitoring Report" on the City of Bismarck Website at https://www.bismarcknd.gov/1457/Monitoring-Report

    - *Although the focus of the MPO is transportation related, the information contained within the MPO's Monitoring Report provides for detail regarding People, Housing, Employment, and Travel within the MPO area (Bismarck/Mandan).*

- Current City of Bismarck City Construction Projects Story Map: https://bismarck.maps.arcgis.com/apps/MapSeries/index.html?appid=e8d06816c8114f18a07019c34d31b04a

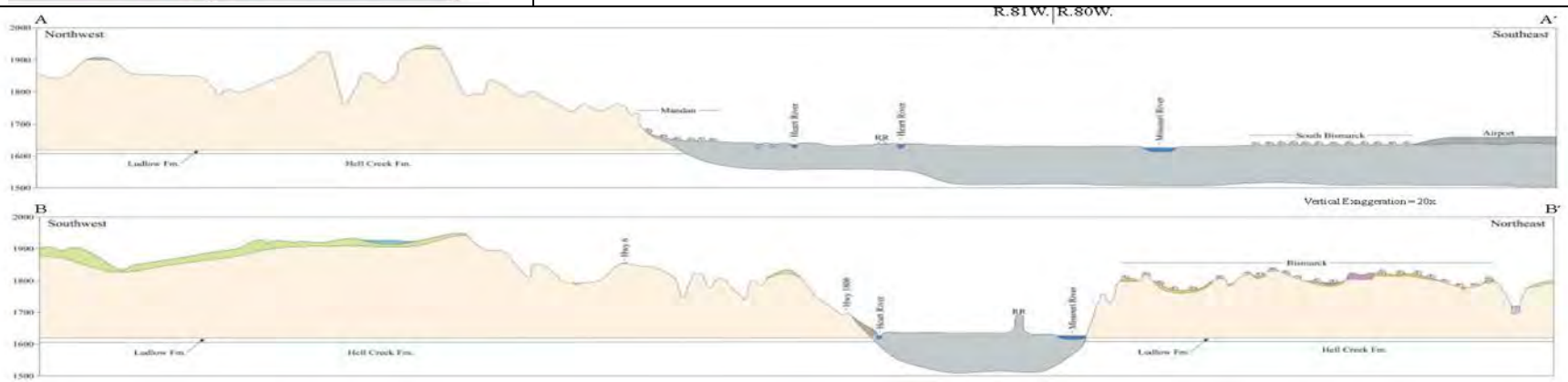
    - The story map link above shows the major construction projects in the city within six different areas:

        1. Street Rehab and Repair
        2. Street Lighting
        3. Watermain
        4. Signal Upgrades
        5. Sewer Upgrades
        6. New Developments.



The Missouri River forms the western boundary of Bismarck. The elevation of the majority of south Bismarck (shown below at right top) is not significantly higher than the normal or typical river elevations throughout the year. Much of south Bismarck could not be developed until after the completion of the Garrison Dam in 1953. The lower right of the bottom diagram shows a cross section of north Bismarck. The location of each cross section below is based on the geology map at left. Mandan is shown on the west (left) side of the map and diagram.

Source of map and diagram: ND Geologic Survey, Department of Mineral Resources
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf



Climate

North Dakota's geographic location results in a sub-humid continental climate characterized by marked fluctuations in temperatures and light to moderate precipitation. Average annual precipitation ranges from fewer than 13 inches in the northwest to more than 20 inches in the southeast part of the state. The precipitation tends to be irregular in occurrence, amount, and area of coverage. The inconsistency of the state's weather arises from the interaction of three major air masses that 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. The polar air mass tends to dominate the other two but its influence is considerably lessened during the summer.

Bismarck Normals (1981-2017)

Month	Max Temp	Min Temp	Precipitation
January	23.4	2.2	0.43
February	28.3	7.9	0.51
March	40.4	19.4	0.87
April	57.0	30.7	1.26
May	68.4	42.6	2.40
June	77.3	52.0	3.17
July	84.7	57.4	2.89
August	83.5	55.5	2.28
September	72.1	45.0	1.59
October	57.5	32.2	1.25
November	39.6	18.8	0.71
December	26.2	6.1	0.49
Annual	55.0	30.9	17.85

Bismarck Record Temperatures

Month	Max Temp	Year	Min Temp	Year
January	63	2002	-45	1916
February	73	2016	-45	1936
March	81	2007*****	-36	1897
April	93	1992*	-12	1975
May	102	1934*	13	1907
June	111	2002	30	1969
July	114	1936	32	1884
August	109	1941	32	1911*
September	105	1959*	10	1876
October	95	1963*	-10	1991*
November	79	1999	-30	1985
December	66	1939	-43	1967

**and earlier dates*

Bismarck Climate Data - Monthly Averages (Years 1981-2017)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Mean Temperature (degree F)												
12.8	18.1	29.9	43.8	55.5	64.6	71.1	69.5	58.5	44.8	29.2	16.2	42.8
Average Maximum Temperature (degree F)												
23.4	28.3	40.4	57.0	68.4	77.2	84.7	83.5	72.1	57.5	39.6	26.2	54.9
Average Minimum Temperature												
2.2	7.9	19.4	30.7	42.7	52.0	57.4	55.5	44.9	32.2	18.8	6.1	30.8
Monthly Average Precipitation (inches)												
0.43	0.5	0.86	1.26	2.39	3.16	2.88	2.27	1.59	1.25	0.71	0.48	17.8
Monthly Average Snowfall (inches)												
8.9	8.1	9.1	4.2	.4	0.0	0.0	0.0	.2	2.2	8.8	9.3	51.2

Bismarck Climate Data - Daily Extremes (Years 1874-2017)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest Daily Temperature (degree F)											
63	73	81	93	102	111	114	107	105	95	79	66
Lowest Daily Temperature											
-44	-45	-28	-12	17	31	32	32	10	-10	-30	-43
Highest Daily Precipitation											
0.60	1.02	1.80	2.35	2.65	3.19	4.32	4.63	4.31	1.68	1.13	1.16
Highest Daily Snowfall											
13.2	9.2	15.5	17.3	8.5	0.00	0.00	0.00	4.1	8.6	10.8	10.5

Bismarck Climate Data - Monthly Extremes (Years 1874-2017)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Precipitation (amount/year)											
1.64	1.74	3.27	5.71	7.04	9.9	13.75	9.29	6.93	4.3	3.10	1.71
1877	2000	1916	1878	1927	1914	1993	1998	1977	1982	1896	1884
Minimum Precipitation (amount/year)											
0.00	0.03	0.00	0.00	0.04	0.47	0.10	"T"	0.02	0.00	0.00	0.00
1878	1934 1985	1930	1952	1901	1936	1936	2001	1948	1935	1990	1944
Record Snowfall											
25.0	25.6	31.1	21.8	10.3	0.00	0.00	0.00	5.00	23.7	31.0	33.3
1982	1979	1975	2013	1950	-	-	-	1984	1991	1896	2008

Bismarck Climate Data - Extremes (top 10 from years 1874-2017)

Rank	Value	Date	Rank	Value	Date
Highest Daily Maximum Temperature (degree F)					
1	114	7/6/1936	6-7	109	7/11/1973
2	112	7/30/2006	6-7	109	8/5/1941
3	111	6/29/2002	8-9	108	7/20/1960
4-5	110	7/16/1936	8-9	108	7/9/1921
4-5	110	7/10/1936	10	107	6/27/1988
Lowest Daily Minimum Temperature (degree F)					
1	-45	2/16/1936	6-9	-43	2/9/1994
2	-45	1/13/1916	6-9	-43	12/31/1967
3-5	-44	1/15/2009	6-9	-43	2/19/1929
3-5	-44	1/18/1950	6-9	-43	2/1/1887
3-5	-44	1/2/1887	10	-42	1/12/1974 2/15/1936 12/20/1916
Highest Daily Precipitation (inches)					
1	4.63	8/21/1998	6	3.36	6/26/1914
2	4.48	8/12/1999	7	3.25	6/3/1947
3	4.32	7/15/1993	8	3.19	6/15/2009
4	4.31	9/15/1994	9	3.12	8/9/1909
5	3.67	9/7/1894	10	2.92	8/1/1915
Highest Daily Snowfall (inches)					
1	17.3	4/14/2013	6	11.9	3/26/1950
2	15.5	3/3/1966	7	11.9	4/3/1937
3	15.2	4/5/1997	8	11.8	3/30/2009
4	13.2	1/17/1996	9	11.6	3/19/1982
5	11.9	4/27/1984	10	11.0	3/21/1894

Source: NOAA - National Weather Service Weather Forecast Office https://www.weather.gov/bis/climate_bis

Annual Temperature Averages and Extremes – Bismarck ND 1874-2019

Annual Average	Highest Annual Average	Year	Lowest Annual Average	Year
43.0 F	46.5 F	2016	35.4 F	1875

Of the top twenty rankings for highest annual average temperature, 13 of 20 records occurred since 1980. Five of the top ten warmest years occurred since year 2000. By comparison, the 1930's hold the record in two of the top ten.

Annual Temperature Rankings
Bismarck, ND
Period of Record Beginning 1874

Warm	Cold	YEAR	Temperature
1	145	2016	46.5°F
2	144	1931	46.3°F
3	143	2006	46.2°F
4	142	1987	46.1°F
5	141	1934	45.7°F
6	140	2012	45.5°F
7	139	2015	45.3°F
8	137	1998	45.2°F
8	137	1878	45.2°F
10	134	2005	44.8°F
10	134	1999	44.8°F
10	134	1981	44.8°F
13	133	2017	44.7°F
14	132	1991	44.6°F
15	131	1921	44.4°F
16	130	2001	44.3°F
17	128	1990	44.2°F
17	128	1953	44.2°F
19	127	1938	44.1°F
20	126	1941	44.0°F

Annual Precipitation Averages and Extremes – Bismarck ND 1875-2019

Annual Average	Highest Annual Average	Year	Lowest Annual Average	Year
17.85"	30.92"	1876	5.97"	NA
	29.58"	2019	7.74"	1934

Eight of the top 20 wettest years have occurred since year 2000.

Annual Precipitation Rankings
Bismarck, ND
Period of Record Beginning 1875

Wet	Dry	YEAR	Precipitation
1	145	1876	30.92"
2	144	2019	29.58"
3	143	1875	27.53"
4	142	1993	26.99"
5	141	2013	26.75"
6	140	1999	26.45"
7	139	1986	24.24"
8	138	1998	23.70"
9	137	2016	23.48"
10	136	1884	23.36"
11	135	1915	23.25"
12	134	2011	23.22"
13	133	2010	23.18"
14	132	2009	23.12"
15	131	2000	23.00"
16	130	1914	22.98"
17	129	1879	22.61"
18	128	1965	21.53"
19	127	1975	21.50"
20	126	2001	21.34"

Seasonal Snowfall Averages and Extremes – Bismarck ND 1886-2019

Annual Average	Highest Annual Average	Year	Lowest Annual Average	Year
51.2"	101.6"	1996-97	11.7"	1980-81
	100.3"	2008-09	13.2"	1902-03

Twenty-three of the top 25 season snowfall records occurred since 1964.

Seasonal Snow Rankings
Bismarck, ND
Period of Record Beginning 1886

Wet	Dry	YEAR	Snow
1	133	1996-1997	101.6"
2	132	2008-2009	100.3"
3	131	1993-1994	91.8"
4	130	1949-1950	86.8"
5	129	2010-2011	85.4"
6	128	1978-1979	83.0"
7	127	1981-1982	80.3"
8	126	1995-1996	80.1"
9	125	1986-1987	67.9"
10	124	1994-1995	67.1"
11	123	1983-1984	66.5"
12	122	1896-1897	64.7"
13	121	1998-1999	64.5"
14	120	1977-1978	63.7"
15	119	1966-1967	61.7"
16	118	1985-1986	61.2"
17	117	2018-2019	60.3"
18	116	1974-1975	58.7"
19	114	2016-2017	57.5"
19	114	1991-1992	57.5"
21	113	2012-2013	57.3"
22	112	2009-2010	55.4"
23	111	1964-1965	54.5"
24	110	1916-1917	52.8"
25	108	1969-1970	52.3"

Source: NOAA - National Weather Service Weather Forecast Office https://www.weather.gov/bis/climate_bis

Economy

Our city consists of agriculture, bakeries, concrete products, construction, education, electric power, farm machinery manufacturing, health care, insurance, machine shops, railroad, retail markets, state and local government, and trucking. We have several shopping malls with 280 stores; 19+ banks, loan and savings associations, nine libraries with 638,037 volumes, and approximately 100 churches representing a variety of faiths. We have one daily newspaper, one weekly newspaper and one monthly newspaper; two movie theater complexes with 30 screens, fourteen radio and four television stations.

Bismarck also has five airlines, which have daily airmail, passenger freight and express mail to several points in the U.S. Several truck lines to provide local and intrastate service. There is one bus terminal. There are two U.S. highways: Highway 83 (north to south) and Interstate 94 (east to west). The city also has four public parking ramps accommodating 1,700 vehicles.

Western North Dakota's energy production is a major economic generator for the state. Bismarck is the corporate headquarters for many of the major energy companies working in North Dakota. Bismarck is within 85 miles of eleven coal-fired electrical generating facilities producing over 4000 megawatts of electricity. In addition, Bismarck is the corporate headquarters for Dakota Gasification, the owners and operators of North America's only commercial lignite coal to synthetic natural gas production facility.

Bismarck's major economic strengths include agriculture, agri-business, energy, development, and health services. Bismarck's medical community provides services in a multi-state area. It currently employs over 4,000 people providing state of the art health care services to residents of western North Dakota, northern South Dakota, and eastern Montana. The hospitals in the Bismarck area include CHI-Bismarck Campus and Sanford Health with 526 patient beds and 27 satellite clinics supply services to residents in a four-state area with the finest patient care.

Bismarck has a modern water system, obtained from the Missouri River, which is filtered and sterilized before delivery. The City has approximately 376 miles of water main and 3,772 fire hydrants. Vast supplies of electricity are available from giant generating plants and the Garrison Dam on the Missouri River, deposits of lignite coal, availability of natural gas and ample supply of water from the Missouri River.

Business Quick Facts

	Bismarck	North Dakota
Total number of firms, 2007	6,424	61,546
Black-owned firms, percent, 2007	F	0.3%
American Indian- and Alaska Native-owned firms, percent, 2007	0.7%	1.6%
Asian-owned firms, percent, 2007	S	0.7%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	F	0.0%
Hispanic-owned firms, percent, 2007	F	0.5%
Women-owned firms, percent, 2007	24.3%	24.8%

F: Fewer than 100 firms

S: Suppressed; does not meet publication standards

Sources: City of Bismarck and US Census Bureau - QuickFacts

Economic Characteristics

EMPLOYMENT STATUS	North Dakota				Bismarck			
	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Population 16 years and over	543,270	+/-509	543,270	(X)	50,288	+/-312	50,288	(X)
In labor force	383,089	+/-1,729	70.5%	+/-0.3	35,882	+/-626	71.4%	+/-1.2

Source: US Census Bureau - QuickFacts

POPULATION BY AGE GROUP

Age	1990		2000		Change 90-00	2010		Change 90-10	2017 Estimate		Change 90-17
	Number	% of total	Number	% of total		Number	% of total		Number	% of total	
Under 5	3,643	7.4%	3,356	6.0%	-237	3,896	6.4%	253	4,670	6.6%	1,027
5-9	4,019	8.2%	3,431	6.2%	-588	3,431	5.6%	-588	4,558	6.5%	539
10-14	3,621	7.4%	3,790	6.8%	169	3,350	5.5%	-271	3,580	5.1%	-41
15-19	3,400	6.9%	4,308	7.8%	908	3,765	6.1%	365	3,850	5.5%	450
20-24	3,397	6.9%	4,380	7.9%	983	5,035	8.2%	1,638	5,189	7.4%	1,792
25-34	8,965	18.2%	7,339	13.2%	-1,626	9,110	14.9%	145	11,192	15.9%	2,227
35-44	7,848	15.9%	8,842	15.9%	994	6,886	11.3%	-962	8,165	11.6%	317
45-54	4,709	9.6%	7,815	14.1%	3,106	8,879	14.5%	4,170	8,491	12.0%	3,782
55-64	4,033	8.2%	4,629	8.4%	596	7,509	12.3%	3,476	9,349	13.3%	5,316
65-74	3,069	6.2%	3,888	7.0%	819	4,435	7.3%	1,366	5,746	8.1%	2,677
75 & over	2,552	5.2%	3,754	6.7%	1,202	4,976	8.1%	2,424	5,746	8.1%	3,194
Total	**49,256**	**100%**	**55,532**	**100%**	**6,276**	**61,272**	**100%**	**12,016**	**70,536**	**100%**	**21,280**

Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates

Population

PEOPLE	Bismarck	North Dakota
Population, 2018 estimate	73,112	760,077
Population, 2012 estimate	64,777	701,345
Population, 2010 (April 1) estimates base	61,264	672,591
Population, percent change, April 1, 2010 to July 1, 2013	9.4%	7.6%
Population, percent change, April 1, 2010 to July 1, 2012	5.7%	4.3%
Population, 2010	61,272	672,591
Persons under 5 years, percent, 2018	6.6%	7.2%
Persons under 18 years, percent, 2018	21.5%	23.5%
Persons 65 years and over, percent, 2018	16.3%	15.3%
Female persons, percent, 2018	50.6%	48.8%

Sources: ND Department of Commerce and US Census Bureau – QuickFacts

North Dakota Census Estimates Show Statewide Population Growth:
North Dakota Communities, Counties Ranked Among Nation's Fastest Growing

Excerpt from ND Dept. of Commerce News Release March 27, 2014:

The U.S. Census Bureau today released the agency's annual metropolitan/micropolitan area and county population estimates showing population growth across all regions of North Dakota. The state had a number of communities and counties ranked as some of the fastest growing in the nation. A metro area contains a population of 50,000 or more, while a micro area contains at least 10,000, but less than 50,000…….

..... Of the nation's 10 fastest growing metropolitan areas, Fargo and Bismarck ranked fourth and fifth respectively. The Fargo metro area (Cass and Clay Counties) gained 6,075 residents, while the Bismarck metro area gained 3,528 residents. Three of the top five micro areas ranked as the nation's fastest growing are in North Dakota, with Williston taking the top spot. Dickinson ranked second on the list and Minot rounded off the top five as the fifth fastest growing micro area……

……..The population data is a breakdown from the Census Bureau's state and national population estimates released in December 2013. The Census Bureau reported that North Dakota's population has reached 723,393 residents, an all-time high.

Demographics

PEOPLE	**Bismarck**	**North Dakota**
White alone, percent, 2018 (a)	90.8%	87.0%
Black or African American alone, percent, 2018 (a)	2.1%	3.4%
American Indian and Alaska Native alone, percent, 2018 (a)	3.8%	5.5%
Asian alone, percent, 2018 (a)	0.9%	1.8%
Native Hawaiian and Other Pacific Islander alone, percent, 2018 (a)	0.1%	0.1%
Two or More Races, percent, 2018	2.0%	2.2%
Hispanic or Latino, percent, 2018 (b)	2.3%	3.9%
White alone, not Hispanic or Latino, percent, 2018	89.0%	84.0%
Living in same house 1 year & over, percent, 2008-2012	82.8%	82.9%
Foreign born persons, percent, 2013-2017	2.7%	3.6%
Language other than English spoken at home, pct age 5+, 2008-2012	4.9%	5.6%
High school graduate or higher, percent of persons age 25+, 2008-2012	92.5%	90.5%
Bachelor's degree or higher, percent of persons age 25+, 2008-2012	33.5%	27.1%
Veterans, 2008-2012	4,934	54,782
Mean travel time to work (minutes), workers age 16+, 2008-2012	17.4	16.5
Housing units, 2010	28,648	317,498
Homeownership rate, 2008-2012	66.3%	66.4%
Housing units in multi-unit structures, percent, 2008-2012	36.0%	25.6%
Median value of owner-occupied housing units, 2008-2012	$156,900	$123,900
Households, 2013-2017	31,368	311,525
Persons per household, 2013-2017	2.18	2.31
Per capita money income in past 12 months (2012 dollars), 2018	$35,436	$34,256
Median household income, 2018	$61,477	$61,285
Persons below poverty level, percent, 2018	9.5%	10.7%

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Z: Value greater than zero but less than half unit of measure shown
Source: US Census Bureau - QuickFacts

Income

	North Dakota				Bismarck			
INCOME AND BENEFITS (IN 2012 INFLATION-ADJUSTED DOLLARS)	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Total households	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Less than $10,000	20,013	+/-971	7.1%	+/-0.3	1,678	+/-239	6.1%	+/-0.9
$10,000 to $14,999	15,556	+/-756	5.5%	+/-0.3	1,152	+/-208	4.2%	+/-0.8
$15,000 to $24,999	29,174	+/-855	10.3%	+/-0.3	2,821	+/-338	10.3%	+/-1.2
$25,000 to $34,999	31,639	+/-1,137	11.2%	+/-0.4	2,957	+/-310	10.8%	+/-1.1
$35,000 to $49,999	41,052	+/-1,098	14.5%	+/-0.4	4,313	+/-394	15.8%	+/-1.4
$50,000 to $74,999	54,586	+/-1,305	19.3%	+/-0.5	5,300	+/-444	19.4%	+/-1.6
$75,000 to $99,999	37,926	+/-897	13.4%	+/-0.3	3,721	+/-289	13.6%	+/-1.1
$100,000 to $149,999	34,652	+/-1,009	12.3%	+/-0.4	3,894	+/-352	14.3%	+/-1.3
$150,000 to $199,999	8,895	+/-496	3.1%	+/-0.2	858	+/-178	3.1%	+/-0.6
$200,000 or more	9,174	+/-477	3.2%	+/-0.2	612	+/-134	2.2%	+/-0.5
Median household income (dollars)	51,641	+/-609	(X)	(X)	53,186	+/-2,013	(X)	(X)
Mean household income (dollars)	67,426	+/-754	(X)	(X)	68,675	+/-3,171	(X)	(X)

An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
An '(X)' means that the estimate is not applicable or not available
Source: US Census Bureau - QuickFacts

Poverty Statistics

PEOPLE	Bismarck	North Dakota
Households, 2013-2017	31,368	311,525
Persons per household, 2013-2017	2.18	2.31
Per capita money income in past 12 months 2018	$35,436	$34,256
Median household income, 2018	$61,477	$61,285
Persons below poverty level, percent, 2018	9.5%	10.7%

Source: US Census Bureau - QuickFacts

Housing Statistics

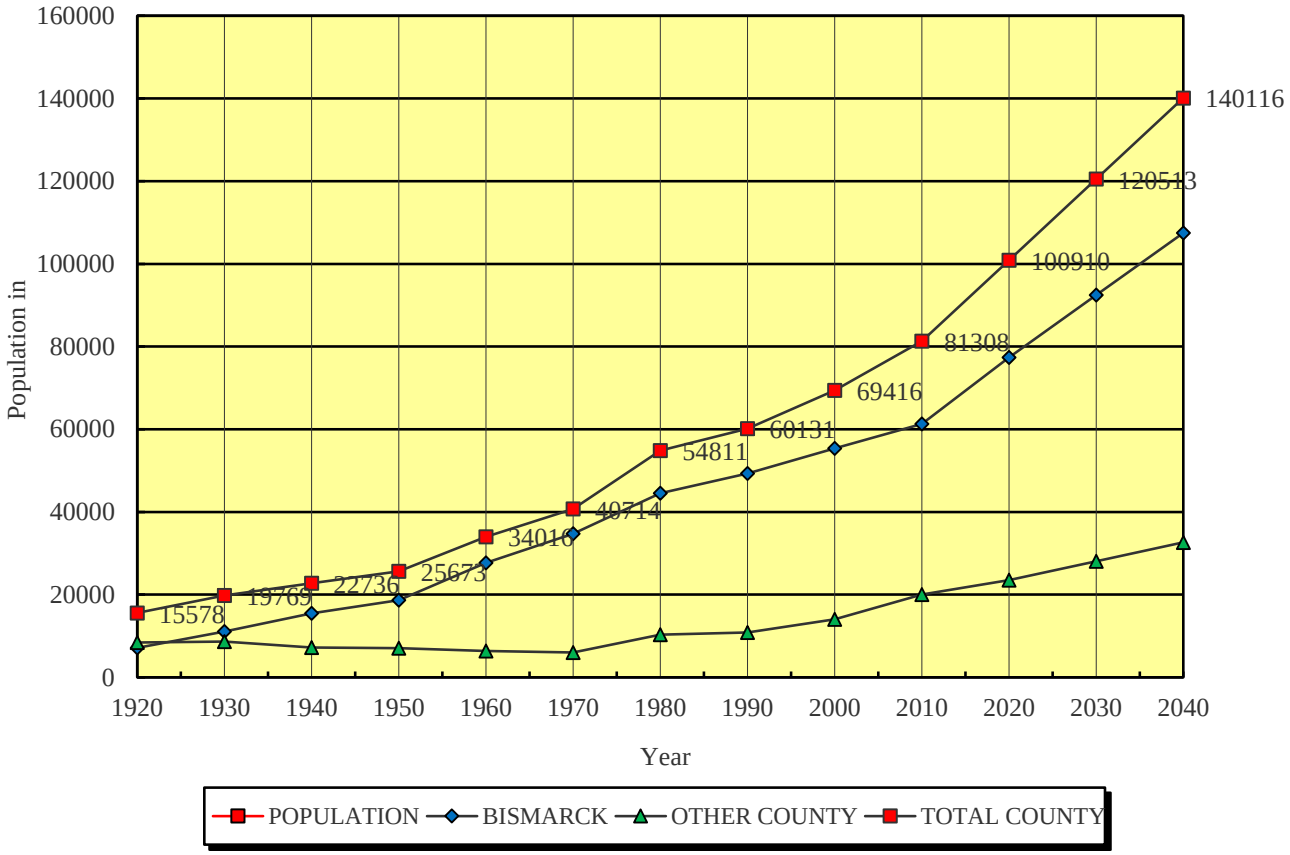
PEOPLE	Bismarck	North Dakota
Living in same house 1 year & over, percent, 2008-2012	82.8%	82.9%
Foreign born persons, percent, 2008-2012	1.4%	2.5%
Language other than English spoken at home, pct age 5+, 2008-2012	5.1%	5.2%
High school graduate or higher, percent of persons age 25+, 2018	92.3%	93.1%
Bachelor's degree or higher, percent of persons age 25+, 2018	28.9%	35.5%
Veterans, 2008-2012	4,934	54,782
Mean travel time to work (minutes), workers age 16+, 2008-2012	17.4	16.5
Housing units, 2010	28,648	317,498
Homeownership rate, 2008-2012	66.3%	66.4%
Housing units in multi-unit structures, percent, 2008-2012	36.0%	25.6%
Median value of owner-occupied housing units, 2008-2012	$156,900	$123,900
Households, 2013-2017	31,368	311,525
Persons per household, 2013-2017	2.18	2.31
Per capita money income in past 12 months (2012 dollars), 2018	$35,436	$34,256
Median household income, 2018	$61,477	$61,285
Persons below poverty level, percent, 2018	9.5%	10.7%

Source: US Census Bureau - QuickFacts

	North Dakota				Bismarck			
HOUSE HEATING FUEL	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Occupied housing units	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Utility gas	117,512	+/-1,070	41.6%	+/-0.4	19,999	+/-500	73.2%	+/-1.7
Bottled, tank, or LP gas	38,588	+/-731	13.7%	+/-0.2	439	+/-127	1.6%	+/-0.5
Electricity	104,733	+/-1,221	37.1%	+/-0.4	6,233	+/-462	22.8%	+/-1.6
Fuel oil, kerosene, etc.	12,952	+/-450	4.6%	+/-0.2	111	+/-81	0.4%	+/-0.3
Coal or coke	1,044	+/-174	0.4%	+/-0.1	38	+/-46	0.1%	+/-0.2
Wood	1,696	+/-154	0.6%	+/-0.1	0	+/-20	0.0%	+/-0.1
Solar energy	54	+/-48	0.0%	+/-0.1	0	+/-20	0.0%	+/-0.1
Other fuel	3,896	+/-395	1.4%	+/-0.1	188	+/-85	0.7%	+/-0.3
No fuel used	2,192	+/-266	0.8%	+/-0.1	298	+/-103	1.1%	+/-0.4
SELECTED CHARACTERISTICS								
Occupied housing units	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Lacking complete plumbing facilities	754	+/-151	0.3%	+/-0.1	85	+/-57	0.3%	+/-0.2
Lacking complete kitchen facilities	1,839	+/-288	0.7%	+/-0.1	262	+/-101	1.0%	+/-0.4
No telephone service available	5,410	+/-455	1.9%	+/-0.2	663	+/-164	2.4%	+/-0.6

An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
An '(X)' means that the estimate is not applicable or not available
Source: U.S. Census Bureau - American FactFinder

BISMARCK-BURLEIGH COUNTY
ACTUAL & PROJECTED POPULATION 1920-2040



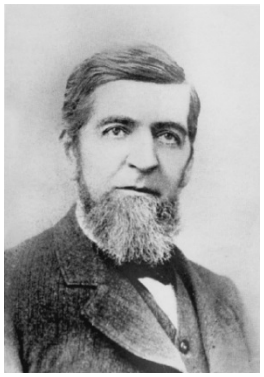
Actual: Projected:

	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020	2030	2040
POPULATION													
BISMARCK	7122	11090	15496	18640	27670	34703	44485	49272	55392	61272	77397	92434	107469
OTHER COUNTY	8456	8679	7240	7033	6346	6011	10326	10859	14024	20036	23513	28079	32647
TOTAL COUNTY	15578	19769	22736	25673	34016	40714	54811	60131	69416	81308	100910	120513	140116
10 YEAR INCREASE													
BISMARCK	--	3968	4406	3144	9030	7033	9782	4787	6120	5880	16125	15037	15035
TOTAL COUNTY	--	4191	2967	2937	8343	6698	14097	5320	9285	11892	19602	19603	19603
AVG ANNUAL % INCREASE													
BISMARCK	--	5.6%	4.0%	2.0%	4.8%	2.5%	2.8%	1.1%	1.2%	1.1%	2.6%	1.9%	1.6%
TOTAL COUNTY	--	2.7%	1.5%	1.3%	3.3%	2.0%	3.5%	1.0%	1.5%	1.7%	2.4%	1.9%	1.6%

Sources: U.S. Census Bureau and Community Development Department
('85 Sp. Census: 47,572)



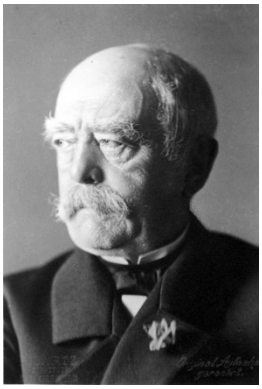
History



Dr. Walter Burleigh

Reaching the Missouri River in 1872, the Northern Pacific Railroad decided to locate its terminus at what was then known as "The Crossing on the Missouri." Called Burleigh Town, a small village two miles south of present Bismarck was established by Dr. Walter Burleigh who was a railroad contractor and speculator in charge of surveyors for the Lake Superior and Puget Sound Company (a firm working for Northern Pacific). This company also established Camp Greeley, named after Horace Greeley, a famous newspaper publisher. In 1872, the Ida Stockdale steamed up the Missouri and brought the first troops to this site, chosen as a military supply depot. The camp was later renamed Camp Hancock after General W. S. Hancock arrived to protect the railroad crew.

At the time of its birth in 1872, Bismarck was the only town west of Fargo, in the midst of Indian Territory. On May 14, 1872 a town site was staked out and christened Edwinton in honor of Edwin Ferry Johnson of Vermont, civil engineer for the Northern Pacific Railway. He was the first to urge the building of a transcontinental railroad. It was before the first locomotive reached Edwinton in 1873 that Henry Villard, Secretary of Northern Pacific, drew a large map of the town site – owing to the German immigrants, moving into the territory. It is situated on the east bank of the Missouri River at the point reached in 1873 by the westward construction of the Northern Pacific Railroad.



Prince Baron Otto Eduard Leopold von Bismarck-Schoenhausen

By February 16, 1873, the post office of Edwinton was established. On July 17, 1873, Bismarck was named in honor of Germany's "Iron Chancellor" Prince Baron Otto Eduard Leopold von Bismarck-Schoenhausen, a famous German statesman from Prussia, credited with the creation of the German Empire and serving as its first chancellor. At this time the railroad was in a financial bind and having trouble attracting investors. The name was given to encourage German capital in the railroad's transcontinental construction program. The map of Bismarck was shown throughout Europe in hopes that the princely statesman would dig deeply into his wallet to get the small metropolis bearing his name on its feet. Bismarck did acknowledge his fledgling namesake with a heartfelt thank you note, but the fervently hoped for Reichsmarks did not materialize. Bismarck's name stayed that way.

In 1876 the Battle of the Little Big Horn put Bismarck on the world map. In 1877 the Sheridan House was built to house railroaders. Also in March of 1877, Bismarck was hit with its first major fire in the business district.

Following the arrival of the railroad, Bismarck quickly became a center of trade and transportation. Steamboat business developed and flourished for a time on the Missouri and Bismarck became a port as well as a railroad terminus until the railroad bridged the Missouri in 1883. Gold discoveries in the Black Hills made Bismarck a freight-shipping center, and long wagon trains pulled by oxen traversed the 300 mile "Custer Route" to the Black Hills.

In 1883, Bismarck became the Capital of the Dakota Territory. Six years later, when the Territory divided into two states, Bismarck became the capital of North Dakota. Since then Bismarck has developed into a major business, financial and cultural center with its retail trade area reaching over 100 miles and serving upwards of 200,000 people, also our wholesale trade services about 350,000 in western North Dakota as well as South Dakota and eastern Montana.

North Dakota's state historic sites are well developed with interpreters, visitor centers with exhibits, furnished buildings, picnic areas, and other amenities. Others lie obscurely in pastures without a monument or fencepost to mark their existence. A few sites are currently closed to visitors because of lack of accessibility, concerns about preservation, or out of respect for American Indians who hold some of these places sacred. An upsurge in heritage tourism across the country has created renewed interest in the history of the northern plains, and North Dakota has many sites of significance. The 56 historic sites are owned by the state and are preserved, maintained, and interpreted by the State Historical Society of North Dakota. The following sites are located in Bismarck.

Sources: City of Bismarck, State Historical Society of North Dakota, and Bismarck Veterans Memorial Public Library

Former Governors' Mansion



The Former Governor's Mansion is located at 320 E. Ave. B in Bismarck; the site consists of a large two and one-half story, restored Victorian house and a carriage house. Constructed in 1884, it housed 20 chief executives between 1893 and 1960. Unique room exhibits feature the restoration process, architectural style changes, and furniture used by several governors.

This house was the North Dakota governors' residence from 1893 to 1960. It was built in 1884 as a private residence by Asa Fisher. At various times he was a wholesale liquor dealer, register of the Bismarck Land Office, and president of the First National Bank. He sold this house to the state for $5,000 in 1893.

Source: State Historical Society of North Dakota

Camp Hancock



This site preserves part of a military installation established as Camp Greeley in 1872 to provide protection for work gangs then building the Northern Pacific Railroad. A log headquarters building still stands on the site; it has been enlarged and remodeled several times, and the logs have been concealed by clapboard siding.

Source: State Historical Society of North Dakota

Steamboat Warehouse



Steamboat Warehouse Historic Marker is located on the east bank of the Missouri River in Bismarck across the street from the water treatment plant on River Road (Hwy 1804). The marker commemorates the Northern Pacific Railroad warehouse built to store goods in transshipment between steamboats and freight trains. It was constructed in 1883 and torn down in 1925.

Source: State Historical Society of North Dakota

North Dakota Heritage Center and State Museum



Heritage Center & State Museum is located on the State Capital grounds off Exit 159 on I-94 in Bismarck, the North Dakota Heritage Center is the headquarters of the State Historical Society of North Dakota and the largest museum in the state. The North Dakota Heritage Center, an enduring monument to North Dakota's past, has been constructed on the Capitol Grounds, including a main gallery with approximately 22,000 feet of exhibit space. It is much more than a museum; it houses collections of the historical society and is an educational center as well. Opened in 1981, it features temporary and permanent exhibits that explore the story of life on the northern plains from prehistory to the present.

Sources: City of Bismarck and State Historical Society of North Dakota

Education

School facilities in Bismarck include a four-year university, a two-year state college with a vocational technical center, 16 grade schools, 5 middle schools, 5 senior high schools, an alternative high school, a Career Academy and Technical Center, and an early childhood program, four parochial grade schools, learning centers, special educational, two commercial colleges, school of medicine, beauty shops, dance studios, school for the handicapped. A non-denominational academy operated by the 7th Day Adventist Church, a Priory and a Conservatory of Music.

The colleges located in Bismarck are the University of Mary, Bismarck State College, and United Tribes Technical College:

- University of Mary serves the needs of adult learners, providing four-year degrees (over 50 different bachelor's degrees) as well as graduate degrees.
- Bismarck State College, a comprehensive community college, is the fourth largest college in North Dakota. BSC offers a wide range of educational services through its threefold mission – to provide academic transfer programs, vocational-technical programs, and community services.
- Located on a 105-acre campus is the United Tribes Technical College. UTTC provides educational services to families. A grade school is located on the campus for the students' children.

Source: City of Bismarck

Recreation

The capital city is home to Bismarck Parks and Recreation District (BPRD), a forward-thinking political subdivision. BPRD is governed by five publicly elected park commissioners. BPRD owns and manages over 3,400 acres of park land and creates programs and places for citizens to enjoy a diverse listing of recreation opportunities throughout the year. BPRD has partnerships with over 250 organizations that provide recreation and programs in or on BPRD facilities, too. Additionally, BPRD manages selected Burleigh County parks and boat ramps.

Some of BPRD's facilities include: three outdoor pools and golf courses, four indoor tennis courts, the World War Memorial Building, five campgrounds, 10 youth baseball fields, over 25 youth soccer fields, over 50 outdoor picnic shelters and playgrounds, Capital Racquet & Fitness Center , the BSC Aquatic & Wellness Center, nine boat ramps, 21 outdoor tennis courts, 19 sand volleyball courts, 13 outdoor skating rinks, High Prairie Arts & Science Complex, McDowell Dam Recreation Area, two baseball fields, skate parks, disc golf courses, cross country skiing locations and over 60 parks.



BPRD's vision is: Be the leader and premier provider of public parks, programs, facilities and leisure services. The BPRD mission: Work with the community to provide residents and visitors the highest quality park, program, facility and event experience. Core purpose: Provide affordable, accessible, and sustainable public park and recreation services. BPRD's core values are accountability, collaboration, community, diversity, integrity and professionalism. BPRD's vision, mission, core purpose and core values are the foundation for a comprehensive and inclusive municipal parks and recreation system.

Source: Bismarck Parks and Recreation District

Missouri River

Dotted with sandbars and lined by gentle river bluffs, this broad, swift waterway commands respect from numerous standpoints. Its historical, recreational, and natural values within the state are unparalleled. The Missouri River ranks as North Dakota's most prominent river. The famed Lewis and Clark expedition, commissioned by President Thomas Jefferson, came through what is now North Dakota in the fall and winter of 1804-05 and the spring of 1806. The Missouri River corridor eventually became a hub for the state's development and growth. Fur trading, steam-boating, and military relics can still be found on the river's banks. Unique and rare flora and fauna inhabit the river and surrounding land. Four federally threatened or endangered species make the river their home: bald eagle, least tern, piping plover and pallid sturgeon. The river bottom forests provide one of the biggest expanses of woodland in the state. Many wildlife species use this corridor for food, shelter, water and as a migration route.

Source: North Dakota Parks and Recreation Department

Sertoma Park

Sertoma Park offers picnic shelters, walking trails, playgrounds, an amusement park and a miniature golf course. The Dakota Zoo is located inside the park.

Source: City of Bismarck

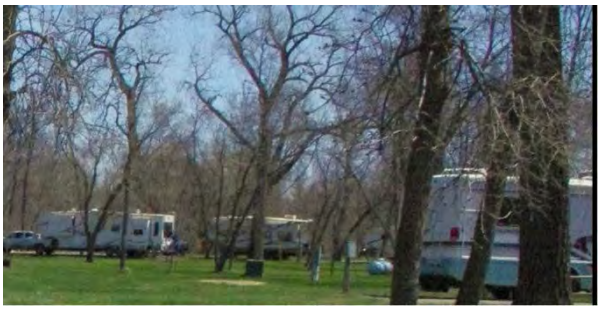


Sibley Park

General Sibley Park is located on South Washington Street four miles south of the Bismarck Expressway.

The park includes camping sites for tents and campers with electrical hook-ups. There are also full service restrooms, picnic shelters, playgrounds, 24-hole disc golf course and a boat ramp.

Source: Bismarck Parks and Recreation District



McDowell Dam Recreation



McDowell Dam Recreation Area is a 271 acre park located five miles east of Bismarck on Old Highway 10 and one mile north. The park is owned by the Burleigh County Water Resource District and managed by the Bismarck Parks and Recreation District. Available activities include swimming, boating, fishing and paddle boating. There is a public beach, picnic shelters that are available (and can be reserved for special occasions), horseshoe pits, a small concessions area, a playground and modern restrooms. There is a paved recreational trail on the grounds, as well as a wooded area for nature walks or runs. There is also a Nature Trail encircling the banks of McDowell Dam.

Source: Bismarck Parks and Recreation District

Dakota Zoo

On June 3, 1961, the Dakota Zoo opened its gates to the public with 75 mammals and 23 birds on some 15 acres of developed land. Forty thousand visitors paid a ten cent admission fee that first year to visit the zoo. Today an average of over 100,000 people walk through the gates each year and view 125 species of birds, reptiles, insects and mammals. Memberships today total approximately 3400.



In 1987, the Dakota Zoo was challenged by the Bismarck Tribune to develop a master plan which would outline the orderly and organized development of the zoo. This challenge was accepted by the zoo board and a plan was developed. The master plan is reviewed and update on an ongoing basis, with the last major revision taking place in 2005. The master plan serves as a "roadmap" of where the Dakota Zoo is going in the future.

In 1988, the Beyond the Bear Necessities capital campaign began. This campaign, Dakota Zoo's first ever attempt to raise large sums of money, raised $1.2 million. Exhibits such as the bear habitat, river otter exhibit and canine and small animal exhibits are some of the fruits of this campaign.



In late 1996, the second major capital campaign, Discovery 2000 - Turning Dollars Into Senses was launched. The goal of this campaign was to raise at least $1.5 million for continued major improvements. Exhibits constructed to date that are the results of this endeavor include moose, mountain goat, mountain lion, bobcat, lynx and the Discovery Zoo.

In 2005, the third major capital campaign, Make the Big Cats Roar, was launched. The celebration goal of just over $1.9 million was reached by the fall of 2005. An extended challenge goal of $2.3 million is currently in the works, with over $2.1 million pledged by March 2007.

Source: Dakota Zoo

Conclusion

As a result of community growth, the vulnerability to hazards and potential for impact may be considered to be somewhat elevated compared to previous years. Therefore, the importance of mitigation, public education, and communication (including foreign language communications) becomes elevated as well. However, community changes and growth have not required significant updates to the hazard profiles as it relates to the identification of risk, vulnerability, and potential impact and has not required modifications to overall ranking of hazards identified.

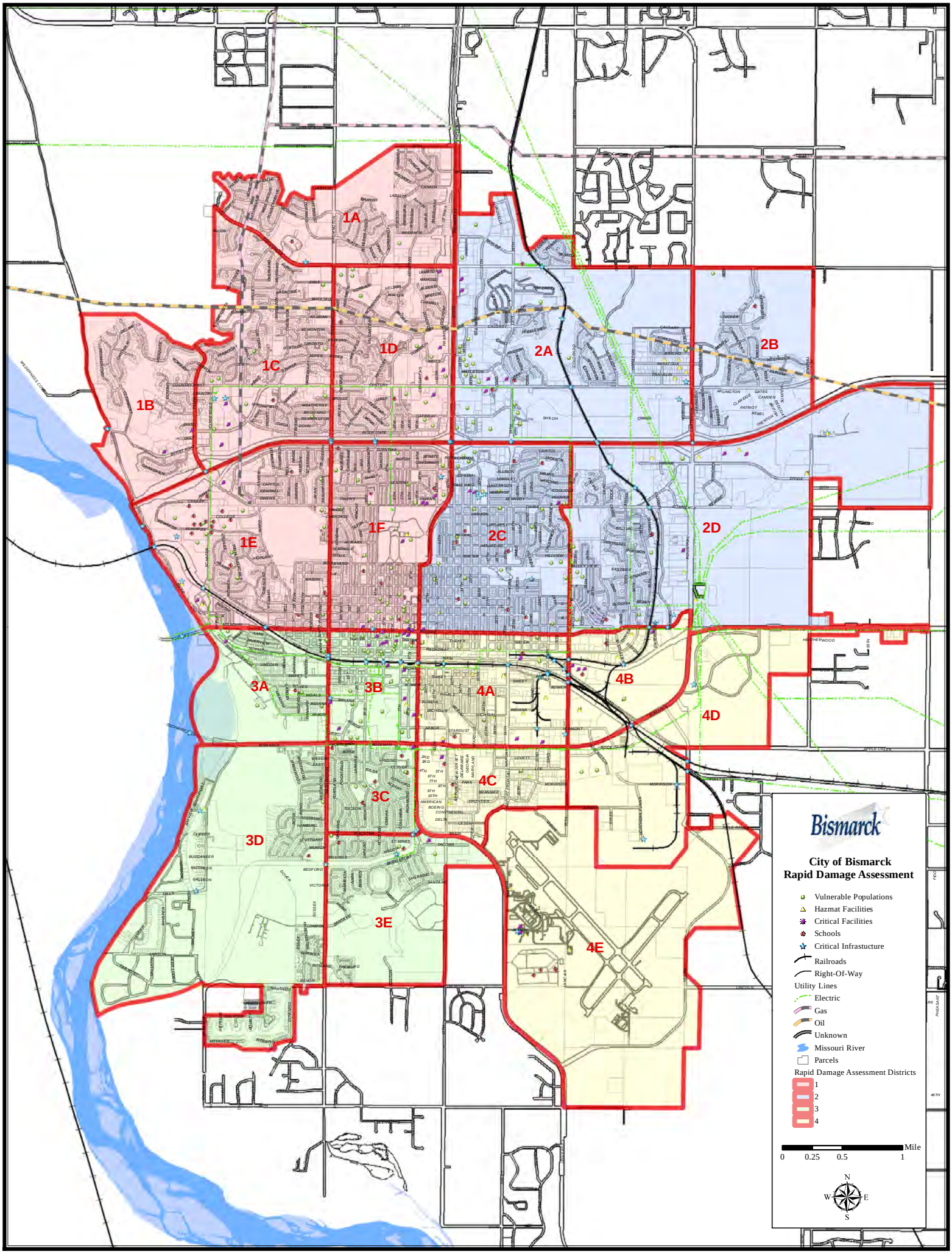
Community Assets

Community Assets are identified for planning purposes, to assist in the identification of potential impacts and vulnerabilities within the various hazard profiles. Community Assets are also identified within the various hazard profiles where applicable. This section provides an overview of community assets to aid in hazard profile development and updating.

Community Asset Categories and category descriptions:

- Critical Facility
  - A facility that provides a critical service or product that is vital to the community for continuity of emergency services, critical government services, medical services, and critical supplies.
- Critical Infrastructure
  - Transportation infrastructure and utility infrastructure:
    - gas, electricity, communications, sewer and water.
- Schools
  - All schools: from licensed daycare to college and private schools.
- Hazardous Materials Sites
  - Hazards Materials Sites contain chemical, biological, or other substances. If a hazardous materials facility is impacted, there may be an additional threat to the community because of the potential for a release.
- Vulnerable / Special Populations
  - Includes areas of "assembly" where a facility or site is likely to have a "high density" population within a relatively small area. Schools are not included, as they are a separate category.
  - Includes populations that may require special assistance during response and recovery efforts. Examples are jail/prison populations, nursing homes, assisted living, etc.

The map on the following page identifies the various community assets as noted above. The map is maintained by Bismarck Emergency Management and Bismarck GIS.


1A
1B
1C
1D
1E
1F
2A
2B
2C
2D
3A
3B
3C
3D
3E
4A
4B
4C
4D
4E
Bismarck
City of Bismarck
Rapid Damage Assessment
Vulnerable Populations
Hazmat Facilities
Critical Facilities
Schools
Critical Infrastucture
Railroads
Right-Of-Way
Utility Lines
Electric
Gas
Oil
Unknown
Missouri River
Parcels
Rapid Damage Assessment Districts
1
2
3
4
Mile
0
0.25
0.5
1
N
W
E
S

Critical Facilities

Emergency Services	
Bismarck Police Department	700 S 9th St
Police - Special Operations	2424 E. Divide Ave
CenCom & Emergency Operations Center	4200 Coleman St.
Fire Station 1 - Headquarters	1020 E Central Av
Fire Station 2 - South	835 E Bismarck
Fire Station 3 - Northwest	2340 Tyler Py
Fire Station 4 - Northeast	4103 Miriam Dr.
Fire Station 5 - North	4227 Lockport St
Metro Area Ambulance North	2940 N 19th St
Metro Area Ambulance South	1139 Memorial Hy
Metro Area Ambulance – East Station	2735 E Broadway Avenue
ND DES	35 Fraine Barracks Rd
Red Cross	1720 Burnt Boat Dr. Suites 102 & 107
Salvation Army	601 S Washington St
Medical/Health	
CHI St. Alexius Health	900 E Broadway Av
Sanford Health Center	300 N 7th St
BioLife Plasma	1800 Burnt Boat Dr
Family Practice Center UND	701 E Rosser Av
Horizon Clinic	4535 Northern Sky Drive
Medical Arts Building	810 E Rosser Av
Mid Dakota Clinic	2700 State St
Mid Dakota Clinic	401 N 9th St
MRI Center	720 E Rosser Av
ND Dept of Health – Emergency Prep	1720 Burlington Dr
ND Department Of Health Lab	2635 E Main Av
ND Dept of Health Warehouse	1200 Industrial Dr, 2
ND State Lab	2641 E Main Av
Q & R Clinic	222 N 7th St
Sanford Clinic - North	3318 N 14th St
Sanford Clinic - South	1040 Tacoma Av
Sanford Clinic-7th and Broadway	715 East Broadway Ave.
Sanford Health Powerhouse	310 N 8th St
Sanford Health Warehouse	1112 S 12th St
CHI St. Alexius Purchasing / Warehouse	1300 Industrial Dr
Vitalent (formerly United Blood Service)	517 S 7th St
Utility & Communications	
Central Power Electric Cooperative	4111 State St
Century Link	220 North 5th St.
DCN – Dakota Carrier Network	4202 Coleman Street
KXMB TV	1811 N 15th St.
MDU	909 Airport Rd
MDU Resources	1200 W Century
Prairie Public Radio	1814 N 15th St.
Williston Basin Office Building	1250 W Century Av
Transportation	
Bismarck Airport	2301 University Dr Unit 17
Bismarck Public School Facilities & Transportation	705 S 9th St
DMVW RR	3501 E Rosser Av
Government	
ND State Capitol	600 E Boulevard Av
State Penitentiary	3303 E Main Av
Air Guard	3410 Airway Av
Bismarck Event Center	315 S 5th St
Bismarck Transition Center	2001 Lee Av
Burleigh County Courthouse	514 E Thayer Av
Burleigh County Highway Department	2000 N 52nd St
Burleigh County Social Services	316 N 5th St
City / County Office Building	221 N 5th St
Federal Aviation Agency	2000 University Dr
Federal Building (old)	304 E Broadway Av
Job Service ND	1000 E Divide Av
Job Service ND	1601 E Century Av
Liberty Memorial Library	608 E Boulevard Av
National Guard - Fraine Barracks	432 Fraine Barracks Rd
National Guard Hazmat Building	4250 E Divide Av
National Weather Service	2301 University Dr
ND Department Of Transportation	608 E Boulevard Av
ND Department Of Transportation	218 Airport Rd
ND Information Technology Dept	4201 Normandy St
ND National Guard USPFO	4100 E Divide Av
ND State Forensics	2637 E Main Av
ND State Highway Department	608 E Boulevard Av
ND State Water Commission	608 E Boulevard Av
Post Office	220 E Rosser Av
Public Health - Bismarck/Burleigh	500 E Front Av
Public Works Department	601 S 26th St
US Postal Processing & Distribution	2220 E Bismarck Ex
Workforce Safety & Insurance	1600 E Century Av
Food	
Cash Wise Foods	1144 E Bismarck Expressway
Cash Wise Foods	900 43rd Ave NE
Dan's Supermarket - Arrowhead	1122 N 3rd St
Dan's Supermarket - North	3101 N 11th St

Dan's Supermarket - Northeast	4227 Saratoga Av
Dan's Supermarket - South	835 S Washington St
Dan's Supermarket - Turnpike	1190 W Turnpike Av
Commercial	
Bismarck Lumber	2200 E Main Av
Lowe's Home Improvement	1401 W Century Av
Menard's	3300 State St

Critical Infrastructure

Emergency Services	
CenCom	4200 Coleman St.
Communications	
CellularTower	2301 University Dr
CellularTower	East of 1925 N 11th St
CellularTower	North of 1810 N 16th St
CellularTower	West Of 2301 University Dr
CellularTower	Southwest of 2501 210th St
CellularTower	Southwest of 5650 ND 36 HY
CellularTower	East of 29850 15 St NW
CellularTower	East of 5351 340th St NE
Clear Channel Radio - KFYR/Y93	3500 E Rosser Av
Warning	
Sirens - Outdoor Warning: 20+4 Bismarck/Burleigh	Various Locations -
Government	
Public Works - Landfill	2111 52nd St NE
Utility	
MDU Substation	976 W Turnpike Ave
MDU Substation Ash Coulee	1501 Ash Coulee Drive
MDU Substation Downtown	402 East Sweet Ave
MDU Substation on Century	164 East Independence Ave
MDU Substation on Clydesdale	2819 Clydesdale Dr.
Powerline at Missouri River	
16th Street Substation	16th Street and Front Avenue
26th & D Substation	26th Street and East Avenue D
26th & Expressway Substation	26th Street and Expressway
4th and Front Substation	Front Avenue Between 3rd and 5th Streets
9th Street Substation	East Wachter Avenue and Tacoma Avenue
Bismarck Water Plant Substation	River Road
Central Power Electric Cooperative	4111 State St N
Capital Substation	Divide Avenue and 6th Street
Century Avenue Substation	Century Avenue and Independence Avenue
East Bismarck Junction Substation	Corner Of East Bismarck Expressway and Hwy 10
Kirkwood Substation	South 7th Street and Arbor Avenue
MDU Operations	400 N 4th St
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd
Montana-Dakota Utilities GO Generator	400 N 4th St
NE Bismarck Switching Substation	Shiloh Drive
Northwest Junction Substation	2819 Clydesdale Drive / Country West Road
Steins Substation	26th Street and Grant Drive
Sunrise Substation	Centennial Road and 43rd Avenue NE
Turnpike Substation	Turnpike Avenue and Grimsrud Avenue
WBI Energy - Natural Gas Pipeline Station	850 NW 57th Avenue
Western Area Power	707 N Bismarck
Western Area Power Administration - Bismarck Substation	719 N Bismarck Expressway
Western Area Power Administration - Bismarck Warehouse	700 N Bismarck Expressway
Western Area Power Administration - Ward Delivery*	7200 Sonora Way
Water/Wastewater	
Water Treatment Plant	615 River Rd
Wastewater Treatment Plant	601 W London Av
Sanitary Sewer Pump Station	100 E Indiana Av
Sanitary Sewer Pump Station	3701 E Bismarck Ex
Sanitary Sewer Pump Station	810 S 26th St
Sanitary Sewer Pump Station	2516 River Rd
Sanitary Sewer Pump Station	850 E Wachter Av
Water Reservior	1602 E Divide Av
Water Reservoir	1103 River Rd
Water Reservoir	1602 E Divide Av
Water Reservoir	2500 Centennial Rd
Water Reservoir	2801 Clydesdale Dr
Water Reservoir	2220 E F Av
Water Tower	2801 Clydesdale Dr
Water Tower	440 Ash Coulee Dr
Transportation	
Northern Plains Commerce Center	1300 Northern Plains Dr
Bis-Man Transit	3750 E Rosser Av
Harlows School Bus Service	3800 E Century Av
Taxi 9000	3750 E Rosser Av
Bridge: 19th St over I-94	19th St Over I-94
Bridge: 3rd St over drainage ditch	Southeast Of 1922 S 3rd St
Bridge: Bismarck Ex over I-94	Bismarck Expressway Over I-94
Bridge: Bismarck Ex over Missouri River	Bismarck Expressway Bridge Over Missouri River
Bridge: Bismarck Ex over Railroad	West Of 3310 E Bismarck Ex

Critical Infrastructure Cont'd

Bridge: east bound I-94 over Railroad	I-94 Over Railroad
Bridge: I-94 east bound over 4th St	I-94 Over 4th St
Bridge: I-94 east bound over Washington St	I-94 Over Washington St
Bridge: I-94 west bound over 4th st	I-94 Over 4th St
Bridge: I-94 west bound over Washington St	I-94 Over Washington St
Bridge: Main Av over Missouri River	West Of 100 Riverside Park Rd
Bridge: Main Av over Washington St	West Of 311 W Main Av
Bridge: Railroad over 7th St	Southwest Of 705 E Main Av
Bridge: Railroad over 9th St	Southwest Of 901 E Main Av
Bridge: Railroad over Hay Creek	West Of 3727 Pebbleview Lp
Bridge: Railroad over Main Av	South Of 906 Missouri Av
Bridge: Railroad over River Rd and Missouri River	North Of 1103 River Rd
Bridge: Railroad over Washington St	Northwest Of 260 W Front Av
Bridge: Riverwood Dr	2300 Riverwood Dr
Bridge: Rosser Av Over Hay Creek	North Of 3605 E Rosser Av
Bridge: Southport Lp	1500 Southport Lp
Bridge: State St over I-94	State Street Over I-94
Bridge: State St over I-94	State Street Over I-94
Bridge: Tyler Py over I-94	Tyler Py Over I-94
Bridge: Wachter over Drainage Ditch	800 Wachter Av E
Bridge: Washington over Drainage Ditch	2201 Washington St
Bridge: West Bound I-94 over Railroad	I-94 Over Railroad
Grant Marsh Bridge Boat Ramp	North Of 1103 River Rd
Railroad Crossing at 12th St	Southeast Of 1131 E Main Av
Railroad Crossing at 24th St	NW Of 2400 E Front Av
Railroad Crossing at 24th St	West Of 2407 Railroad Av
Railroad Crossing at 24th St N	SE Of 2321 E Broadway Av
Railroad Crossing at 26th St	East Of 114 N 26th St
Railroad Crossing at 26th St	SE Of 210 S 26th St
Railroad Crossing at 26th St	Southwest Of 207 S 26th St
Railroad Crossing at 3rd St	Southwest Of 1003 S 3rd St
Railroad Crossing at 43rd Av	South Of 2300 Pointe Lp
Railroad Crossing at 5th St	Southwest Of 113 S 5th St
Railroad Crossing at Airport Rd	Southeast Of 1833 E Main Av
Railroad Crossing at Century Av	East Of 2500 E Century Av
Railroad Crossing at Divide Av	SE Of 3500 Divide Av E
Railroad Crossing at Eastdale Dr	SW Of 109 Eastdale Dr
Railroad Crossing at Fraine Barracks	East Of 600 River Rd
Railroad Crossing at Front Av	East Of 2201 E Front Av
Railroad Crossing at Main Av	North Of 2409 E Main Av
Railroad Crossing at Morrison Av	3810 Morrison Av
Railroad Crossing at Railroad Av	SE Of 2516 Railroad Av
Railroad Crossing at Rosser Av	East Of 3422 E Rosser Av
Railroad Crossing at Vermont Av	NW Of 2220 Vermont Av
Railroad Crossing at Yegen Rd	East Of 1200 Yegen Rd
Railroad Crossing at Yegen Rd	SE Of 910 Yegen Rd
Railroad Over Hay Creek	East Of 3120 E Capitol Av
Railroad Over Hay Creek	SE Of 2920 E Capitol Av

Hazardous Materials Sites – 2020 Tier II Sites

Mandan	
Marathon (formerly Tesoro Refinery)	900 Old Red Trail NE
Bismarck	
Ameripride Services Inc	1238 Frontier Drive
AT&T - ND0410	1823 N 16th St
Bismarck Public Schools Facilities and Transportation	705 S 9th St
Bismarck Public Schools Legacy High School	3400 E Calgary Av
Bismarck Tribune, The	707 E Front Ave
Burleigh County Highway Dept Shop	8100 43rd Av NE
Burleigh County Sheriff's Dept - East	2000 N 52nd St
Capital Electric Cooperative	4111 State St N
Capital Electric Cooperative - Apple Creek Substation	3307 McCurry Way
Capital Electric Cooperative - Bismarck 71st Avenue	7130 Williamson Dr
Capital Electric Cooperative - Bismarck East Substation	701 N Bismarck Expwy
Capital Electric Cooperative - Circle K Substation	7016 Golden Crest Rd
Capital Electric Cooperative - Grandview Pines Substation	3963 Prairie Pines Lp
Capital Electric Cooperative - Horizon Substation	1501 Ash Coulee Dr
Capital Electric Cooperative - Lincoln Substation	4800 University Dr
Capital Electric Cooperative - South Washington Substation	4100 S Washington St
Capital Electric Cooperative - Ward Distribution Substation	6950 15th St NW
Capital Electric Cooperative - Ward Transmission Substation	1000 71st NW
Capital Electric Cooperative- Bismarck North Substation	2105 E Century Ave
Central Dakota Frontier Cooperative Bismarck	1505 Yegen Rd
CenturyLink (Qwest Corporation)	220 N 5th St
CHI St Alexius Health	900 E Broadway Av
CHI St Alexius Health Technology & Education Building	1310 E Main
City of Bismarck Public Works Department	601 S 26th St
City of Bismarck Public Works Department- Haycreek Lift Station	3701 E Bismarck Expwy
City of Bismarck Public Works- Municipal Landfill	2111 N 52nd St
City of Bismarck Public Works- Old Airport Lift Station	2301 University Dr #19
City of Bismarck Public Works- Pioneer Park Lift Station	2516 River Rd
City of Bismarck Public Works- Wastewater Treatment Plant	601 London Ave
City of Bismarck Public Works- Water Treatment Plant	615 River Rd
City of Bismarck Public Works- West End Pump Station	1701 Edwards Av
Coca-Cola Bottling Company High Country	3225 E Thayer Av
Cofells Plumbing & Heating Inc	1000 Industrial Dr
Dakota Carrier Network LLC (DCN)	4202 Coleman St
DAL Global Services	2301 University Dr
Dean Foods North Central (Land O'Lakes)	1207 E Main Ave
Doosan/Bobcat	521 S 22nd St
Executive Air Taxi Corp Fuel Farm	2301 University Dr
Ferrellgas Bismarck	2300 E Main Ave
GCCD Bismarck Terminal	1316 E Front Ave
General Services Administration Bismarck FB/CH/PO	220 East Rosser Ave.
Gerdau-Bismarck	1320 Airport Rd
HERC Rentals Bismarck 9452	3101 Morrison Ave
Holcim (US) Inc-Bismarck Terminal	714 E Front Ave
Holcim (US) Inc-NPCC Terminal	2103 Trade St
Hubbard Feeds	1503 Yegen Road
Jiffy Lube #519	1017 S Washington St
Knife River ND - Bismarck Rock Island Pl	3305 Rock Island Place
Lowe's of Bismarck, ND Store #2533	1402 Century Ave W
Mariner Construction	1771 W Cavalry Dr
Misty Waters Marina	5800 Burnt Creek Lp
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd
Montana-Dakota Utilities General Office Generator	400 N 4th St
National Weather Service	2301 University Dr Bldg 27
ND Department of Transportation Bismarck HQ	218 Airport Rd

Hazardous Materials Sites Cont'd

ND Department of Transportation-Capitol Ground	600 E Boulevard Av
ND National Guard - Army Aviation Support Facility	3410 Yegen Road
ND National Guard - Fraine Barracks	432 Fraine Barracks Rd
ND National Guard - Raymond J Bohn Armory	4200 Miriam Avenue
New Cingular Wireless PCS, LLC (Bismarck - ZX2GBF)	1925 N 11th St
Nutrien Ag Solutions	1240 Hemlock St
Praxair Distribution Inc Plant	2730 Vermont Ave
Safety-Kleen Systems Inc	3704 Saratoga Ave
Sam's Club #4933	2821 Rock Island Pl
Schwan's Home Service Inc 115300	3500 Miriam Ave
Sprint United Management Company	215 S 15th St
Stamart Travel Center #1224	3936 Miriam Ave
Strata Concrete	900 Yegen Rd
Supervalu Inc Bismarck	707 Airport Rd
Target T2194-Burleigh	600 Kirkwood Mall
Tri Energy Cooperative Broadway Store	2006 E Broadway Ave
United Parcel Service Inc	3814 Franklin Av
United Rentals	3925 Miriam Ave
US Foods	3500 Saratoga Ave
Verizon Wireless-Country West 698998	1160 W Divide Ave
Verizon Wireless-Expressway 4932311	911 S 9th St
Western Area Power Administration - Bismarck Substation	719 N Bismarck Expressway
Western Area Power Administration - Bismarck Warehouse	700 N Bismarck Expressway
Williston Basin Interstate - Bismarck Station	850 57th Ave NW
Zayo Group	1520 E Sweet Av

Schools

Elementary School	
Brentwood Elementary	9111 Wentworth Drive
Cathedral Elementary	508 Raymond St
Centennial Elementary	2800 Ithica Dr
Dorothy Moses Elementary	1312 Columbia Dr
Grimsrud Elementary	716 W St Benedict Dr
Highland Acres Elementary	1200 Prairie Dr
Jeanette Myhre Elementary	919 S 12th St
Liberty Elementary School	5400 Onyx Dr
Martin Luther Elementary/Daycare	413 E Av D
Northridge Elem.	1727 N 3rd St
Pioneer Elementary	1400 Braman Av
Rita Murphy Elementary	611 N 31st St
Robert Miller Elementary	1989 N 20th St
Roosevelt Elementary	613 W B Av
Shepherd of the Valley School	801 E Denver Av
Shiloh Christian School	1915 Shiloh Dr
South Central High School	406 S Anderson St
St. Anne's Elementary	1315 N 13th St
St. Mary's Elementary	807 E Thayer Av
Sunrise Elementary School	3800 Nickerson Av
United Tribes - Elementary School	3315 University Drive
United Tribes - Elementary School	3315 University Drive
Victor Solheim Elementary	325 Munich Dr
Will-Moore Elementary	400 E Av E
Middle School	
Horizon Middle School	500 Ash Coulee Dr
Simle Middle School	1215 19th
South Central Middle School	806 N Washington St
Wachter Middle School	1107 S 7th St
St. Mary's Academy	1025 N 2nd St.
High School	
Bismarck High School	723 N 7th St
Century High School	1000 E Century Av
Legacy High School	3400 E Calgary Av
St. Marys Central High School	58502 Ridgeland Drive
Daycare / Preschool	
After School & Summer Program	306 E Divide Av
Angel Academy	1617 Michigan Av
Ascension Church School	1911 S 3rd St
BECEP / Richholt	720 N 14th St
Child's Hope Learning Center	2921 19th
Discovery Daycare	1413 Sharloh Lp
Door of Hope	1996 Ne 43rd Av
ECLC	1901 Oakland Dr
ECLC	2727 N 4th St
ECLC	2330 E Divide Ave
Emanual Christian School	2101 E Broadway Av
Enrichment Center	1911 N 11th St
Exploring Minds	120 E Calgary Av
First Presbyterian Church- Daycare	214 E Thayer Av
First Steps Central	1824 N 11th St
First Steps Learning Center	1910 E Capitol Av
Kidz First Daycare	619 19th
KinderKidz Daycare	1413 Sharloh Lp
Lighthouse Learning Center	3838 Jericho Rd
Little Einsteins	3800 Nebraska Drive
Merry-Go-Round Daycare	1004 E Highland Acres Rd
Montessori Daycare	200 W Turnpike Av
Noah's Ark Daycare	1550 Wichita Dr
Open Door Community Center	1030 N 6th St.
Perfect Start	1001 Basin Ave
Preschool Program - House of Prayer	1470 S Washington St
Shepherd of the Valley Preschool	801 E Denver Av
Shiloh Christian Preschool	1915 Shiloh Dr
Super Kids Jr. Academy	1227 Park Av
The After School / Lori Sager	1030 N 6th St
United Tribes - Daycare	3315 University Drive
YMCA - C. Baptist Daycare	205 Colt Av
YMCA Daycare	1608 N Washington St
YMCA Youth Development Center North	1701 East Century Ave.
College	
BPS Career Academy	1221 College Dr
BSC Aquatic Center	1601 Canary Av
BSC Armory	1601 Edwards Av
BSC Gate City Bank Hall	1226 Edwards Ave
BSC Jack Science Center	1420 Schafer St
BSC Library	1511 Edwards Av
BSC Lloyd Ritchie Hall	1248 Edwards Ave
BSC Office Annex	1309 Schafer St
BSC Schafer Hall	1500 Edwards Av
BSC Student Union	1425 Schafer St
BSC Swenson Hall	1411 Schafer St
BSC Vo Tech Center	1200 College Dr
BSC Werner Hall	1600 Edwards Av
Sanford College of Nursing	512 N 7th St
United Tribes Technical College	3315 University Drive

Schools Cont'd

Other	
Ehrmantraut Academy	2215 E Main Av
Hair Academy	2101 E Broadway Av
ND Environmental Training Facility	2639 E Main Av
The Innovation School	613 N 3rd St.
Theo Art School	1810 Schafer St

Vulnerable / Special Populations

Hospital	
CHI St. Alexius Health	900 E Broadway Av
Sanford Health Center	300 N 7th St
Cancer Center	500 N 8th St
Nursing Homes	
Baptist Health Care Center	3400 Nebraska Dr
Crescent Manor	107 E Bowen Av
Edgewood Vista	3124 Colorado Ln
Horizon Care Home	3216 Daytona Dr
Marillac Manor	1016 N 28th St
Missouri Slope Lutheran Care	2425 Hillview Av
St. Gabriel's Care Center	4580 Coleman St
St. Vincents Care Center	1021 N 26th St
Touchmark Nursing Home	1000 W Century Av
Assisted Living	
Edgewood Vista	3406 Dominion St
Good Samaritan Senior Care	316 Versailles Av
Maple View (East)	2625 N 19th St
Maple View (North)	4217 Montreal St
Patterson Place	420 E Main Av
Primrose Assisted Living	1144 College Dr
The Terrace	901 E Bowen Av
Valley View Heights	2500 Valley View Av
Special Needs	
Bismarck Transition Center	2001 Lee Av
Custer Home	301 W Thayer Av
Dacotah Foundation	600 S 2nd St
Dakota Boys Ranch	1227 N 35th St
Diane's Hope House	315 W Indiana Av
Sunrise Apartments (formerly Grandma's House)	114 N 3rd St
Pride Heritage Alcohol & Drug Program	112 N 5th St
Ronald McDonald House	609 N 7th St
Ruth Meier's Horizons Apartment Building	305 N 23rd St
Ruth Meier's Hospitality House	1100 E Boulevard Av
United Way	1140 South 12th St
Mobile Homes	
Airport Village	1437 University Dr
Bismarck Mobile Home Park	2406 E Thayer Av
Capitol Park Village	1821 N 11th St
Century Centennial	2500 Centennial Rd
Century Park	4191 E Century Av
Colonial Estates	1501 E Bismarck Ex
Dakota Mobile Home Park	2520 E Broadway Av
Hay Creek Court	4005 Ne 19th St
Holiday Park	600 S 9th St
Mobile Homes - 18th Street & Thayer	1713 E Rosser Av
North Valley	4224 N 19th St
Parkview Estates	614 W Sweet Av
Skyway Park Village	1119 University Dr
Stardust Terrace	725 S 12th St
Tatley Meadows	2200 S Washington St
Public Assembly	
Belle Mehus City Auditorium	201 N 6th St
Bismarck Civic Center	315 S 5th St
BSC Leach Music Center	1414 Schafer St
BSC Lidstrom Hall	1221 College Dr
BSC National Energy Center of Excellence	1200 Schafer St
Dakota Stage Ltd	412 E Main Av
Grand Theater	1486 Interstate Lp
VFW Club	1326 E Broadway Av
Government	
ND State Capitol	600 E Boulevard Av
State Penitentiary	3303 E Main Av
Bank of North Dakota	1215 Memorial Hy
Bismarck Veteran's Memorial Library	515 N 5th St
Burleigh County Courthouse	514 E Thayer Av
Burleigh/Morton County Detention Center	4000 Apple Creek Road
ND Heritage Center	612 E Boulevard Av
ND Law Enforcement Training Academy	1320 Schafer St
Recreational	
All Seasons Arena	1200 N Washington St
Bismarck Community Bowl	1701 Canary Av
Elks Pool	321 W Broadway Av
Fore Seasons Center - Golf Dome	2525 19th
Hillside Pool	1719 E Boulevard Av
Schaumburg Ice Arena	221 E Reno Av
Snoopers - Tons of Fun	711 E Sweet Av
Wachter Aquatic Pool	205 E Reno Av
World War Memorial Building	215 N 6th St
YMCA	1608 N Washington St

Vulnerable / Special Populations Cont'd

Commercial	
Arrowhead Plaza	1122 N 3rd St
Front Street Plaza	200 E Front Av
Gateway Mall	2700 State St
Hay Creek Shops	1403 E Lassalle Dr
Kirkwood Mall	600 S 5th St
Kirkwood Office Tower	919 S 7th St
K-Mart	2625 State St
Mall	1440 Mapleton Av
Northbrook Mall	1929 N Washington St
Northdale Mall	1411 Mapleton Av
Pinehurst Square	1424 W Century Av
Sam's Club	2821 Rock Island Pl
Skyline Strip Mall	1401 Skyline Bl
Southridge Center	565 S 7th St
Walmart Supercenter - North	1400 Skyline Bl
Walmart Supercenter - South	2717 Rock Island Pl
Hotels	
Amercnn Lodge & Suites	3235 State St
Bestwestern Doublewood Inn	1400 Interchange Av
Bismarck Motor Hotel	2301 E Main Av
Budget Inn Express	122 E Thayer Av
Candlewood Suites	4403 Skyline Crossing
Comfort Inn/Mainstay Suites	1030 E Interstate Av
Comfort Suites	929 Gateway Av
Country Inn & Suites	3205 N 14th St
Courtyard by Marriott	3319 N 14th St
Days Inn	1300 E Capitol Av
Expressway Inn	200 E Bismarck
Expressway Suites	180 E Bismarck
Fairfield Inn - South	135 Ivy Av
Fairfield Marriot - North	1120 E Century Av
Hampton Inn	1440 Mapleton Av
Hampton Inn	2020 Schafer St
Holiday Inn	3001 N 15th St
Holiday Inn	3903 State St
Kelly Inn	1800 N 12th St
Motel 6	2433 State St
Radisson Inn	605 E Broadway Av
Ramada Limited Suites	3808 E Divide Av
Ramkota	800 3rd St
Select Inn	1505 Interchange Av
Sleep Inn	1402 E Century Av
Staybridge Suites	2801 Gateway Av
Super 8 Hotel	1124 E Capitol Av
Super 8 Motel	1405 Skyline Wy
Windgate Inn	1421 Skyline Bl
Apartments	
Belcastle Apartments	1830 East Capitol Ave
Boulder Apartments	2112 Grimsrud Dr
Bradbury Apartments	1121 West Capitol Ave
Broadway Centre	100 West Broadway Ave
Cambridge Apartments	2700 Hawken St
Capitol Apartments	1820 East Capitol Ave
Cottonwood Apartments	2100 S 12th St
Coulee Ridge Apartments	3105 NE 43 Ave
Crestview Apartment Complex	1701 East Capitol Ave
Edgewood Apartments	2100 Koch Dr
Garden Grove Apartments	2010 Xavier St
Hawken Ridge Apartments	2817 Hawken St
Hawkpoint Apartments	4201 Montreal St
High Ridge Apartments	404 Apollo Ave
Ithica Heights Apartments	2820 Ithica Dr
Kirkwood Park Apartment Homes	140 East Indiana Ave
Kirkwood Park Apartments	207 East Arbor Ave
Legacy Apartments	3900 Alabama St
Mapleton Apartments	1600 Mapleton Ave
Marriott Residence Inn	3421 N 14th St
Meadowlark Apartments	4309 N 19th St.
Northridge Apartments	3103 E Calgary Av
Overlook Ridge Apartments	2200 Koch Dr
Park Century Apartments	2810 Gateway Ave
Parkview Arms Apartments	1114 Jefferson Ave
Pebble Creek Apartments	2925 Iowa Ln
River Ridge Apartments	2130 S 12th St
Sierra Court Apartments	2821 Ithica Dr
Sierra Ridge Apartments	1025 West Turnpike Ave
Stonefield Apartments	4700 N 19th St
Sundance Apartments	320 West Lasalle Dr
Sunset Ridge Apartments	2100 Koch Drive
The Castle by Belcastle	137 Irvine Lp
Cottonwood Apartments	2100 S 12th St

Vulnerable / Special Populations Cont'd

Edgewood Apartments	2100 Koch Dr
Hawkpoint Apartments	4201 Montreal St
Marriott Residence Inn	3421 N 14th St
Northridge Apartments	3103 E Calgary Av
Stonefield Apartments	4700 N 19th St
The Castle by Belcastle	137 Irvine Lp
Turnpike Apartments	2140 Xavier St
Veraway Apartments	2055 Xavier St
Washington Heights Apartments	2723 Hawken St
Westwood Park Apartments	1101 Westwood St
Churches	
Agape Christian Fellowship	1808 Heritage Av
Bethel Lutheran Church	615 E Turnpike Av
Bible Baptist Church	1100 E B Av
Bismarck Baptist Church	2211 Laforest Av
Bismarck Community Church	1617 Michigan Av
Bismarck Evangelical Church	929 N 14th St
Bismarck Temple	2930 Cody Dr
Calvary Free Lutheran Church	417 S Anderson St
Calvary United Methodist	609 N 34th St
Capital Christian Center	3838 Jericho Rd
Capitol Heights Baptist Church	4307 43rd Av Ne
Cathedral of the Holy Spirit	519 Raymond St
Century Baptist Church	205 Colt Av
Charity Lutheran Church	120 Aspen Av
Church of Christ	1914 Assumption Dr
Church of Corpus Christi	1919 N 2nd St
Church of God of Prophecy	2303 E Divide Av
Church of Jesus Christ of Latter Day Saints	1500 Country West Rd
Church of the Ascension	1905 S 3rd St
Church of the Cross	1004 E Highland Acres Rd
Cornerstone Community Church	111 E Wachter Av
Crystal River Worship Center	2223 E Rosser Av
Emmaus Place	1020 N 26th St
Evangel Assembly of God	3225 Harvest Ln
Evangelical Free Church America	318 Apollo Av
Evangelical Lutheran Church	1614 Capitol
Faith Lutheran Church	1402 E Av C
First Baptist Church	306 E Divide Av
First Evangelical Free Church	205 N 43rd Av
First Lutheran Church	800 N 7th St
First Presbyterian Church	214 E Thayer Av
First United Methodist Church	924 N 11th St
First United Pentacostal	2630 E Av A
Gateway Community Fellowship	1915 Shiloh Dr
Good Shepherd Lutheran Church	106 Osage Av
Grace Lutheran Brethren Church	503 N 24th St
Grace Point Church	205 NE 43rd Ave
House of Prayer Lutheran Church	1470 S Washington St
Legacy United Methodist Church	4600 Durango Dr
Living Hope 1st Church of Nazarene	1826 N 8th St
Lord of Life Lutheran Church	1143 N 26th St
McCabe United Methodist Church	1030 N 6th St
New Song Community Church/Daycare	3200 N 11th St
Open Door Baptist Church	623 N 7th St
Our Saviors Evangelical Lutheran Church	1615 N 18th St
Prairie Family Church	500 Remington Av
Riverwood Baptist Church	3030 S Washington St
Seventh Day Adventist Church	1109 N 26th St
Shepherd of the Valley Lutheran Church	801 E Denver Av
Solomon's Rest	703 N 5th St
St. Anne'sChurch / Daycare	1327 N 13th St
St. George's Episcopal Church	601 N 4th St
St. Mary's Catholic Church	806 E Broadway Av
St. Paul Lutheran Church	2510 E Divide Av
Trinity Lutheran Church	310 E Av A
Unitarian Universalist Fellowship	818 E Divide Av
United Church of Christ	1200 E Highland Acres Rd
Word of Faith Church	1503 E Divide Av
Zion Lutheran Church	413 E Av D
Transportation	
Bismarck Airport	2301 UNIVERSITY DR UNIT 17

Vulnerable / Special Populations Cont'd

Other	
Parking Ramp - 3rd & Main	117 N 3RD ST
Parking Ramp	6th St and Broadway
Utility	
Basin Electric Headquarters	1717 E INTERSTATE AV
Animals	
Dakota Zoo	600 RIVERSIDE PARK RD

Risk Assessment Overview

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Hazard Identification

Many hazards have the potential to affect Bismarck, from regional or global events to isolated, localized events. To provide a framework for the risk assessment, hazards were identified for inclusion in this plan based on previous occurrences as well as hazards addressed in the Bismarck Emergency Operations Plan, the previous 2015 Bismarck Multi-Hazard Mitigation Plan, and review of the 2018 State of North Dakota Multi-Hazard Enhanced Mitigation Plan. As an outcome of the plan update kick-off meeting, it was decided to identify the impacts of climate change on each of the hazards. Including an assessment of climate change and its impacts are a new element of this plan and are included here in Section 9 as an addendum. Each hazard profile in Section 10 also includes the highlights of the climate change impact on risk assessment.

As new hazards are identified, they can be added to the hazard list, profiled, and mitigated. Hazards excluded from the plan are noted on page 6.

Hazards were ranked as **"High," "Moderate," or "Low"** as part of the initial development of the mitigation plan (2015) and were reviewed, updated, and approved as part of the plan update process throughout 2019 and 2020. Considerations for hazard ranking include the status of existing hazard mitigation, opportunities and capability to mitigate, as well as emergency response capabilities related to each hazard.

The results of the hazard specific mitigation planning team meetings are reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works for final evaluation and consensus prior to submitting to ND Department of Emergency Services and the Federal Emergency Management Agency for approval.

Integration of Threat/Hazard Identification and Risk Assessment (THIRA) methodologies:

The THIRA risk assessment methodology is applied to each of the hazard profiles within section 10 of this mitigation plan. THIRA ratings are based on consensus of each hazard specific planning team as a result of the initial plan development and process completed in 2015. THIRA was applied to various scenarios within each hazard to better illustrate the full range of likelihood and impact per hazard. The THIRA ratings support the decision making process, but do NOT dictate the hazard ranking of "High, Moderate, or Low."

Hazard Ranking

	Natural Hazards	Technological or Human Caused
High	Winter Storm Tornado	
Moderate	Severe Summer Weather Flood Communicable Disease	Shortage or Outage of Critical Materials or Infrastructure Hazardous Materials Release Train Derailment Active Threat Civil Disturbance
Low	Biological Infestation: *Urban Forest* Drought Geologic Hazard Wildland Fire	Fire Dam Failure Aircraft Accident

The following factors were considered while ranking hazards:

- Likelihood of Occurrence (Risk/Probability)
- Potential Impact
    - to Life, Property, Environment, Economy, Psychological, Continuity of Essential Functions
- Mitigation Status: Existing Mitigation in place
    - if already mitigated, hazard may be of lower priority
- New Mitigation Actions
    - hazard may rank higher if it's NOT mitigated, and there's high need and/or good opportunity to mitigate
- Response Capabilities
    - mitigating a hazard may be more important if response capabilities are lower compared to other hazards

Threat/Hazard Identification and Risk Assessment (THIRA)

Each hazard profile (section 10) includes Threat and Hazard Identification and Risk Assessment (THIRA) ratings which are summarized here. The THIRA ratings for each hazard are based on consensus of each hazard specific planning team. The THIRA ratings/scores facilitate the decision making process regarding the hazard ranking, but do not dictate the hazard ranking of "High, Moderate, or Low." Additional considerations for hazard ranking include the status of existing hazard mitigation as well as response capabilities related to each hazard.

	Score	Very Likely 5	Likely 4	Possible 3	Unlikely 2	Improbable 1
Catastrophic	5			Communicable Disease *(Pandemic)*	*SCMI (EMP) Dam Failure *(Garrison Dam)* Tornado *(EF4-EF5)*	
Significant	4			Train Derailment *(involving hazmat/fire)* Aircraft as Weapon Aircraft Accident		
Moderate	3	Winter Storm	Hazmat Release: *Transportation*	Tornado (EF2-EF3) Hazmat Release: *Pipeline or Fixed Facility*	Fire: Conflagration Flood: 500-Year	
Minor	2	Severe Summer WX Fire: Residential Flood: Urban Flooding	*SCMI *3-day power outage* Biological Infestation *(ie: DED or EAB)* Communicable Disease *(Foodborne Illness)*	*SCMI *1-week Power Outage* Tornado (EF0-EF1) Drought (D4 rating) Flood: Ice Jam Active Threat Geologic Hazard		
None / Negligible	1	Wildland Fire *(WUI)*				

*SCMI = Shortage or Outage of Critical Materials or Infrastructure. SCMI includes power outages as well as power outages caused by an Electromagnetic Pulse (EMP) event.

Threat and Hazard Identification and Risk Assessment (THIRA) Terminology and Definitions

Frequency				
Very Likely (5)	Likely (4)	Possible (3)	Unlikely (2)	Improbable (1)
The potential for impact is very probable (near 100%) in the next year.	The potential for impact is between 10% and 100% within the next year, or there is at least one chance of occurrence within the next 10 years.	The potential for impact is between 1% and 10% within the next year, or there is at least one chance of occurrence within the next 100 years.	The potential for impact is less than 1% in the next 100 years.	The potential for impact can safely be ruled out because it either does not exist (e.g. hurricane) and/or the potential for it to occur in the next 100 years is so low it can safely be called 0%.
Human Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
0 fatalities < 10 injuries is most likely	< 10 fatalities and/or < 50 injuries is most likely	10-25 fatalities and/or < 100 injuries is most likely	25-100 fatalities and/or 100 – 500 injuries is most likely	> 100 fatalities and/or > 500 injuries is most likely
Economic Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
< $500K losses or damages is most likely	> $500K to <$1 Million losses or damages is most likely	>$1 Million to $50 Million losses or damages is most likely	>$50 Million to <$100 Million losses or damages is most likely	>$100 Million losses or damages is most likely
Psychological Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
Event most likely creates minimal population behavior change or effects on social functioning	Event most likely creates occasional or minor loss of nonessential social functions	Event most likely creates a loss of many nonessential social functions	Event most likely creates dysfunctional behavior and disruption of important social functions	Event most likely creates a loss in belief of government and some institutions
Government Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
Event most likely creates no measureable change in the accomplishment of government functions/missions	Event most likely creates only minor changes in the accomplishment of government functions/missions	Event most likely creates a moderate interruption or change in the ability to sustain government functions/missions	Event most likely creates a widespread and significant change in ability to sustain government functions/missions	Event most likely creates a widespread and sustained loss of ability to sustain government functions/missions

Threat and Hazard Risk Assessment

Hazard Name and Scenario	Frequency	IMPACT				*THIRA Score
		Human	Economic	Psychological	Government	
Winter Storm	Very Likely 5	Minor 2	Moderate 3	Significant 4	Minor 2	**7.75**
Communicable Disease: Pandemic	Possible 3	Catastrophic 5	Catastrophic 5	Significant 4	Significant 4	**7.50**
Aircraft as Weapon	Possible 3	Catastrophic 5	Catastrophic 5	Significant 4	Moderate 3	**7.25**
Severe Summer Weather	Very Likely 5	Minor 2	Moderate 3	Minor 2	Minor 2	**7.25**
SCMI - EMP event	Unlikely 2	Catastrophic 5	Catastrophic 5	Catastrophic 5	Catastrophic 5	**7.00**
Fire: Residential	Very Likely 5	Minor 2	Moderate 3	Minor 2	None/Negligible 1	**7.00**
Dam Failure – Catastrophic (Adversarial)	Unlikely 2	Catastrophic 5	Catastrophic 5	Significant 4	Catastrophic 5	**6.75**
Train Derailment (ie: hazmat/fire)	Possible 3	Significant 4	Significant 4	Significant 4	Moderate 3	**6.75**
Hazmat Release: Transportation	Likely 4	Moderate 3	Moderate 3	Minor 2	Moderate 3	**6.75**
Aircraft Accident	Possible 3	Catastrophic 5	Catastrophic 5	Moderate 3	Minor 2	**6.75**
Flood: Urban Flooding	Very Likely 5	None/Negligible 1	Minor 2	Minor 2	Minor 2	**6.75**
Tornado EF4/5	Unlikely 2	Catastrophic 5	Catastrophic 5	Significant 4	Significant 4	**6.50**
Wildland Fire	Very Likely 5	Minor 2	None/Negligible 1	None/Negligible 1	None/Negligible 1	**6.25**
Hazmat Release: Pipeline	Possible 3	Significant 4	Significant 4	Minor 2	Minor 2	**6.00**
Tornado EF2/3	Possible 3	Significant 4	Moderate 3	Minor 2	Moderate 3	**6.00**
Communicable Disease: Foodborne Illness	Likely 4	Minor 2	Minor 2	Minor 2	None/Negligible 1	**5.75**
SCMI - 3 day power outage	Likely 4	Minor 2	None/Negligible 1	None/Negligible 1	Minor 2	**5.50**
Hazmat Release - Fixed Facility	Possible 3	Moderate 3	Moderate 3	Minor 2	Minor 2	**5.50**
Biological Infestation (Urban Forest)	Likely 4	None/Negligible 1	Moderate 3	None/Negligible 1	None/Negligible 1	**5.50**
SCMI - 1 week power outage	Possible 3	Minor 2	Minor 2	Minor 2	Moderate 3	**5.25**
Fire: Conflagration	Unlikely 2	Moderate 3	Catastrophic 5	Moderate 3	Minor 2	**5.25**
Flood: Ice Jam	Possible 3	Minor 2	Minor 2	Minor 2	Moderate 3	**5.25**
Flood: 500-Year	Unlikely 2	Moderate 3	Moderate 3	Moderate 3	Moderate 3	**5.00**
Active Threat	Possible 3	Minor 2	None/Negligible 1	Moderate 3	Minor 2	**5.00**
Drought - D4	Possible 3	None/Negligible 1	Moderate 3	Minor 2	None/Negligible 1	**4.75**
Tornado EF0/1	Possible 3	Minor 2	Minor 2	None/Negligible 1	Minor 2	**4.75**
Geologic Hazard	Possible 3	None/Negligible 1	Minor 2	Minor 2	Minor 2	**4.75**

*THIRA Score = Frequency + Average of Impact Ratings

Hazards Excluded from this Plan Natural Hazards Excluded from this Bismarck Multi-Hazard Mitigation Plan are consistent with natural hazards excluded from the ND Department of Emergency Services Multi-Hazard Mitigation Plan.	
Hazard	**Why Excluded/Where Addressed**
Avalanche	Avalanches generally require long stretches of slopes of 25-55 degrees; North Dakota has few areas that meet this criteria. North Dakota is not covered by a National Avalanche Center. North Dakota does not have a history of any declared state or federal avalanche disasters.
Coastal Erosion	North Dakota does not have an ocean coastline.
Coastal Storm	North Dakota does not have an ocean coastline.
Hurricane	North Dakota does not have an ocean coastline, nor is it located in a potential hurricane impact area.
Tsunami	North Dakota does not have an ocean coastline.
Volcano	Volcanic ashfall can occur over North Dakota, but the frequency is relatively rare and the potential impacts are not expected to exceed local capabilities. North Dakota does not have a history of any declared state or federal volcano disasters.

Climate Change – Risk Assessment Addendum

Introduction

The North Dakota Climate Summary insert (next 4 pages) developed by the National Oceanic and Atmospheric Administration (NOAA) serves as the climate change situation assessment executive summary for this section on climate change. Following the NOAA 4-page climate summary are statements derived from the sources listed below to identify how climate change may influence each of the hazards addressed within this mitigation plan.

Following the hazard specific climate change impact statements (pages 6-10) is a more detailed situation assessment (pages 11-23) which highlights the importance of mitigation (and adaption) as it relates to climate change currently and through year 2100 and beyond. As stated in the Fourth National Climate Assessment Volume II: "The effects of different future greenhouse gas emissions levels on global climate become most evident around 2050…"

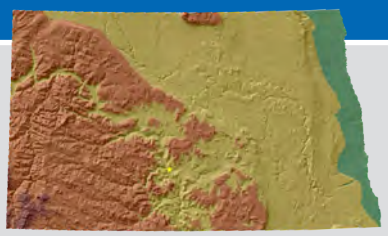
Information within this section on climate change is derived from the sources noted below. Exceptions will be specifically noted. Those reviewing this section on climate change are encouraged to review the sources below to learn more.

- **National Aeronautics and Space Administration (NASA):** https://climate.nasa.gov/
  NASA's role is to make detailed climate data available to the global community, including the public, policy- and decision-makers, and scientific and planning agencies.
- **Fourth National Climate Assessment - Volume I: Climate Science Special Report**: **(NCA4 Vol I)**: https://science2017.globalchange.gov/
- **Fourth National Climate Assessment - Volume II: Impacts, Risks, and Adaptation in the United States: (NCA4 Vol II)**: https://nca2018.globalchange.gov/
- **National Oceanic and Atmospheric Administration (NOAA) (NOAA Climate Summary – ND):** https://statesummaries.ncics.org/

Note: This section on climate change refers to climate change scenarios which are identified as "RCP8.5"and "RCP4.5." (RCP = Representative Concentration Pathway). The Fourth National Climate Assessment Volumes I and II focuses on RCP8.5 as a "higher" scenario, associated with more warming, and RCP4.5 as a "lower" scenario with less warming. For a more detailed description of the climate change scenarios used, see page 23 of this section on climate change.

Climate Change Situation Assessment – Executive Summary

The NOAA Climate Summary for North Dakota serves as the executive summary this section on climate change. See pages 2 through 5. The reader may also wish to review the Fourth National Climate Assessment Volume I Executive Summary available here: https://science2017.globalchange.gov/downloads/CSSR2017_PRINT_Executive_Summary.pdf



NORTH DAKOTA

Key Messages

North Dakota has experienced one of the largest temperature increases of any contiguous U.S. state, with annual average temperatures increasing at a rate of 0.26°F per decade. This increase is most evident in winter warming, which has been characterized by the much below average occurrence of extremely cold days since 1980. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century.

Higher temperatures will increase the rate of warm season soil moisture depletion, leading to more serious conditions during future naturally occurring droughts.

Precipitation is projected to increase during the colder part of the year. Heavy precipitation events are also projected to increase.

North Dakota lies in the northern Great Plains, straddling the transition from the moist eastern United States to the semi-arid western United States. Due to its location in the center of the North American continent, the state has a continental climate and experiences wide temperature extremes. Average January temperatures range from 0°F in the northeast to 15°F in the southwest, while average July temperatures range from 65°F in the northeast to 72°F in the south. Temperatures of 100°F or more occur nearly every year and are most prevalent in the drier southwestern and south-central regions. The lack of mountain ranges to the north allows arctic air masses to enter the state frequently during the winter, bringing bitter cold spells.

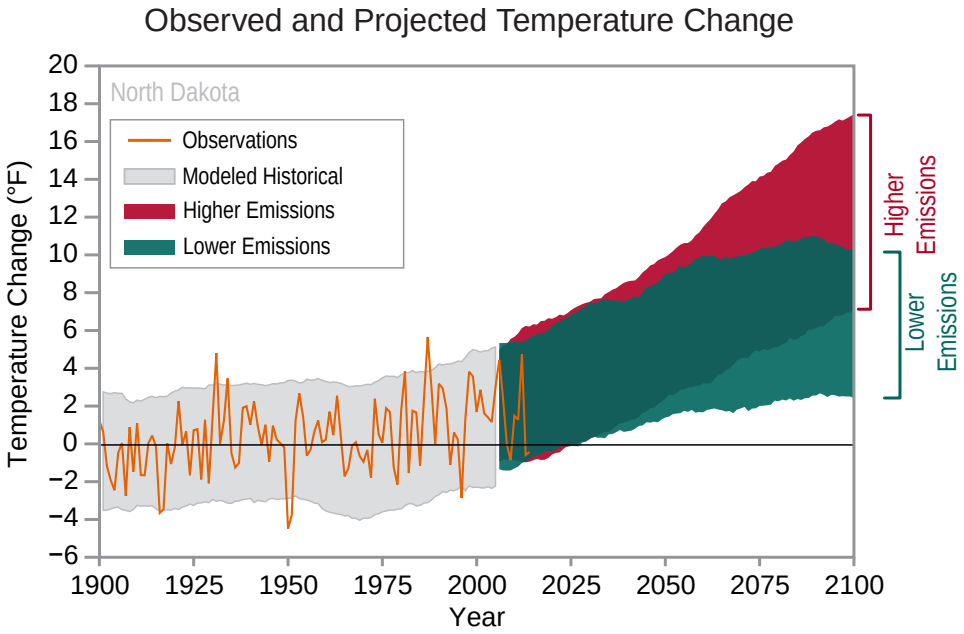


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for North Dakota. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions)[1]. Temperatures in North Dakota (orange line) have risen more than 2°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about 2°F warmer than the long-term average; green shading) and more warming under a higher emissions future (the hottest years being about 11ºF warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI.

[1]Technical details on models and projections are provided in an appendix, available online at: https://statesummaries.ncics.org/nd.

The 2000s have been one of the warmest periods on record for North Dakota, with several very warm years comparable to the extreme heat of the 1930s Dust Bowl era when extreme drought and poor land management likely exacerbated the hot summer temperatures (Figure 1). Over the last 130 years, North Dakota's annual average temperature has increased 0.26°F per decade, one of the fastest increases of any state in the contiguous United States. This warming has been concentrated in the winter and spring while summers have not warmed substantially in the state, a feature characteristic of much of the Great Plains and Midwest. This is reflected in a below average occurrence of very hot days (days with maximum temperature greater than 95°F) in recent years (Figure 2) and no overall trend in warm nights (days with minimum temperature greater than 70°F) since the beginning of the 20th century (Figure 3). The winter warming trend is reflected in a below average number of very cold days (days with maximum temperature less than 0°F) since 2000 (Figure 4). Additionally, over the past 130 years, winter temperatures have increased by 4.4°F per century, more than three times as much as the summer trend of 1.4°F per century during the same time period.

Annual precipitation ranges from less than 14 inches in the northwest to 22 inches in the southeast. Statewide average annual precipitation varies from year to year, ranging from a low of 8.81 inches in 1936 to a high of 23.48 inches in 2010. The wettest multi-year periods were in the early 1940s, 1990s, and 2010s, and the driest in the 1930s. The wettest 5-year period was 2007–2011 and the driest was 1933–1937 (Figure 5). Most of the state's precipitation falls during the summer months when thunderstorm activity is highest. The most severe of these storms can produce hail, tornadoes, or damaging straight-line winds exceeding 75mph. **The frequency of heavy rain events has increased** (Figure 6). Since 1990, the number of such events has been above average, peaking during the most recent 5-year period (2010–2014).

Compared to other northern states, North Dakota receives less snowfall, averaging 25 to 45 inches annually. However, due to the state's northern location, winter storm systems can be accompanied by exceptionally severe conditions, including heavy snows, high winds, and low wind chill temperatures. The probability of a blizzard occurring in any given year is greater than 50% for the state, one of the highest in the nation. During the winter of 1996–1997, North Dakota

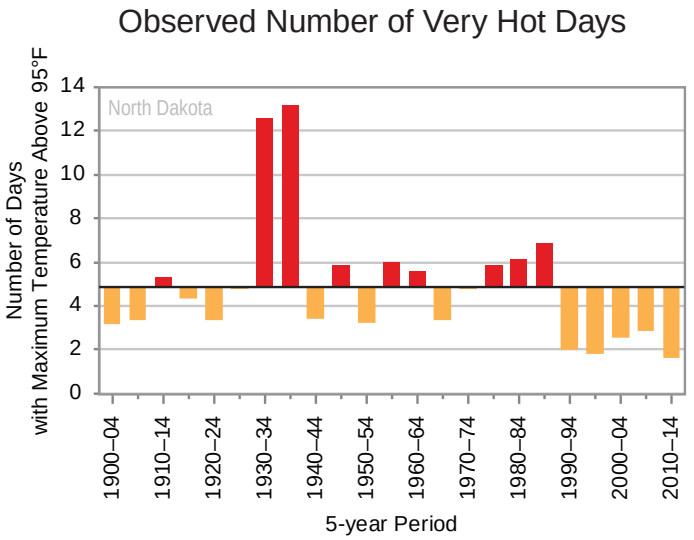


Figure 2: The observed number of very hot days (annual number of days with maximum temperature above 95°F) for 1900–2014, averaged over 5-year periods; these values are averages from 16 long-term reporting stations. The dark horizontal line represents the long-term average. The 1930s were North Dakota's hottest period over the past century. From 1930 to 1939, the number of extremely hot days was more than double the long-term average. Since 1990, however, the number of very hot days has been below the long-term average. Source: CICS-NC and NOAA NCEI.

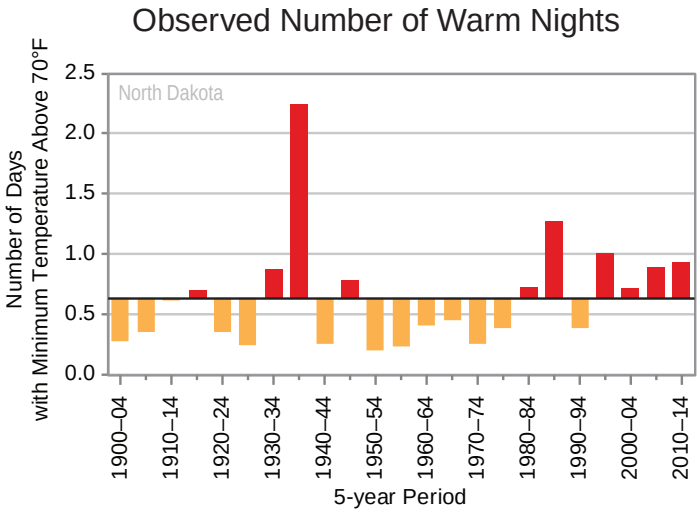


Figure 3: The observed number of warm nights (annual number of days with minimum temperature above 70°F) for 1900–2014, averaged over 5-year periods; these values are averages from 16 long-term reporting stations. The dark horizontal line represents the long-term average. The late 1930s had the highest frequency of warm nights, more than three times the long-term average. Over the past two decades, North Dakota has experienced an above average number of warm nights. Source: CICS-NC and NOAA NCEI.

experienced nine blizzards and four winter storms which produced seasonal snowfalls of over 100 inches in some parts of the state.

The Red River Valley is one of the most flood-prone areas in the United States due to the river's low gradient and northward flow. The spring thaw causes snow and river ice in the south to melt prior to the downstream river channel to the north. This creates natural ice jams, flooding of the upstream river, and backfill of runoff into the river's tributaries. In addition to snowmelt, recharge of soil moisture due to fall precipitation and direct runoff of spring rainfall from saturated soils contribute to spring floods. Based on more than 100 years of river stage data collected in Fargo, the Red River has exceeded major flood stages 16 times. In the spring of 1997, the melting of record snowfall caused record floods along the river; this record was exceeded in the 2009 floods, when the river at Fargo reached the highest level in recorded history. Another flood-prone area in the state is Devils Lake. The rising water of Devils Lake and Stump Lake has destroyed hundreds of homes and businesses and inundated thousands of acres of productive farmland. Since 1993, the state of North Dakota and the U.S. Government has spent more than $450 million in flood-mitigation efforts in the region. If lake levels continue to rise, an uncontrolled natural spill to the Sheyenne River could occur, potentially causing extensive downstream flooding, channel erosion, and water quality degradation (Figure 7).

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century (Figure 1). Even under a lower pathway of greenhouse gas emissions, average annual temperatures are projected to most likely exceed historical occurrences by the middle of the 21st century. However, there is a large range of temperature increases under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records (Figure 1). Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease.

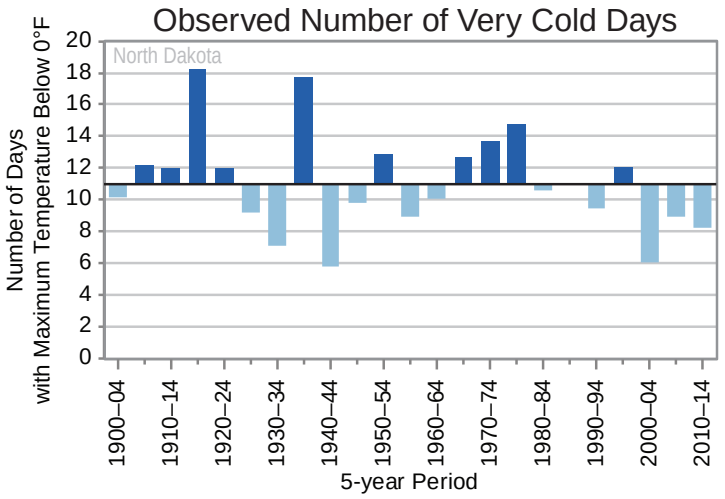


Figure 4: The observed number of very cold days (annual number of days with maximum temperature below 0°F) for 1900–2014, averaged over 5-year periods; these values are averages from 16 long-term reporting stations. The dark horizontal line represents the long-term average. Since 2000, North Dakota has experienced a below normal number of extremely cold days, indicative of overall winter warming in the region. Source: CICS-NC and NOAA NCEI.

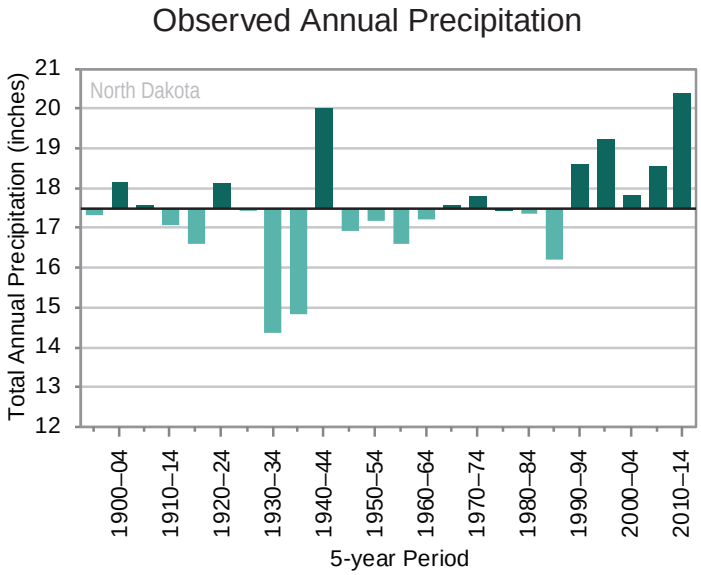


Figure 5: The observed spring and summer precipitation for 1895–2014, averaged over 5-year periods; these values are averages from NCEI's version 2 climate division dataset. The dark horizontal line represents the long-term average. Annual precipitation varies widely, but recent years have seen above average precipitation. The wettest 5-year period on record is 2007–2011, averaging 20.38 inches, while the driest period on record (1933–1937) averaged 14.36 inches. Source: CICS-NC and NOAA NCEI.

Even though the current observed records do not show a positive trend in cold season precipitation so far, projections suggest that winter precipitation will increase (Figure 8), even under a lower emissions pathway. Increased cold season precipitation can have both positive and negative impacts on North Dakota's agricultural economy, improving soil moisture but potentially delaying planting and resulting in loss of yield. **Heavy precipitation events are also projected to increase**, leading to increased runoff and flooding which can reduce water quality and erode soils.

The intensity of droughts is projected to increase. Droughts are a natural part of the climate system and because precipitation increases are projected to occur during the cooler months, North Dakota will remain vulnerable to periodic drought. Higher temperatures will increase the rate of depletion of soil moisture during dry conditions in the warm season, leading to more serious conditions during future droughts. Mid-summer through early fall wildfires may also become more common.

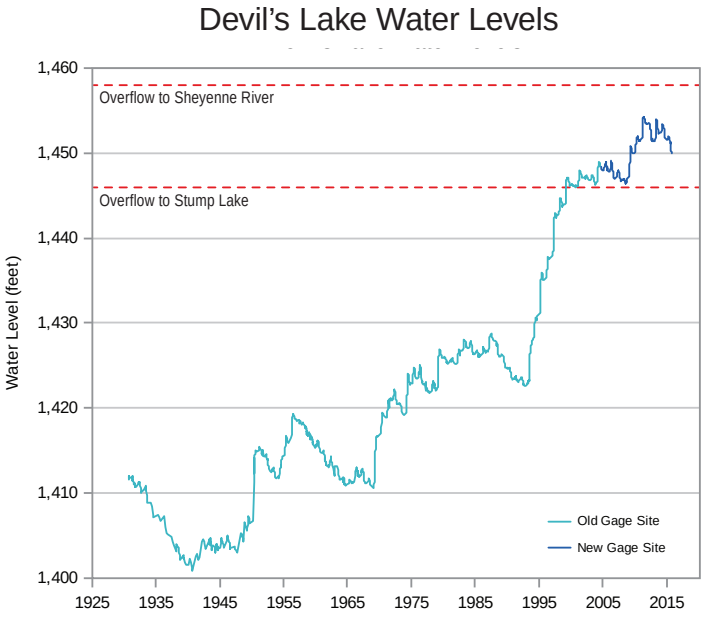


Figure 7: Time series of the water level of Devils Lake at Creel Bay. Lake levels have fluctuated over time, but have been steadily rising overall since the 1940s. Water began spilling from Devils Lake to Stump Lake in 1999, and in 2007 Devils Lake and Stump Lake essentially became one continuous body of water. If lake levels continue to rise, an uncontrolled natural spill to the Sheyenne River could occur. Source: USGS.

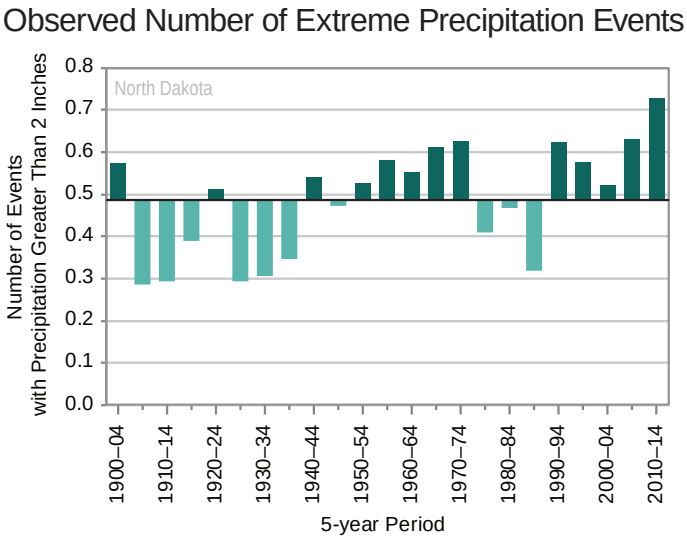


Figure 6: The observed number of extreme precipitation events (annual number of days with precipitation greater than 2 inches) for 1900–2014, averaged over 5-year periods; these values are averages from 11 long-term reporting stations. In an average year, 50% of stations will experience a day with 2 inches or more of precipitation. Since 1990, North Dakota has experienced an above average number of extreme rain events. Source: CICS-NC and NOAA NCEI.

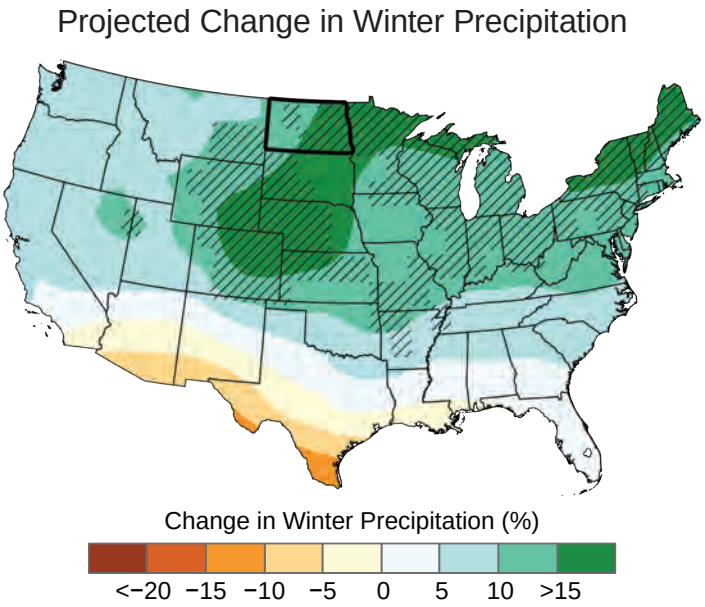


Figure 8: Projected change in winter precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. Winter precipitation is projected to increase in the range of 10%–20% by 2050. Spring precipitation is also projected to increase in North Dakota. North Dakota is part of a large area in the northern and central United States with projected increases. Source: CICS-NC, NOAA NCEI, and NEMAC.

Climate change information within the table below is derived from these sources:

- **National Aeronautics and Space Administration (NASA):** https://climate.nasa.gov/
  NASA's role is to make detailed climate data available to the global community, including the public, policy- and decision-makers, and scientific and planning agencies.
- **Fourth National Climate Assessment - Volume I: Climate Science Special Report (NCA4 Vol I)**: https://science2017.globalchange.gov/
- **Fourth National Climate Assessment - Volume II: Impacts, Risks, and Adaptation in the United States (NCA4 Vol II):** https://nca2018.globalchange.gov/
- **National Oceanic and Atmospheric Administration (NOAA):** https://statesummaries.ncics.org/ **(NOAA Climate Summary)**

Hazard	Climate Change Impact Statements	Source
ALL Hazards	Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century. By year 2100, the projected temperature change for North Dakota depends on the lower emissions versus higher emission scenarios. In a lower emissions scenario, the coldest years are projected to be about 2°F warmer than the long-term average with the hottest years being about 11°F warmer than the hottest year in historical record. *Current trends in annual greenhouse gas emissions, globally, are consistent with RCP8.5.*	NOAA Climate Summary (ND) *NCA4 Vol II Overview*
All Hazards	*An increase in CO2 emissions within the Bismarck area is anticipated based on land development trends and city growth creating more traffic.*	*Local Planning Team Input*
Biological Infestation	Among other anticipated changes, projected warmer and generally wetter conditions with elevated atmospheric carbon dioxide concentrations are expected to increase the abundance and competitive ability of weeds and invasive species.	NCA4 Vol II Chapter 22 (Northern Great Plains)
Communicable Disease	Changes in weather and climate can degrade air and water quality; affect the geographic range, seasonality, and intensity of transmission of infectious diseases through food, water, and disease-carrying vectors (such as mosquitoes and ticks); and increase stresses that affect mental health and well-being. Changing weather patterns also interact with demographic and socioeconomic factors, as well as underlying health trends, to influence the extent of the consequences of climate change for individuals and communities. While all Americans are at risk of experiencing adverse climate-related health outcomes, some populations are disproportionately vulnerable. The risks of climate change for human health are expected to increase in the future, with the extent of the resulting impacts dependent on the effectiveness of adaptation efforts and on the magnitude and pattern of future climate change.	NCA4 Vol II *Chapter 14 Executive Summary*

Drought	The intensity of droughts is projected to increase: Droughts are a natural part of the climate system and because precipitation increases are projected to occur during the cooler months, North Dakota will remain vulnerable to periodic drought. Higher temperatures will increase the rate of depletion of soil moisture during dry conditions in the warm season, leading to more serious conditions during future droughts. Mid-summer through early fall wildfires may also become more common. Higher temperatures will increase the rate of warm season soil moisture depletion, leading to more serious conditions during future naturally occurring droughts. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease.	NOAA Climate Summary (ND)
	Major flooding across the basin in 2011 was followed by severe drought in 2012, representing new and unprecedented variability that is likely to become more common in a warmer world.	*NCA Volume II Chapter 22 Northern Great Plains)*
	The Great Plains/Midwest drought of 2012 was the most severe summer meteorological drought in the observational record for that region. An unfortunate string of three different patterns of large-scale meteorology from May through August 2012 precluded the normal frequency of summer thunderstorms and was not predicted by the NOAA seasonal forecasts. Significant U.S. seasonal precipitation deficits are not confidently projected outside of the Southwest. However, future higher temperatures will *likely* lead to greater frequencies and magnitudes of agricultural droughts throughout the continental United States as the resulting increases in evapotranspiration outpace projected precipitation increases.	NCA4 Volume I Chapter 8
Flood	The frequency of heavy rain events has increased. Since 1990, the number of such events has been above average, peaking during the most recent 5-year period (2010–2014). The peak 5-year period for total annual precipitation is the 2007-2011 time period. Heavy precipitation events are also projected to increase. *(note: "heavy" is defined as events with greater than 1 inch per day)* Current observed records do not show a positive trend in cold season precipitation so far, however, projections suggest that winter precipitation will increase even under a lower emissions pathway.	NOAA Climate Summary (ND)

	Overall, climate models project an increase in the number of heavy precipitation events (events with greater than 1 inch per day) for much of the region, with the exception of the high-mountain areas in the southwestern portion. Over the coming century, significant increases *(of precipitation)* are projected in winter and spring over the Northern Great Plains, the Upper Midwest, and the Northeast. Observed increases in the frequency and intensity of heavy precipitation events in most parts of the United States are projected to continue.	NCA4 Vol II Chapter 22 (Northern Great Plains) NCA4 Vol II Chapter 2
Severe Summer Weather	The warming trend in ND has been concentrated in the winter and spring. The winter warming trend is reflected in a below average number of very cold days (days with maximum temperature less than 0 degrees F) since year 2000. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease. With continued warming, cold-related deaths are projected to decrease and heat-related deaths are projected to increase; in most regions, increases in heat-related deaths are expected to outpace reductions in cold-related deaths. The probability for more very hot days (days with maximum temperatures above 90°F) is expected to increase, with potential impacts on agriculture, energy production, human health, streamflows, snowmelt, and fires.	NOAA Climate Summary (ND) NCA4 Vol II Summary Findings NCA4 Vol II Chapter 22 (Northern Great Plains)
Shortage or Outage of Critical Materials	… "Finally, higher maximum temperatures, longer and more severe heat waves, and higher overnight lows are expected to increase electricity demand for cooling in the summer, further stressing the power grid." …	NCA4 Vol II Chapter 22 (Northern Great Plains)
Tornado	Tornado activity in the United States has become more variable, particularly over the 2000s, with a decrease in the number of days per year with tornadoes and an increase in the number of tornadoes on these days (*medium confidence*). Confidence in past trends for hail and severe thunderstorm winds, however, is *low*. Climate models consistently project environmental changes that would putatively support an increase in the frequency and intensity of severe thunderstorms (a category that combines tornadoes, hail, and winds), especially over regions that are currently prone to these hazards, but confidence in the details of this projected increase is *low*. … "judicious use of the report database has revealed important information about tornado trends. Since the 1970s, the United States has experienced a decrease in the number of days per year on which tornadoes occur, but an increase in the number of tornadoes that form on such days. One important	NCA4 Volume I Chapter 9

	implication is that the frequency of days with large numbers of tornadoes—tornado outbreaks—appears to be increasing. The extent of the season over which such tornado activity occurs is increasing as well: although tornadoes in the United States are observed in all months of the year, an earlier calendar-day start to the season of high activity is emerging. In general, there is more interannual variability, or volatility, in tornado occurrence."	
Wildland Fire *Wildland Urban Interface (WUI)*	Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease. The intensity of droughts is projected to increase: Droughts are a natural part of the climate system and because precipitation increases are projected to occur during the cooler months, North Dakota will remain vulnerable to periodic drought. Higher temperatures will increase the rate of depletion of soil moisture during dry conditions in the warm season, leading to more serious conditions during future droughts. Mid-summer through early fall wildfires may also become more common.	NOAA Climate Summary (ND)
Winter Storm	Current observed records do not show a positive trend in cold season precipitation so far, however, projections suggest that winter precipitation will increase even under a lower emissions pathway. The warming trend in ND has been concentrated in the winter and spring. The winter warming trend is reflected in a below average number of very cold days (days with maximum temperature less than 0 degrees F) since year 2000. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease. With continued warming, cold-related deaths are projected to decrease and heat-related deaths are projected to increase; in most regions, increases in heat-related deaths are expected to outpace reductions in cold-related deaths. There are projected to be many fewer cool days (days with minimum temperatures less than 28°F), an indicator of damaging frost, with decreases of 30 days or more per year by mid-century. These changes would have important implications for the region's snowpack and consequently streamflow and water use." Surface soil moisture over most of the United States is likely to decrease, accompanied by large declines in snowpack in the western United States and shifts to more winter precipitation falling as rain rather than snow.	NOAA Climate Summary (ND) NCA4 Vol II Summary Findings NCA4 Vol II Chapter 22 (Northern Great Plains) NCA4 Vol II Chapter 2

Climate Change Impact Statements Continued

Regarding the hazards listed below, no direct statements of climate change influence were found within the sources as referenced in this section on climate change. The impact statements for each hazard within the table below are assumptions based on impact statements relating to the various natural hazards within the previous table on pages 6-9.	
Active Shooter	See "Civil Disturbance" below.
Aircraft Accident	Impact would be indirect. Projected increases in frequency or intensity of storms may impact likelihood.
Civil Disturbance	Due to the human-caused nature of civil disturbance, climate change is not expected to impact this hazard. However, the growing public concern over climate change may influence protests that can turn into civil disturbance directed towards the prominent oil and gas industry in North Dakota. *Source: ND DES Mitigation Plan (2018)*
Dam Failure	An increase in high intensity precipitation events in North Dakota from climate change may put more dams at risk to conditions that exceed the original design criteria of aging dams. *Source: ND DES Mitigation Plan (2018).* However, this statement is not specific to the dams which are relevant (Garrison Dam and Jackman Coulee Dam #2) to the City of Bismarck.
Geologic Hazards	A projected increase in the frequency of heavy rain events may impact likelihood of areas already prone to geologic hazards.
Fire	Impact would be indirect. More extremes in weather events (ie: heat waves, drought) can impact risk (enhance likelihood).
Hazardous Materials Release	Impact would be indirect. More extremes or higher frequency of significant weather events (ie: heat waves, heavy rain events) can impact risk (enhance likelihood).
Train Derailment	Impact would be indirect. More extremes in weather events (ie: heat waves) can impact risk (enhance likelihood). Track failures may occur more frequently as a result of higher frequency or intensity of heat waves (track buckling/warping).

Bismarck National Weather Service posted the graph below January 2017. Bismarck had its warmest year on record in 2016 (3.5 above normal) and its 8th wettest year on record (5.63 inches above normal).

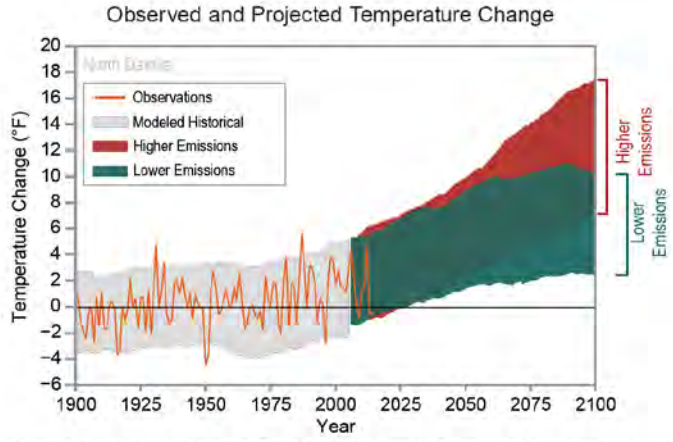


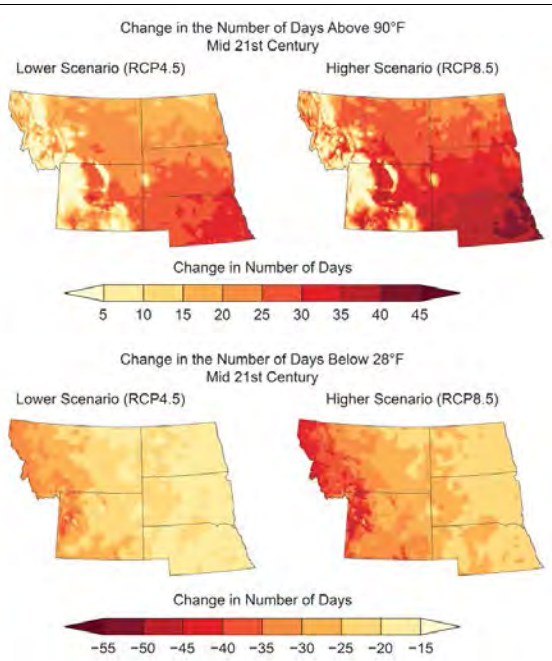
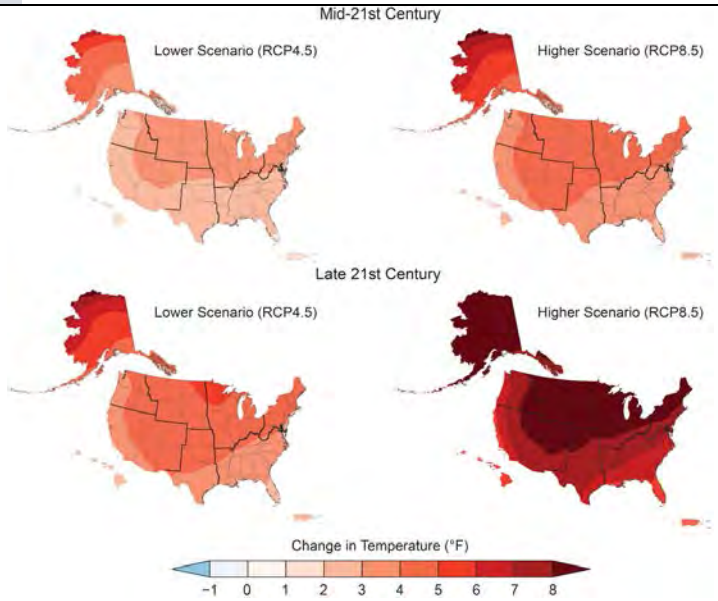
Climate Change – Situation Assessment Overview

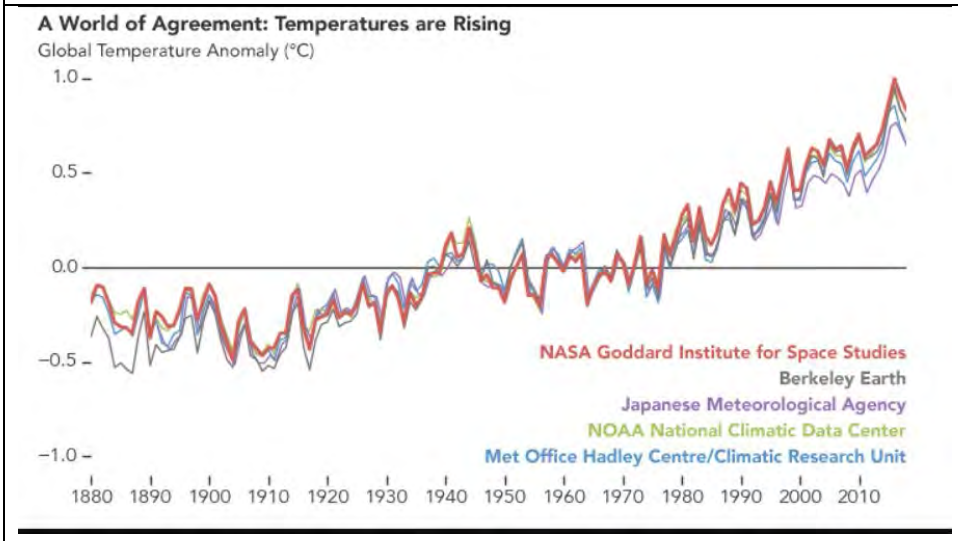
This situation assessment on climate change is intended to provide perspective on current and long-term climate change issues and highlight the importance of mitigation and adaption strategies for the long-term. The situation assessment information is derived from the same sources as referenced on page 1 of this section on climate change.

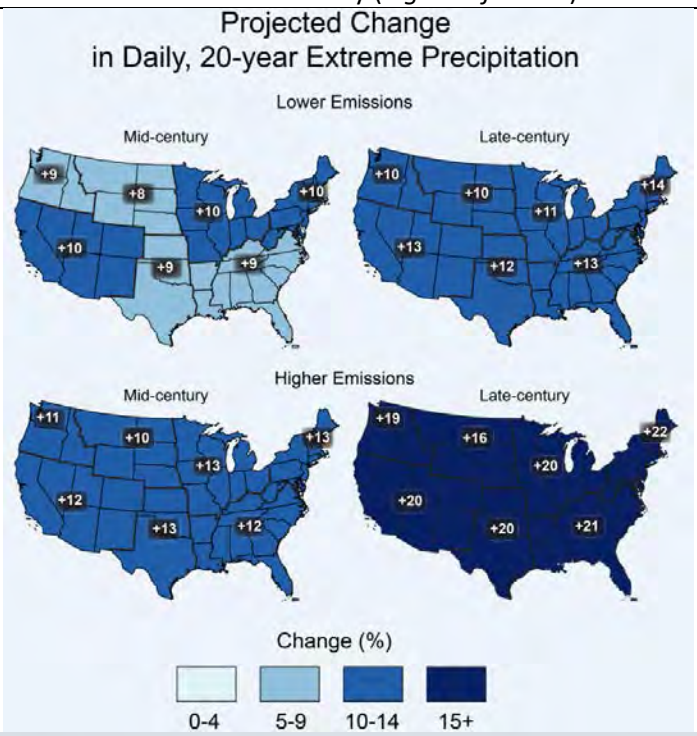
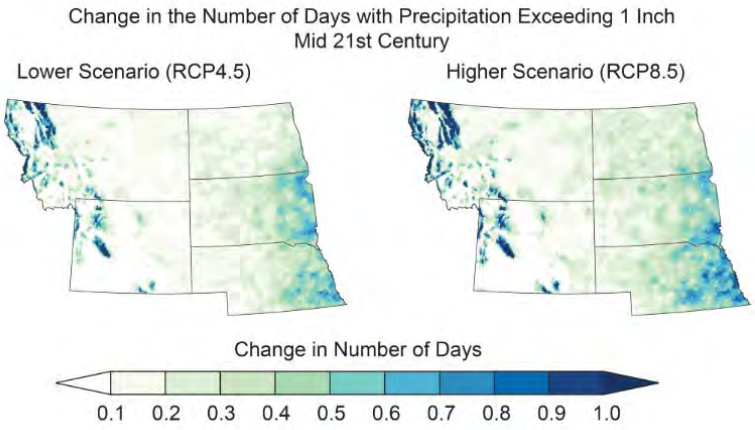
Situation Assessment - Overview

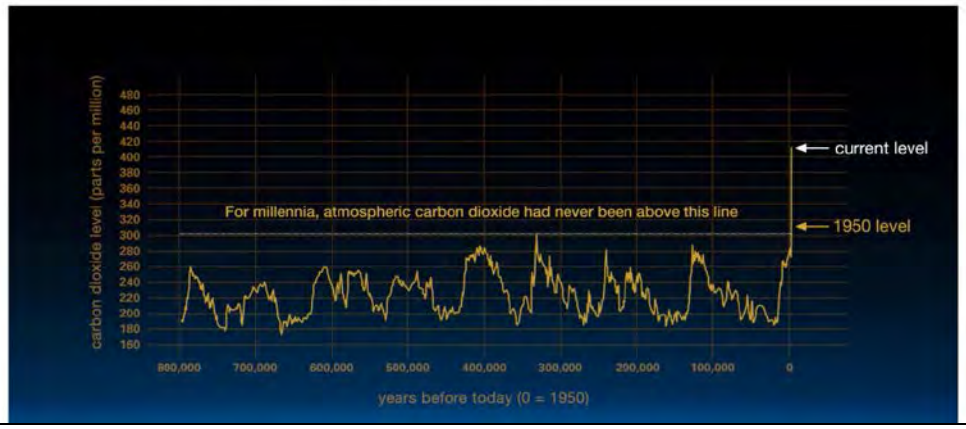
The effects of different future greenhouse gas emissions levels on global climate become most evident around 2050, when temperature, precipitation, and sea level rise projections based on each scenario begin to diverge significantly.	NCA4 Volume II Overview
Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century. By year 2100, the projected temperature change for North Dakota depends on the lower emissions versus higher emission scenarios. In a lower emissions scenario, the coldest years are projected to be about 2°F warmer than the long-term average with the hottest years being about 11°F warmer than the hottest year in historical record.	NOAA Climate Summary - North Dakota
Earth's climate will continue to change over this century and beyond. Past mid-century, how much the climate changes will depend primarily on global emissions of greenhouse gases and on the response of Earth's climate system to human-induced warming. With significant reductions in emissions, global temperature increase could be limited to 3.6°F (2°C) or less compared to preindustrial temperatures. Without significant reductions, annual average global temperatures could increase by 9°F (5°C) or more by the end of this century compared to preindustrial temperatures.	NCA4 Vol II Chapter 2
Current trends in annual greenhouse gas emissions, globally, are consistent with RCP8.5. *Author Note: This is the higher emissions scenario. See page 23.*	NCA4 Volume II Overview
The Intergovernmental Panel on Climate Change (IPCC), predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase. "Taken as a whole," the IPCC states, "the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time."	NASA *Effects*
Market forces and technological change, particularly within the electric power sector, have contributed to a decline in U.S. greenhouse gas emissions over the past decade. In 2016, U.S. emissions were at their lowest levels since 1994. Power sector emissions were 25% below 2005 levels in 2016, the largest emissions reduction for a sector of the American economy over this time. This decline was in large part due to increases in natural gas and renewable energy generation, as well as enhanced energy efficiency standards and programs . **Given these advances in electricity generation, transmission, and distribution, the largest annual sectoral emissions in the United States now come from transportation.** As of the writing of this report, business-as-usual (as in, no new policies) projections of U.S. carbon dioxide and other greenhouse gas emissions show flat or declining trajectories over the next decade with a central estimate of about 15% to 20% reduction below 2005 levels by 2025.	NCA4 Vol II Overview

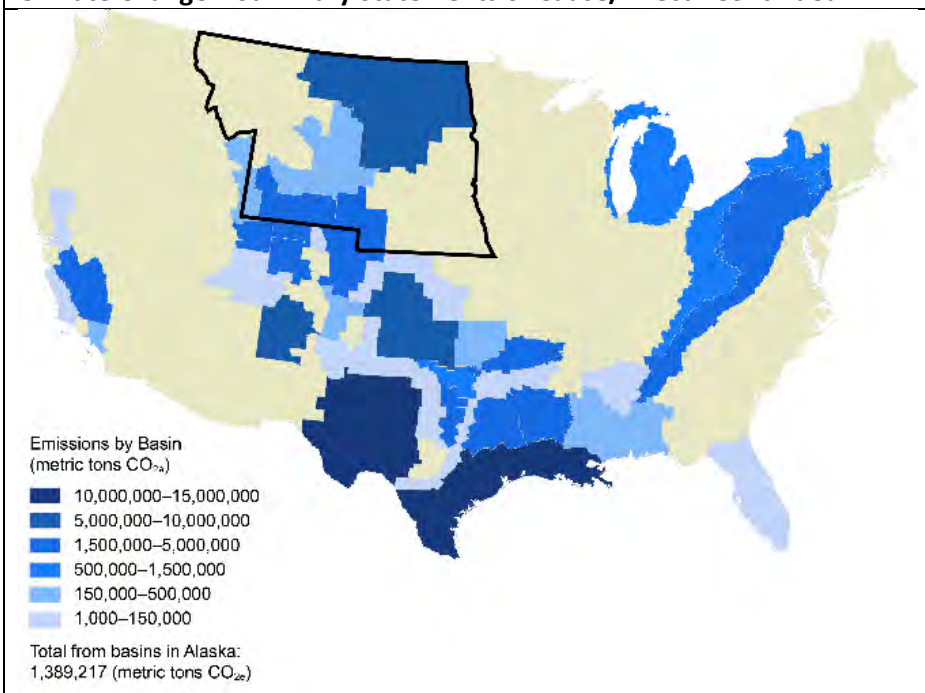
Temperature Change Overview	Source
Global annually averaged surface air temperature has increased by about 1.8°F (1.0°C) over the last 115 years (1901–2016).	NCA4 Volume I Executive Summary
Annual average temperature over the contiguous United States has increased by 1.2ºF (0.7°C) over the last few decades and by 1.8°F (1°C) relative to the beginning of the last century. Additional increases in annual average temperature of about 2.5°F (1.4°C) are expected over the next few decades regardless of future emissions, and increases ranging from 3°F to 12°F (1.6°–6.6°C) are expected by the end of century, depending on whether the world follows a higher or lower future scenario, with proportionally greater changes in high temperature extremes.	NCA4 Volume II Chapter 2
Temperatures in North Dakota have risen more than 2°F since the beginning of the 21st Century. North Dakota has experienced one of the largest temperature increases of any contiguous U.S. state, with annual average temperatures increasing at a rate of 0.26°F per decade. This increase is most evident in winter warming, which has been characterized by the much below average occurrence of extremely cold days since 1980. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century.	NOAA state climate summary (ND)
Annual average near-surface air temperatures across Alaska and the Arctic have increased over the last 50 years at a rate more than twice as fast as the global average temperature (*very high confidence*).	NCA4 Vol I Chapter 11
… "small changes in temperature correspond to enormous changes in the environment. For example, at the end of the last ice age, when the Northeast United States was covered by more than 3,000 feet of ice, average temperatures were only 5 to 9 degrees cooler than today."	NASA Effects tab
 **Figure 1:** Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for North Dakota. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions)[1]. Temperatures in North Dakota (orange line) have risen more than 2°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about 2°F warmer than the long-term average; green shading) and more warming under a higher emissions future (the hottest years being about 11°F warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI	NOAA state climate summary (ND) See page 2 of this climate change section for a larger view of the graphic.

 Projected changes are shown for the annual number of very hot days (days with maximum temperatures above 90°F, an indicator of crop stress and impacts on human health), and the annual number of cool days (days with minimum temperatures below 28°F, an indicator of damaging frost). Sources: NOAA NCEI and CICS-NC.	NCA4 Volume II Chapter 22 Figure 22.2
 Annual average temperatures across the United States are projected to increase over this century, with greater changes at higher latitudes as compared to lower latitudes, and under a higher scenario (RCP8.5; right) than under a lower one (RCP4.5; left). This figure shows projected differences in annual average temperatures for mid-century (2036–2065; top) and end of century (2071–2100; bottom) relative to the near present (1986–2015).	NCA4 Volume 1 Chapter 1 Overview Figure 1.3

Extreme temperatures in the contiguous United States are projected to increase even more than average temperatures. The temperatures of extremely cold days and extremely warm days are both expected to increase. Cold waves are projected to become less intense while heat waves will become more intense. The number of days below freezing is projected to decline while the number above 90°F will rise. (*Very high confidence*)	NCA4 Vol I Chapter 6
 Temperature data showing rapid warming in the past few decades, the latest data going up to 2018. According to NASA data, 2016 was the warmest year since 1880, continuing a long-term trend of rising global temperatures. The 10 warmest years in the 139-year record all have occurred since 2005, with the five warmest years being the five most recent years. Credit: NASA's Earth Observatory.	NASA Facts/Scientific Consensus

Precipitation	
The frequency and intensity of heavy precipitation events are projected to continue to increase over the 21st century (*high confidence*).	NCA4 Vol 1 Chapter 7
 Projected change in the 20-year return period amount for daily precipitation for mid- (left maps) and late-21st century (right maps). Results are shown for a lower scenario (top maps; RCP4.5) and for a higher scenario (bottom maps, RCP8.5). These results are calculated from the LOCA downscaled data. (Figure source: CICS-NC and NOAA NCEI).	NCA4 Vol 1 Chapter 7
 Heavy precipitation events (the annual number of days with greater than 1 inch of rainfall; areas in white do not normally experience more than 1 inch of rainfall in a single day). Projections are shown for the middle of the 21st century (2036–2065) as compared to the 1976–2005 average under the lower and higher scenarios (RCP4.5 and RCP8.5). Sources: NOAA NCEI and CICS-NC.	NCA4 Volume II Chapter 22 Figure 22.2

Climate Change – Summary Statements of Cause/Effect	Source
Scientists attribute the global warming trend observed since the mid-20th century to the human expansion of the "greenhouse effect" — warming that results when the atmosphere traps heat radiating from Earth toward space. Carbon dioxide (CO_2). A minor but very important component of the atmosphere, carbon dioxide is released through natural processes such as respiration and volcano eruptions and through human activities such as deforestation, land use changes, and burning fossil fuels. Humans have increased atmospheric CO_2 concentration by more than a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change. In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 95 percent probability that human activities over the past 50 years have warmed our planet. The industrial activities that our modern civilization depends upon have raised atmospheric carbon dioxide levels from 280 parts per million to 400 parts per million in the last 150 years.	NASA (Facts/Causes)
Climate Change: How Do We Know?  	NASA (Facts/Evidence)
Carbon Dioxide: 412 ppm as of November 2019	NASA (Facts/Vital Signs)
Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010.	NASA (Facts/Evidence)
List of Worldwide Scientific Organizations The following page lists the nearly 200 worldwide scientific organizations that hold the position that climate change has been caused by human action. http://www.opr.ca.gov/facts/list-of-scientific-organizations.html NASA – Scientific Consensus: https://climate.nasa.gov/scientific-consensus/	NASA

Climate Change – Summary Statements of Cause/Effect - Continued	Source
 **Figure 22.6:** Greenhouse gas emissions (shown here in metric tons of carbon dioxide equivalent, or CO_{2e}, per geologic basin) from petroleum and natural gas production facilities in the Northern Great Plains are among the highest in the United States. The data used to produce this map are from EPA's Greenhouse Gas Reporting Program, which only includes facilities that emit 25,000 metric tons of CO_{2e} or more annually.[117] Each production facility must provide the total emissions from all their well pads in a geologic basin. Source: adapted from EPA 2017.[117]	NCA4 Vol II Chapter 22
"Strategies being employed in the region to reduce greenhouse gas emissions from the energy sector include increasing the performance of coal-fired power plants; offsetting fossil fuel-fired generation with renewable energy; conducting methane leak detection and repair programs using remote sensing technologies at natural gas operations; upgrading the equipment used to produce, store, and transport oil and gas; and demand-side management of electricity use."	

Future Effects	Source
Some of the long-term effects of global climate change in the United States are as follows, according to the Third and Fourth National Climate Assessment Reports: **Change will Continue Through This Century and Beyond.** Global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases emitted globally, and how sensitive the Earth's climate is to those emissions. **Temperatures Will Continue to Rise** Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time. **Frost-free Season (and Growing Season) will Lengthen** The length of the frost-free season (and the corresponding growing season) has been increasing nationally since the 1980s, with the largest increases occurring in the western United States, affecting ecosystems and agriculture. Across the United States, the growing season is projected to continue to lengthen. In a future in which heat-trapping gas emissions continue to grow, increases of a month or more in the lengths of the frost-free and growing seasons are projected across most of the U.S. by the end of the century, with slightly smaller increases in the northern Great Plains. The largest increases in the frost-free season (more than eight weeks) are projected for the western U.S., particularly in high elevation and coastal areas. The increases will be considerably smaller if heat-trapping gas emissions are reduced. **Changes in Precipitation Patterns** Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases. More winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century. Projections of future climate over the U.S. suggest that the recent trend towards increased heavy precipitation events will continue. This trend is projected to occur even in regions where total precipitation is expected to decrease, such as the Southwest. **More Droughts and Heat Waves** Droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) everywhere are projected to become more intense, and cold waves less intense everywhere. Summer temperatures are projected to continue rising, and a reduction of soil moisture, which exacerbates heat waves, is projected for much of the western and central U.S. in summer. By the end of this century, what have been once-in-20-year extreme heat days (one-day events) are projected to occur every two or three years over most of the nation.	NASA Facts/Effects
Note: Additional effects relate to Hurricane intensity, Sea Level Rise, and Arctic Ice levels. See https://climate.nasa.gov/effects/ for more information.	

Mitigating and Adapting to Climate Change

Responding to Climate Change Because we are already committed to some level of climate change, responding to climate change involves a two-pronged approach: 1. Reducing emissions of and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere ("mitigation"); 2. Adapting to the climate change already in the pipeline ("adaptation").	Source: NASA *Solutions/ Mitigation and Adaption*
Mitigation refers to measures to reduce the amount and speed of future climate change by reducing emissions of greenhouse gases (GHGs) or by increasing their removal from the atmosphere. Emission reduction measures include replacing conventional, CO2-emitting fossil fuel energy technologies or systems with low- or zero-emissions ones (such as wind, solar, nuclear, biofuels, fossil energy with carbon capture and storage, and energy efficiency measures), as well as changing technologies and practices in order to lower emissions of other GHGs such as methane, nitrous oxide, and hydrofluorocarbons. Measures that enhance the removal of CO2 from the atmosphere include changing land-use and management practices to store carbon in plants, trees, and soils; increasing ocean carbon storage through biological or chemical means; capturing atmospheric CO2 through engineered chemical reactions and storing it in geologic reservoirs; or converting terrestrial biomass into energy while capturing and storing the CO2. 16 Using captured CO2 in products such as polymers and cement is a potential alternative to geologic storage. The adoption of these measures may be promoted through a variety of policy instruments, such as emissions pricing (that is, GHG emission fees or emissions caps with permit trading), regulations and standards (such as emission standards, technology requirements, and building codes), subsidies (for example, tax incentives and rebates), and public funding for research, development, and demonstration programs.	NCA4 Vol II Chapter 29
Adaptation refers to actions taken at the individual, local, regional, and national levels to reduce risks from even today's changed climate conditions and to prepare for impacts from additional changes projected for the future. Adaptation involves managing both short- and long-term risks.	NCA4 Vol II Chapter 28
Timing and Magnitude of Action Current and future emissions, and thus emissions mitigation actions, are crucial for determining future risks and impacts. The scale of risks that can be avoided through mitigation actions is influenced by the magnitude of emissions reductions, the timing of those emissions reductions, and the relative mix of mitigation strategies for emissions of long-lived GHGs (namely, CO_2), short-lived GHGs (such as methane), and land-based biologic carbon. Intentional removal of CO_2 from the atmosphere, often referred to as negative emissions, or other climate interventions have also been proposed and may play a role in future mitigation strategies. Net cumulative CO_2 emissions in the industrial era will largely determine long-term global average temperature change and thus the risks and impacts associated with that change in the climate. Large reductions in present-day emissions of the long-lived GHGs are estimated to have modest temperature effects in the near term (over the next couple decades), but these emission reductions are necessary to achieve any long-term objective of preventing warming of any desired magnitude.	NCA4 Vol II Chapter 29

Decisions that decrease or increase emissions over the next few decades will set into motion the degree of impacts that will likely last throughout the rest of this century, with some impacts (such as sea level rise) lasting for thousands of years or even longer.	
Many activities within the public and private sectors aim for or have the effect of reducing greenhouse gas emissions, such as the increasing use of natural gas in place of coal or the expansion of wind and solar energy to generate electricity. Fossil fuel combustion accounts for approximately 85% of total U.S. greenhouse gas emissions, with agriculture, land-cover change, industrial processes, and methane from fossil fuel extraction and processing as well as from waste (including landfills, wastewater treatment, and composting) accounting for most of the remainder. A number of efforts exist at the federal level to promote low-carbon energy technologies and to increase soil and forest carbon storage. State, local, and tribal government approaches to mitigating greenhouse gas emissions include comprehensive emissions reduction strategies as well as sector- and technology-specific policies. Since NCA3, private companies have increasingly reported their greenhouse gas emissions, announced emissions reductions targets, implemented actions to achieve those targets, and, in some cases, even put an internal price on carbon. Individuals and other organizations are also making choices every day to reduce their carbon footprints. Market forces and technological change, particularly within the electric power sector, have contributed to a decline in U.S. greenhouse gas emissions over the past decade. In 2016, U.S. emissions were at their lowest levels since 1994. Power sector emissions were 25% below 2005 levels in 2016, the largest emissions reduction for a sector of the American economy over this time. This decline was in large part due to increases in natural gas and renewable energy generation, as well as enhanced energy efficiency standards and programs. **Given these advances in electricity generation, transmission, and distribution, the largest annual sectoral emissions in the United States now come from transportation.** As of the writing of this report, business-as-usual (as in, no new policies) projections of U.S. carbon dioxide and other greenhouse gas emissions show flat or declining trajectories over the next decade with a central estimate of about 15% to 20% reduction below 2005 levels by 2025.	NCA4 Vol II Overview
…. "Individual extreme weather and climate-related events—even those that have not been clearly attributed to climate change by scientific analyses—reveal risks to society and vulnerabilities that mirror those we expect in a warmer world." ….	NCA4 Vol II Overview
Reducing net emissions of CO_2 is necessary to limit near-term climate change and long-term warming. Other greenhouse gases (for example, methane) and black carbon aerosols exert stronger warming effects than CO_2 on a per ton basis, but they do not persist as long in the atmosphere; therefore, mitigation of non-CO_2 species contributes substantially to near-term cooling benefits but cannot be relied upon for ultimate stabilization goals. (*Very high confidence*) Stabilizing global mean temperature to less than 3.6°F (2°C) above preindustrial levels requires substantial reductions in net global CO_2 emissions prior to 2040 relative to present-day values and likely requires net emissions to become zero or	NCA4 Vol I Chapter 14 *Perspectives on Climate Change Mitigation*

possibly negative later in the century. After accounting for the temperature effects of non-CO_2 species, cumulative global CO_2 emissions must stay below about 800 GtC in order to provide a two-thirds likelihood of preventing 3.6°F (2°C) of warming. Given estimated cumulative emissions since 1870, no more than approximately 230 GtC may be emitted in the future to remain under this temperature threshold. Assuming global emissions are equal to or greater than those consistent with the RCP4.5 scenario, this cumulative carbon threshold would be exceeded in approximately two decades. (*High confidence*) Achieving global greenhouse gas emissions reductions before 2030 consistent with targets and actions announced by governments in the lead up to the 2015 Paris climate conference would hold open the possibility of meeting the long-term temperature goal of limiting global warming to 3.6°F (2°C) above preindustrial levels, whereas there would be virtually no chance if net global emissions followed a pathway well above those implied by country announcements. Actions in the announcements are, by themselves, insufficient to meet a 3.6°F (2°C) goal; the likelihood of achieving that goal depends strongly on the magnitude of global emissions reductions after 2030. (*High confidence*)	
While climate models incorporate important climate processes that can be well quantified, they do not include all of the processes that can contribute to feedbacks, compound extreme events, and abrupt and/or irreversible changes. For this reason, future changes outside the range projected by climate models cannot be ruled out (*very high confidence*). Moreover, the systematic tendency of climate models to underestimate temperature change during warm paleoclimates suggests that climate models are more likely to underestimate than to overestimate the amount of long-term future change (*medium confidence*).	NCA4 Vol I Chapter 15 *Potential Surprises – Compound Extremes and Tipping Elements*
The health benefits of reducing greenhouse gas emissions could result in economic benefits of hundreds of billions of dollars each year by the end of the century. Annual health impacts and health-related costs are projected to be approximately 50% lower under a lower scenario (RCP4.5) compared to a higher scenario (RCP8.5). These estimates would be even larger if they included the benefits of health outcomes that are difficult to quantify, such as avoided mental health impacts or long-term physical health impacts.	NCA4 Vol II *Chapter 14 Executive Summary*

Below are examples of Adoption Strategies provided by the Intergovernmental Panel on Climate Change (IPCC). The IPCC is the United Nations body for assessing the science related to climate change. https://www.ipcc.ch/

Table 14-1 | Categories and examples of adaptation options.

Category		Examples of options*
Structural/ physical	Engineered and built environment	Sea walls and coastal protection structures (5.5.2 and 24.4.3.5; Figure 5-5); flood levees and culverts (26.3.3); water storage and pump storage (Section 23.3.4); sewage works (3.5.2.3); improved drainage (24.4.5.5); beach nourishment (5.4.2.1); flood and cyclone shelters (11.7); building codes (Section 8.1.5); storm and waste water management (8.2.4.1); transport and road infrastructure adaptation (8.3.3.6); floating houses (8.3.3.4); adjusting power plants and electricity grids (10.2.2; Table 10-2)
	Technological	New crop and animal varieties (7.5.1.1.1, 7.5.1.1.3, 7.5.1.3; Box 9-3; Table 9-7); genetic techniques (27.3.4.2); traditional technologies and methods (7.5.2, 27.3.4.2, 28.2.6.1, and 29.6.2.1); efficient irrigation (10.3.6 and 22.4.5.7; Box 20-4); water saving technologies (24.4.1.5 and 26.3.3) including rainwater harvesting (8.3.3.4); conservation agriculture (9.4.3.1 and 22.4.5.7); food storage and preservation facilities (22.4.5.7); hazard mapping and monitoring technology (15.3.2.3 and 28.4.1); early warning systems (7.5.1.1, 8.1.4.2, 8.3.3.3, 11.7.3, 15.4.3.2, 18.6.4, 22.2.2.1, 22.3.5.3, and 22.4.5.2); building insulation (8.3.3.3); mechanical and passive cooling (8.3.3.3); renewable energy technologies (29.7.2); second-generation biofuels (27.3.6.2)
	Ecosystem-based[a]	Cross Chapter Box CC-EA, Ecological restoration (5.5.2, 5.5.7, 9.4.3.3, and 27.3.2.2; Box 15-1) including wetland and floodplain conservation and restoration; increasing biological diversity (26.4.3); afforestation and reforestation (Box 22-2); conservation and replanting mangrove forest (15.3.4 and 29.7.2); bushfire reduction and prescribed fire (Section 24.4.2.5; Box 26-2); green infrastructure (e.g., shade trees, green roofs) (8.2.4.5, 8.3.3, 11.7.4, and 23.7.4); controlling overfishing (28.2.5.1 and 30.6.1); fisheries co-management (9.4.3.4 and 27.3.3.1); assisted migration or managed translocation (4.4.2.4, 24.4.2.5, 24.4.3.5, and 25.6.2.3); ecological corridors (4.4.2.4); ex situ conservation and seed banks (4.4.2.5); community-based natural resource management (CBNRM) (22.4.5.6); adaptive land use management (Section 23.6.2)
	Services	Social safety nets and social protection (Box 13-2; 8.3, 17.5.1, and 22.4.5.2); food banks and distribution of food surplus (29.6.2.1); municipal services including water and sanitation (3.5.2.3 and 8.3.3.4); vaccination programs (11.7.1), essential public health services (11.7.2) including reproductive health services (11.9.2) and enhanced emergency medical services (8.3.3.8); international trade (9.3, 9.4, and 23.9.2)
Social	Educational	Awareness raising and integrating into education (11.7, 15.2, and 22.4.5.5); gender equity in education (Box 9-2); extension services (9.4.4); sharing local and traditional knowledge (12.3.4 and 28.4.1) including integrating into adaptation planning (29.6.2.1); participatory action research and social learning (22.4.5.3); community surveys (Section 8.4.2.2); knowledge-sharing and learning platforms (8.3.2.2, 8.4.2.4, 15.2.4.2, and 22.4.5.4); international conferences and research networks (8.4.2.5); communication through media (22.4.5.5)
	Informational	Hazard and vulnerability mapping (11.7.2, 8.4.1.5); early warning and response systems (15.4.2.3 and 22.4.5.2) including health early warning systems (11.7.3, 23.5.1, 24.4.6.5, and 26.6.3); systematic monitoring and remote sensing (15.4.2.1 and 28.6); climate services (2.3.3) including improved forecasts (27.3.4.2); downscaling climate scenarios (8.4.1.5); longitudinal data sets (26.6.2); integrating indigenous climate observations (22.4.5.4, 25.8.2.1, and 28.2.6.1); community-based adaptation plans (5.5.1.4 and 24.4.6.5) including community-driven slum upgrading (8.3.2.2) and participatory scenario development (22.4.4.5)
	Behavioral	Accommodation (5.5.2); household preparation and evacuation planning (23.7.3); retreat (5.5.2) and migration (29.6.2.4), which has its own implications for human health (11.7.4) and human security (12.4.2); soil and water conservation (23.6.2 and 27.3.4.2); livelihood diversification (7.5.1.1, 7.5.2, and 22.4.5.2); changing livestock and aquaculture practices (7.5.1.1); crop-switching (22.3.4.1); changing cropping practices, patterns, and planting dates (7.5.1.1.1, 23.4.1, 26.5.4, and 27.3.4.2; Table 24-2); silvicultural options (25.7.1.2); reliance on social networks (Section 29.6.2.2)
Institutional	Economic	Financial incentives including taxes and subsidies (Box 8-4; 8.4.3 and 17.5.6); insurance (8.4.2.3, 13.3.2.2, 15.2.4.6, 17.5.1, 26.7.4.3, and 29.6.2.2; Box 25-7) including index-based weather insurance schemes (9.4.2 and 22.4.5.2); catastrophe bonds (8.4.2.3 and 10.7.5.1); revolving funds (8.4.3.1); payments for ecosystem services (9.4.3.3 and 27.6.2; Table 27-7); water tariffs (8.3.3.4.1 and 17.5.3); savings groups (8.4.2.3 and 11.7.4; Box 9-4); microfinance (Box 8-3; 22.4.5.2); disaster contingency funds (22.4.5.2 and 26.7.4.3); cash transfers (Box 13-2)
	Laws and regulations	Land zoning laws (22.4.4.2 and 23.7.4); building standards (8.3.2.2, 10.7.5, and 22.4.5.7); easements (27.3.3.2); water regulations and agreements (26.3.4 and 27.3.1.2); laws to support disaster risk reduction (8.3.2.2); laws to encourage insurance purchasing (10.7.6.2); defining property rights and land tenure security (22.4.6 and 24.4.6.5); protected areas (4.4.2.2); marine protected areas (Box CC-CR Chapter 6; 23.6.5 and 27.3.3.2); fishing quotas (23.9.2); patent pools and technology transfer (15.4.3 and 17.5.5)
	Government policies and programs	National and regional adaptation plans (15.2 and 22.4.4.2; Box 23-3) including mainstreaming climate change; sub-national and local adaptation plans (15.2.1.3 and 22.4.4.4; Box 23-3); urban upgrading programs (8.3.2.2); municipal water management programs (8.3.3.4; Box 25-2); disaster planning and preparedness (11.7); city-level plans (8.3.3.3 and 27.3.5.2; Boxes 26-3 and 27-1), district-level plans (26.3.3), sector plans (26.5.4), which may include integrated water resource management (3.6.1 and 23.7.2), landscape and watershed management (4.4.2.3), integrated coastal zone management (2.4.3, 5.5.4.1, and 23.7.1), adaptive management (2.2.1.3 and 5.5.1.4; Box 5-2), ecosystem-based management (6.4.2.1), sustainable forest management (2.3.4), fisheries management (7.5.1.1.3 and 30.6.2.1), and community-based adaptation (5.5.4.1, 8.4, 15.2.2, 21.3.2, 22.4.4.5, 24.5.2, 29.6.2.2, and 29.6.2.3; Tables 5-4 and 8-4; FAQ 15.1)

https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap14_FINAL.pdf

Use of Scenarios Climate modeling experts develop climate projections for a range of plausible futures. These projections capture variables such as the relationship between human choices, greenhouse gas (GHG) and particulate matter emissions, GHG concentrations in our atmosphere, and the resulting impacts, including temperature change and sea level rise. Some projections are consistent with continued dependence on fossil fuels, while others are achieved by reducing GHG emissions. The resulting range of projections reflects, in part, the uncertainty that comes with quantifying future human activities and their influence on climate. The most recent set of climate projections developed by the international scientific community is classified under four Representative Concentration Pathways, or RCPs. A wide range of future socioeconomic assumptions could be consistent with the RCPs used throughout NCA4. NCA4 focuses on RCP8.5 as a "higher" scenario, associated with more warming, and RCP4.5 as a "lower" scenario with less warming. Other RCP scenarios (e.g., RCP2.6, a "very low" scenario) are used where instructive, such as in analyses of mitigation science issues. To promote understanding while capturing the context of the RCPs, authors use the phrases "a higher scenario (RCP8.5)" and "a lower scenario (RCP4.5)." RCP8.5 is generally associated with higher population growth, less technological innovation, and higher carbon intensity of the global energy mix. RCP4.5 is generally associated with lower population growth, more technological innovation, and lower carbon intensity of the global energy mix. NCA4 does not evaluate the feasibility of the socioeconomic assumptions within the RCPs. Future socioeconomic conditions—and especially the relationship between economic growth, population growth, and innovation—will have a significant impact on which climate change scenario is realized.	NCA4 Vol II *Guide to This Report*
RCPs are not emissions scenarios; they are radiative forcing scenarios. Each scenario is tied to one value: the change in radiative forcing at the tropopause by 2100 relative to preindustrial levels. The four RCPs are numbered according to the change in radiative forcing by 2100: +2.6, +4.5, +6.0 and +8.5 watts per square meter (W/m^2). Atmospheric carbon dioxide levels for RCP8.5 rise from current-day levels of 400 up to 936 ppm (ppm) by the end of this century… and global temperature is projected to increase by 5.4°–9.9°F (3°–5.5°C) by 2100 relative to the 1986–2005 average. Under the lower scenarios (RCP4.5 and RCP2.6), atmospheric CO_2 levels remain below 550 and 450 ppm by 2100, respectively.	NCA4 Vol I *Chapter 4*

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Hazard Profiles – Section 10

Table of Contents

Hazard Profiles are included Alphabetically by Hazard Name.

- Active Threat
- Aircraft Accident
- Biological Infestation
- Civil Disturbance
- Communicable Disease
- Dam Failure
- Drought
- Fire
- Flood
- Geologic Hazards
- Hazardous Materials Release
- Severe Summer Weather
- Shortage or Outage of Critical Materials or Infrastructure
- Tornado
- Train Derailment
- Wildland Fire
- Winter Storm

Nine of the hazards are addressed primarily as **Natural Hazards**: Biological Infestation, Communicable Disease, Drought, Flood, Geologic Hazards, Severe Summer Weather, Tornado, Wildland Fire, and Winter Storm.

Eight of the Hazards are addressed primarily as **Technological or Human-Caused Hazards**: Active Threat, Aircraft Accident, Dam Failure, Fire, Hazardous Materials Release, Shortage or Outage of Critical Materials or Infrastructure, and Train Derailment.

In some cases, hazards may be the result of natural, technological, and/or human caused. Each hazard is categorized based on the more likely cause of significant impact.

Methodology

Each hazard or group of related hazards has its own profile. A stand-alone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. The Tornado hazard was addressed separately from Severe Summer Weather because of the significant differences in terms of probability as well as impact compared to other summer storms and because local citizens tend to identify it as its own unique hazard. Each hazard contains a hazard *Description, Risk Assessment, and Vulnerability Assessment.* Hazard descriptions are based on reliable sources including area expertise. Risk Assessment methodology is explained in Section 9. The hazard profiles contain a vulnerability assessment table which is used as a tool to identify vulnerabilities from different perspectives – such as potential vulnerability to Continuum of Government/Continuity of Operations (COG/COOP). Vulnerability summary statements are based on vulnerability assessments within each hazard profile, and are included in section 3 of this mitigation plan.

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Active Threat – Hazard Profile

Description

Vulnerabilities and specific mitigation actions will not be included in this plan for the Active Threat Hazard to avoid compromising safety and security of specific facilities and populations. Regarding the active threat hazard, the mitigation plan content is limited to profiling the hazard, identifying existing mitigation or prevention measures, and identifying general risk mitigation recommendations.

Active Threat

The Bismarck Police Department has developed an "Active Threat Response Plan" to provide uniform guidelines and provisions for use in responding and resolving situation involving crimes of violence in progress involving an Active Threat situation with the potential for more victims. Active Threat crimes include, but are not limited to situation such as Active assailants in schools, businesses, public places, gatherings as well as any other type of ongoing crime of violence where innocent victims are in in continuous imminent danger due to the ongoing act of an Active Threat.

Active Threat definition (within Bismarck PD Active Threat Response Plan): Subject or subjects that are utilizing deadly force and without intervention would continue to do so while, having unrestricted access to additional victims. The means of deadly force by the subject does not necessarily need to be that of a firearm.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Active Threat:

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	None/Negligible	Moderate	Minor

Building Security Risk Mitigation Recommendations (ie: Active Threat Hazard)

Procedures:

- Conduct a realistic security assessment to determine the facility's vulnerability to an active assailant attack.
- Identify multiple evacuation routes and practice evacuations under varying conditions; post evacuation routes in conspicuous locations throughout the facility; ensure that evacuation routes account for individuals with special needs and disabilities.
- Designate shelter locations with thick walls, solid doors with locks, minimal interior windows, first-aid emergency kits, communication devices, and duress alarms.
- Designate a point-of-contact with knowledge of the facility's security procedures and floor plan to liaise with police and other emergency agencies in the event of an attack.
- Incorporate an active assailant/threat drill into the organization's emergency preparedness procedures.
- Vary security guards' patrols and patterns of operation.
- Limit access to blueprints, floor plans, and other documents containing sensitive security information, but make sure these documents are available to law enforcement responding to an incident.
- Establish a central command station for building security.

Systems:

- Put in place credential-based access control systems that provide accurate attendance reporting, limit unauthorized entry, and do not impede emergency egress.
- Put in place closed-circuit television systems that provide domain awareness of the entire facility and its perimeter; ensure that video feeds are viewable from a central command station.
- Put in place communications infrastructure that allows for facility-wide, real-time messaging.
- Put in place elevator systems that may be controlled or locked down from a central command station.

Training:

- Train building occupants on response options outlined by the Department of Homeland Security in "Active Assailant: How to Respond" when an active assailant is in the vicinity.
    - **Evacuate**: Building occupants should evacuate the facility if safe to do so; evacuees should leave behind their belongings, visualize their entire escape route before beginning to move, and avoid using elevators or escalators.
    - **Hide**: If evacuating the facility is not possible, building occupants should hide in a secure area (preferably a designated shelter location), lock the door, blockade the door with heavy furniture, cover all windows, turn off all lights, silence any electronic devices, lie on the floor, and remain silent.
    - **Take Action**: If neither evacuating the facility nor seeking shelter is possible, building occupants should attempt to disrupt and/or incapacitate the active shooter by throwing objects, using aggressive force, and yelling.
- Train building occupants to call 911 as soon as it is safe to do so.
- Train building occupants on how to respond when law enforcement arrives on scene: follow all official instructions, remain calm, keep hands empty and visible at all times, and avoid making sudden or alarming movements.

Aircraft Accident – Hazard Profile

Description

The property of Bismarck Airport, located in south Bismarck, consists of 2,400 acres which includes two runways, a control tower, and a 70,000 square foot terminal building completed in 2005.

In part because of the economic growth in Bismarck and in the state, as well as being a destination location for hunters and other tourists, the airport continues to expand its commercial flight options and is actively used by those using or owning privately owned smaller aircraft. Throughout much of the airports history, there have typically been two commercial airlines providing service. As of 2019, there are five commercial airlines and 79 general aviation based airplanes. The airport now has more flights, more destinations, and more use of the airport by the local, regional, and wider community.

Total annual passenger boardings continue to increase:

Total Annual Passenger Boardings				
2010	**2011**	**2012**	**2013**	**2014**
194,043	196,414	236,172	237,683	245,205
2015	**2016**	**2017**	**2018**	**2019**
259,734	271,022	272,739	282,363	309,337

Additional information regarding the Bismarck Airport: www.bismarckairport.com

In most disasters, death and injury represent one of the effects of the hazard, while in aircraft accidents (ie: incidents involving major airlines), mass casualties are often the primary impact and focus of the event. An aircraft accident may be intentional as well. Terrorists have used transportation, particularly mass transportation, as a method of delivering their attacks throughout the world.

A mass casualty event from an airline crashing on or near the airport would stress the city's hospitals, clinics and emergency response capabilities. Mass casualties can be defined as an incident resulting in a large number of deaths and/or injuries that reaches a magnitude that overwhelms local resources. In this case, mutual aid as well as state, federal, and private resource assistance would be requested.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings

(1) Commercial Aircraft Accident (accidental with >50 passengers)
(2) Aircraft as Weapon

	Consequence			
Frequency	Human	Economic	Psychological	Government
(1) Possible	Catastrophic	Catastrophic	Moderate	Minor
(2) Possible	Catastrophic	Catastrophic	Significant	Moderate

Climate Change Impact:

Impact would be indirect. Projected increases in frequency or intensity of storms may impact likelihood.

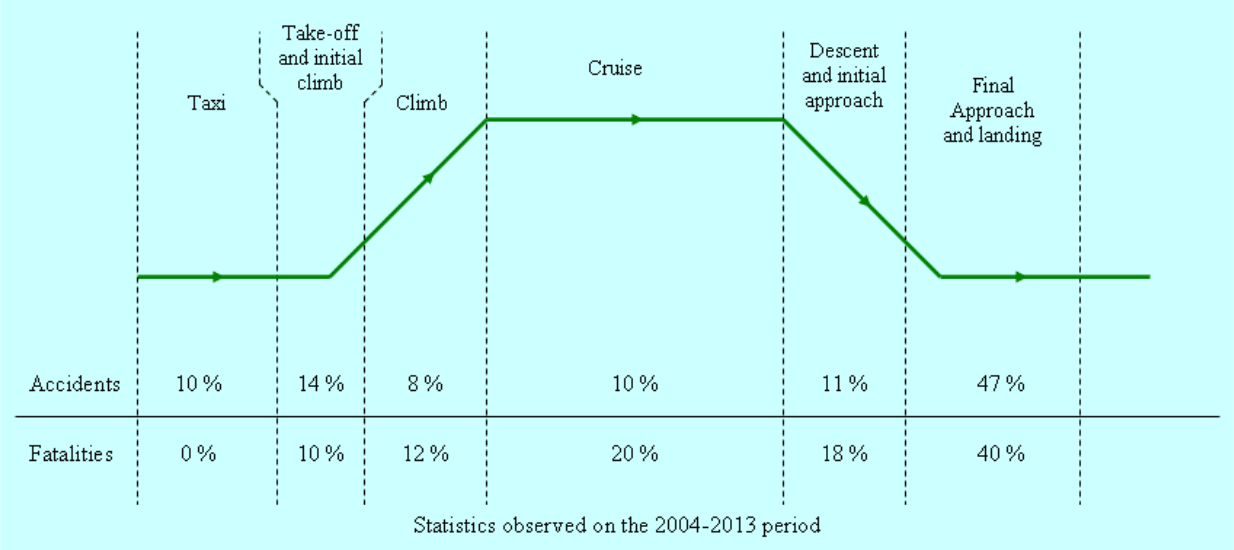
History:

As of 2019, there have been no large commercial line aircraft accidents at the Bismarck Airport or within Burleigh County. However, there have been accidents and even fatalities involving smaller aircraft. The largest number of fatalities for any one incident within Burleigh County is one fatality. Most aircraft accidents involve smaller aircraft.

Bismarck Airport may also be the receiver of redirected flights for aircraft requiring emergency landing. In these cases, the aircraft is not landing at its destination location. Airline incidents and incident related information can be found at the National Transportation Safety Board website: http://www.ntsb.gov/

Airplane Accident Statistics

http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html

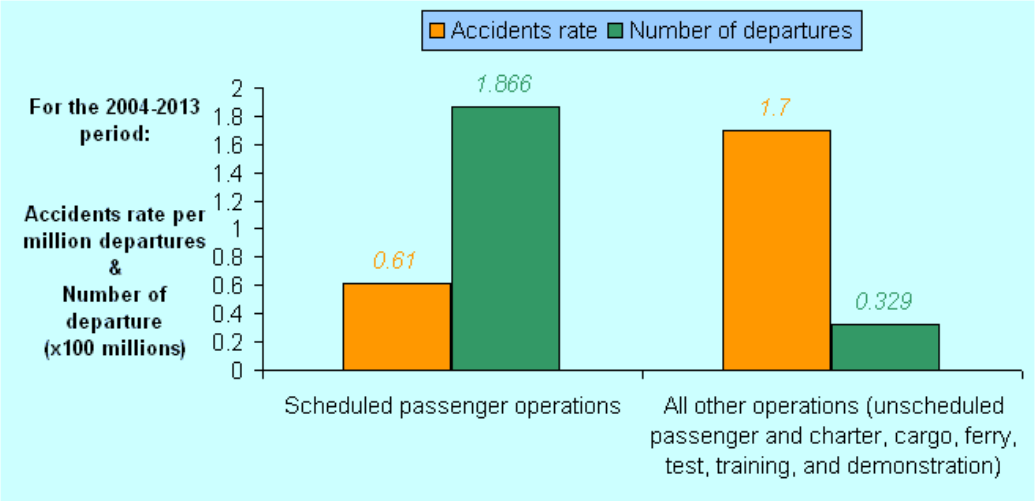


Eighty percent (80%) of all aircraft accidents take place during the departure (take-off/climb) and arrival (approach/landing stages). During these phases aircraft are close to the ground and in a more vulnerable configuration than during flight phases.

Over half of all accidents occur during the final approach and landing stages. These aren't the most devastating accidents, however. A runway overrun may result in only a few injuries, for example.

Fatal accidents are more likely to occur during the climbing stage. If the aircraft left the gate with undetected faults, these may become apparent during the climb, as the first stage taking place off the ground, and could prove dangerous. If the crew believe the failure requires the aircraft to land as soon as possible, they will decide to perform an IFTB (In-Flight Turn Back). This could turn out to be difficult, however, as the aircraft may have already lost some of its capabilities.

Reference: http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html

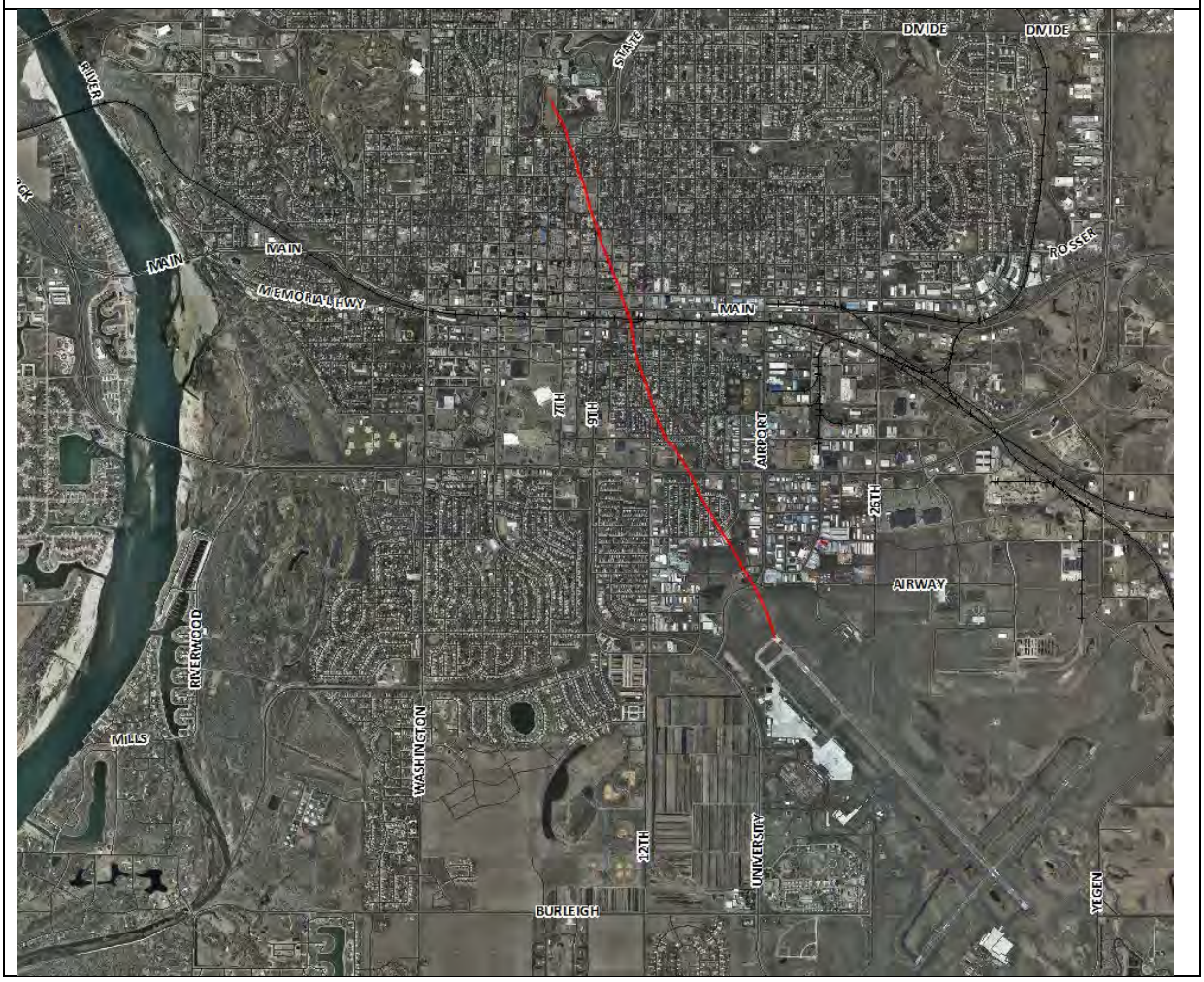
Scheduled passenger operations are the most common operations, yet, they result in fewer accidents than all other operations combined (unscheduled passenger and charter, cargo, ferry, test, training, and demonstration).	
http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html	

Vulnerability

The **Accident Potential Zone (APZ)** encompasses an area that extends 15,000 feet beyond the ends of the runway. Reference: Aircraft Rescue and Fire Fighting IFSTA Manual 5th Addition.

The width of the zone would vary depending on the type of aircraft as well as any turns made shortly after take-off or turns made prior to landing. The red line within the map is an example and does NOT represent a complete Accident Potential Zone.

Approximate distance from the end of the runway to the State Capitol is 14,500 feet (noted by red line). Approximate distance to the two major hospitals is 9,000 to 10,000 feet.



The highest population and number of properties within 15,000 feet (within the APZ) of the Bismarck Airport are northwest of the airport based on the alignment of the runway running NW/SE. Properties and populations within that distance include CHI St. Alexius Health, Sanford Health, the State Capitol, five mobile home parks, twelve schools, and Bismarck critical facilities including Bismarck Police Department, the City/County Building and Bismarck Burleigh Public Health.

The most vulnerable populations are the crew members and frequent travelers based on extensive use of aircraft (higher use equals higher risk or probability).

The city of Lincoln, as it continues to grow, will be within the air traffic pattern of the Bismarck Airport (within the Accident Potential Zone).

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Aircraft Accident– Commercial Airline
Probability	Possible
Speed of Onset	No notice event or may have some notice based on identified issues creating risk (prior to landing)
Geographic Area	Not specific, however, areas of concern include the geographic area within the Accident Potential Zone (APZ)
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Crash impact and/or Fire A. Crew and Passengers B. Those within the APZ (higher risk)
Mass Casualty Incident	1. Yes. Mass casualty is the primary concern for aircraft accidents.
Property Losses	1. Properties within the Accident Potential Zone.
Environmental	1. An aircraft accident could involve the Missouri River, Hay Creek, or Apple Creek. Environmental impact would be primarily fuel and debris entering the waterways.
COG/COOP	Critical Facilities within the APZ: 1. City County Building 2. Bismarck Police Department 3. Bismarck Burleigh Public Health 4. State Capitol 5. Burleigh County Courthouse 6. United Tribes Technical College, although in close proximity, is NOT within the flight path.
Critical Facilities	1. See COG/COOP above. 2. Bismarck Civic Center 3. CHI St. Alexius Health 4. Sanford Health
Critical Infrastructure	1. Railroad (BNSF) is within APZ 2. DMVW Railroad within APZ

	Aircraft Accident– Commercial Airline
Schools	Schools within the APZ: 1. Jeanette Myhre Elementary School 2. Bismarck High School 3. St. Mary's Central High School 4. Willmore Elementary 5. BECEP 6. St. Anne's Grade School 7. Pioneer Elementary 8. Saxvik Elementary 9. Simle Middle School 10. South Central Middle School 11. Roosevelt Elementary 12. Cathedral Elementary
High Risk Facilities (chemical)	1. Airport Fuel Farm
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Crescent Manor 2. Mobile Home Parks: Holiday Park, Airport Village, Skyway Park Village, Stardust Terrace, Colonial Estates
Economy (community wide)	Catastrophic (THIRA Rating)
OTHER:	

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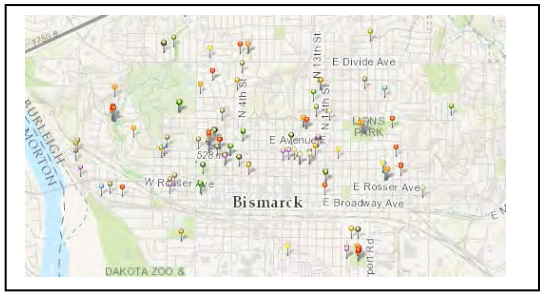
Biological Infestation – Hazard Profile

Urban Forest Damaging Pests

Description

There are several pests and diseases, some more harmful than others, that are prevalent in Bismarck.

Dutch Elm Disease (DED): The most common disease in Bismarck every year is Dutch Elm Disease (DED). Approximately twenty Elm trees are removed in Bismarck each year due to DED. Click here to view the map showing the history of DED.





Dutch elm disease (DED) was first detected in North Dakota in 1969, and has since been recorded in all North Dakota counties. Dutch elm disease is a wilt disease caused by the fungus *Ophiostoma novo-ulmi* and only affects trees in the elm family (*Ulmaceae*). Dutch elm disease (DED) is spread (vectored) by native elm bark beetles, European elm bark beetles and the banded elm bark beetle in North Dakota. DED is also spread by moving elm firewood from infected trees into new areas.

First detected in Mandan, North Dakota in 1969, Dutch Elm Disease (DED) is a fungus that is spread by elm bark beetles. When an elm tree is infected with DED, branches in the upper crown will yellow, curl and wilt, commonly referred to as *flagging*. If a healthy elm tree is next to a tree infected with DED it is possible for the fungus to spread through the root systems. This happens when trees are planted close together and as they mature their roots fuse together, also known as root grafting.

Tree mortality can occur within one year of infection, though DED generally takes three years or more to kill a tree.

Why is Dutch elm disease a problem?

- Dutch elm disease kills trees rapidly and spreads readily if not properly managed.
- There is no 'cure' for DED and the disease is widespread in urban and rural areas throughout North Dakota.
- Dutch elm disease kills American elm trees, the North Dakota State Tree, which is well-adapted to environmental conditions in our state.
- Management of Dutch elm disease in North Dakota communities is costly.

What are the current impacts of Dutch elm disease in North Dakota?

- Continual need to spend considerable amounts of money to manage Dutch elm disease in North Dakota communities.
- Continual loss of a prominent, well-adapted tree species in natural settings.
- Continual incremental loss of a prominent and excellent tree for urban settings.

The Forestry Division is also on watch for Emerald Ash Borer (EAB). EAB attacks Ash (*Fraxinus*) trees. It has not been found in the State of North Dakota; however, EAB has been found in other Midwest States, including Minnesota.

Emerald Ash Borer (EAB) is an invasive pest from China that first appeared in Detroit, MI from there it has spread out to Colorado, Kansas, South Dakota, Texas, Oklahoma, Georgia, Maine, Minnesota and all states in-between. EAB has now spread to 35 states. EAB has also been found in Winnipeg, MB. The world has become a Global Market, meaning North America and other countries are receiving material from other parts of the world. Along with these products invasive pest are also being shipped. Looking back at the major pest problems all are an invasive pest or disease; Gypsy Moth, Dutch Elm Disease (DED), Chestnut Blight, and now EAB. It is difficult to tell what future pest will be introduced to the North America and North Dakota. In the case of EAB, the City of Bismarck has close to 30% of the boulevard trees are composed of an ash species. Bismarck has been successful in its efforts with DED. As the City report states when City staff has to address EAB this will detract from our DED program. This will then put the 20% elm street tree population at risk of finally succumbing to DED. With those two efforts the City of Bismarck has the potential of losing 50% of its street population. This does not account for the Bismarck Park District and private trees.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

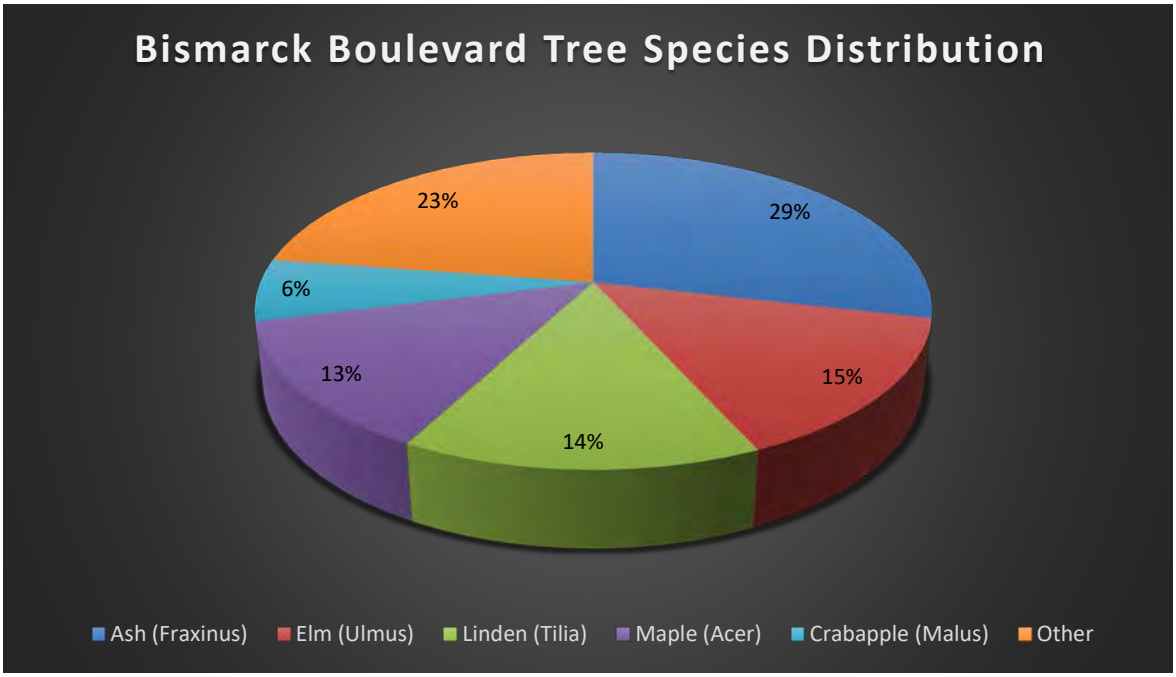
THIRA Ratings – Biological Infestation – EAB or DED

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	None/Negligible	Moderate	None/Negligible	None/Negligible

Climate Change Impact:

Among other anticipated changes, projected warmer and generally wetter conditions with elevated atmospheric carbon dioxide concentrations are expected to increase the abundance and competitive ability of weeds and invasive species.	NCA4 Vol II Chapter 22 (Northern Great Plains)

History: EAB is an exotic wood boring beetle that attacks all ash species and its cultivated varieties. Since its discovery in the United States in 2002, the insect has emerged in the states of Michigan, Ohio, Indiana, Illinois, Kentucky, Maryland, Pennsylvania, West Virginia, Wisconsin, Minnesota, New York, Quebec, Canada and Ontario, Canada. This pest has killed millions of ash trees along the way.



Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Biological Infestation – Emerald Ash Borer and Dutch Elm Disease
Probability	Likely
Speed of Onset	Slow
Geographic Area	City, County, Statewide
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Trimming or removing trees. A. Those without adequate training or experience in tree removal, if attempting to trim or remove their own trees. B. City Forestry staff due to a potentially high number of impacted trees should EAB impact Bismarck.
Mass Casualty Incident	No.
Property Losses	1. Potentially ALL Ash Trees (Emerald Ash Borer) 2. Elm Trees (Dutch Elm Disease)
Environmental	1. Loss of shading and protection increases heating and cooling requirements (and costs) of surrounding facilities. 2. Aesthetics. 3. Storm water system impacted due to rainwater not being intercepted by mature trees.
COG/COOP	1. No impact on continuity of government or continuity of operations.
Critical Facilities	1. None.
Critical Infrastructure	1. None.
Schools	1. None.
High Risk Facilities (chemical)	1. None.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. None.
Economy (community wide)	Moderate impact. See “Scope of Emerald Ash Borer Impact on Bismarck” below.
OTHER:	Transporting of infested firewood.

Scope of Emerald Ash Borer Impact on Bismarck:
Ash is one of the most important and abundant species in the City of Bismarck and the surrounding area. Ash composes nearly 29% of all street trees (6,444 street trees, all of these ash trees will be impacted by EAB) in Bismarck. This does not take into account park property and private trees in Bismarck. Once introduced to Bismarck and the surrounding area, it is likely that every ash tree will be impacted by EAB.

In 2020, the Forestry Division surveyed a few local tree services and nurseries to develop cost estimates. The estimates presented here represent 2020 dollars:
Removal and stump grinding of a medium sized tree could cost $1000 per tree. Replanting a 2" caliper tree would cost anywhere from $500-550 per tree. Taking a conservative approach, the City would be spending 5.5 million dollars for removals and citizens could spend 3 million dollars replanting lost ash trees. This does not account for the lost economic benefits that these trees provide to the City and the residents such as; more rainwater would work its way into the storm water systems without the trees to intercept the rainwater, household cooling cost would increase due to the lost shade provided by the trees, winter heating cost would increase without these trees blocking the harsh winter winds.

This impact would have an enormous economic, social and ecological impact to the City.
To review the entire City of Bismarck Emerald Ash Borer Response Plan, visit the following website:
http://www.bismarcknd.gov/DocumentCenter/Home/View/2124

Civil Disturbance – Hazard Profile

Description

Civil disturbance is a term that is typically used by law enforcement to describe forms of disturbance caused by groups of people. Civil disturbance is typically a symptom of socio-political problems in the form of a protest or riot. The severity of these actions typically coincide with the level of public outrage.

Civil disturbances can also arise out of labors disputes, correction center uprisings, or a public gathering or event that becomes disorderly. Civil disturbance can range from a group of people impeding access to a building, blocking a street, or disrupting normal activity through noise or intimidation. Civil disturbance can manifest in many different levels of disruption. These vary from a peaceful demonstration, such as a sit-in to a mob that burns or destroys property and terrorizes and assaults citizens. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. Often protests intended to be a peaceful demonstration to the public and the government can escalate into general chaos. There are two types of large gatherings typically associated with civil disturbances: a crowd and a mob. A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified in to the following four categories (Blumer 1946):

- Casual Crowd: A casual crowd is a group of people who happen to be in the same place at the same time. Violent conduct does not occur.

- Cohesive Crowd: A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting event. Members of these crowds may have intense internal discipline, and require substantial provocation to arouse to action.

- Expressive Crowd: An expressive crowd is one held together by a common commitment or purpose. They may not be formally organized, and are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest.

- Aggressive Crowd: An aggressive crowd is composed of individuals who have assembled for a specific purpose. This crowd often has leaders who attempt to arouse the members or motivate them to action. Members are noisy and threatening and will taunt authorities. They may be more impulsive and emotional and require only minimal stimulation to arouse violence. Examples of this type of civil unrest crowd could include demonstrators and strikers, though not all demonstrators and strikers are aggressive.

Civil unrest and disturbances affect the following factions of society:

- The Public: The general population could serve as participants or targets in actions of civil unrest. Wide spread unrest could cause fear amongst the populace and cause them to be absent from school or work activities. During an event, bystanders may be harmed because of the activities of participants.

- Responders: Responses to civil unrest events are generally handled at the local level. In a large event, the resources of a local jurisdiction may be exceeded. In this instance, State resources would be activated to fill the need. During an event, responders may become targets, which could hamper their effectiveness.

- Continuity of Operations: The outbreak of widespread rioting or looting could have potential impact on the City's ability to provide services and conduct its normal operations. Protesters could occupy government buildings and interrupt the normal functions of government, or targeted attacks on government facilities could interrupt operations entirely.

- Property: Private property often serves as a target in instances of civil unrest. Businesses can be targeted for looting or vandalism. If an event is particularly large, damage could reach millions of dollars and recovery could take years.

- Facilities: Often in acts of civil unrest government facilities become the focal point of protests or targets for vandalism. Damage suffered during an event or the inability of a worker to enter a facility may greatly reduce a facility's effective capacity or close it completely.

- Infrastructure: Similar to government facilities, public and private infrastructure can become targets of civil unrest. Damage to transportation, communications, or utilities infrastructure could further exacerbate the situation.

- Environment: Normally, instance of civil unrest will have a minimal impact on the environment. However, if petroleum or other chemical facilities were a target for vandalism or large-scale fires occurred, the impact on the environment could be significant.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Civil Disturbance:

	*Consequence			
*Frequency	Human	Economic	Psychological	Government
Unlikely	None/Negligible	None/Negligible	Minor	None/Negligble

*The risk analysis above is primarily based on the lack of historical incidents within the City of Bismarck.

Mitigation:

The City of Bismarck bears the first and primary responsibility to control the disturbance within the city limit of Bismarck. Civil unrest that remains uncontrolled warrants local mutual aid from neighboring municipalities and/or county resources. If the civil unrest remains beyond the capabilities of local law enforcement agencies alone, the North Dakota Highway Patrol assistance may be requested. If the restoration of law and order is beyond local, county and state abilities, the Governor may declare a State of Emergency calling on federal support such as the North Dakota National Guard to assist in restoring order.

It is a continuing goal of the Bismarck Police Department to train officers to respond to civil disturbance situations in a professional and tactical manner. Officers are trained Field Force Operations and Field Force Extrication Tactics from the Center of Domestic Preparedness in Anniston, Al.

Building Security Risk Mitigation Recommendations (ie: Active Threat Hazard)

Procedures:

- Conduct a realistic security assessment to determine the facility's vulnerability to an active assailant attack.
- Identify multiple evacuation routes and practice evacuations under varying conditions; post evacuation routes in conspicuous locations throughout the facility; ensure that evacuation routes account for individuals with special needs and disabilities.
- Designate shelter locations with thick walls, solid doors with locks, minimal interior windows, first-aid emergency kits, communication devices, and duress alarms.
- Designate a point-of-contact with knowledge of the facility's security procedures and floor plan to liaise with police and other emergency agencies in the event of an attack.
- Incorporate an active assailant/threat drill into the organization's emergency preparedness procedures.
- Vary security guards' patrols and patterns of operation.
- Limit access to blueprints, floor plans, and other documents containing sensitive security information, but make sure these documents are available to law enforcement responding to an incident.
- Establish a central command station for building security.

Systems:

- Put in place credential-based access control systems that provide accurate attendance reporting, limit unauthorized entry, and do not impede emergency egress.
- Put in place closed-circuit television systems that provide domain awareness of the entire facility and its perimeter; ensure that video feeds are viewable from a central command station.
- Put in place communications infrastructure that allows for facility-wide, real-time messaging.
- Put in place elevator systems that may be controlled or locked down from a central command station.

Training:

- Train building occupants on response options outlined by the Department of Homeland Security in "Active Assailant: How to Respond" when an active assailant is in the vicinity.

    - **Evacuate**: Building occupants should evacuate the facility if safe to do so; evacuees should leave behind their belongings, visualize their entire escape route before beginning to move, and avoid using elevators or escalators.
    - **Hide**: If evacuating the facility is not possible, building occupants should hide in a secure area (preferably a designated shelter location), lock the door, blockade the door with heavy furniture, cover all windows, turn off all lights, silence any electronic devices, lie on the floor, and remain silent.
    - **Take Action**: If neither evacuating the facility nor seeking shelter is possible, building occupants should attempt to disrupt and/or incapacitate the active shooter by throwing objects, using aggressive force, and yelling.
- Train building occupants to call 911 as soon as it is safe to do so.
- Train building occupants on how to respond when law enforcement arrives on scene: follow all official instructions, remain calm, keep hands empty and visible at all times, and avoid making sudden or alarming movements.

Communicable Disease - Hazard Profile

Includes Pandemic Influenza, Bio-Terrorism, and specific infectious diseases

Description

Communicable diseases are naturally occurring biological diseases in humans as well as those biological agents found in the environment, or diagnosed in animals, that have the potential for transmission to humans. An infectious disease is a clinically evident illness resulting from the presence of pathogenic biological agents, including pathogenic viruses, pathogenic bacteria, fungi, protozoa, multicellular parasites, and aberrant proteins known as prions. These pathogens are able to cause disease in animals and/or plants. Infectious pathologies are also called communicable diseases or transmissible diseases due to their potential of transmission from one person or species to another by a replicating agent (as opposed to a toxin).

Transmission of an infectious disease may occur through one or more of diverse pathways including physical contact with infected individuals. These infecting agents may also be transmitted through liquids, food, body fluids, contaminated objects, airborne inhalation, or through vector-borne spread. Transmissible diseases which occur through contact with an ill person or their secretions, or objects touched by them, are especially infective, and are sometimes referred to as contagious diseases. Infectious (communicable) diseases which usually require a more specialized route of infection, such as vector transmission, blood or needle transmission, or sexual transmission, are usually not regarded as contagious, and thus are not as amenable to medical quarantine of victims.

Human epidemics may lead to quarantines, large-scale use of the medical care system, and mass fatalities. Typically, the elderly, young children, and those with suppressed immune systems at greatest risk from communicable diseases. The following biologic agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. (Centers for Disease Control and Prevention, 2010)

In addition to global disease and bioterrorism concerns, naturally occurring diseases can threaten communities. Natural illnesses of particular concern include Influenza, Meningitis, Pertussis (Whooping Cough), Measles, Norwalk Virus, Severe Acute Respiratory Syndrome (SARS), and food-borne illnesses such as E. coli and Salmonella outbreaks, among others. These diseases can infect populations rapidly, particularly through groups of people in close proximity such as schools, assisted living facilities, and workplaces.

An **influenza pandemic** is a global outbreak of a new influenza A virus. Pandemics happen when new (novel) influenza A viruses emerge which are able to infect people easily and spread from person to person in an efficient and sustained way. https://www.cdc.gov/flu/pandemic-resources/index.htm

The COVID-19 pandemic has illustrated that incidents considered less likely to happen can and do occur, and that pandemics may impact areas that are considered less vulnerable due to the more rural nature and less densely populated areas such as here in North Dakota.

Influenza data and statistics are relating to the 2017 seasonal flu, 2009 H1N1, 1918 Spanish Flu, and COVID-19 are included within this hazard profile starting on page 13

Foodborne Illness:

Foodborne illness (sometimes called "foodborne disease," "foodborne infection," or "food poisoning) is a common, costly—yet preventable—public health problem. The Centers for Disease Control and Prevention (CDC) define a foodborne illness outbreak when two or more people get the same illness from the same contaminated food or drink. Many different disease-causing microbes, or pathogens, can contaminate foods, so there are many different foodborne infections. In addition, poisonous chemicals, or other harmful substances can cause foodborne diseases if they are present in food. Foodborne illnesses are a major public health problem. The CDC estimate that each year one in six Americans get sick by consuming contaminated foods or beverages; 128,000 are hospitalized; and 3,000 die of foodborne diseases.

Recreational Water Illness:

Recreational water illnesses (RWIs) are caused by germs spread by swallowing, breathing in mists or aerosols of, or having contact with contaminated water in swimming pools, hot tubs, water parks, water play areas, interactive fountains, lakes, rivers, or oceans. RWIs can also be caused by chemicals in the water or chemicals that evaporate from the water and cause indoor air quality problems. RWIs include a wide variety of infections, such as gastrointestinal, skin, ear, respiratory, eye, neurologic, and wound infections. The most commonly reported RWI is diarrhea. In the past two decades, there has been a substantial increase in the number of RWI outbreaks associated with swimming. Crypto (short for Cryptosporidium) which can stay alive for days even in well-maintained pools, has become the leading cause of swimming pool-related outbreaks of diarrheal illness.

West Nile:

West Nile virus (WNV) is most commonly transmitted to humans by mosquitoes. There are no medications to treat or vaccines to prevent WNV infection. Most people infected with WNV will have no symptoms. About 1 in 5 people who are infected will develop a fever with other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness.

In 2012, an unprecedented outbreak of WNV occurred in Texas; 1,868 cases were reported, including 844 (45%) cases of (WNV neuroinvasive disease [WNND], which included encephalitis, meningoencephalitis, and meningitis) and 89 deaths (case-fatality rate 5%). Male patients, persons >65 years of age, and minorities were at highest risk for neuroinvasive disease. Fifty-three percent of counties reported a case; 48% of case-patients resided in 4 counties around Dallas/Fort Worth. The economic cost was >$47.6 million.

Communicable diseases, whether human, animal, or plant are not governed by geographic boundaries. However, those jurisdictions with the highest human and livestock populations and crop exposure are at greatest risk from communicable diseases.

Five human influenza pandemics have occurred over the past 100 years including the current COVID-19 pandemic and the 1918 "Spanish Flu" pandemic, severely affecting the United States.

Many of the diseases that have the potential to result in serious outbreaks, such as diphtheria, measles, influenza and polio, are preventable through routine vaccination. Vaccination rates have been rising slowly since 2007. Although higher than United States rates for this indicator, the coverage rate is below the target of 90%, as designated by the CDC.

The entire state is vulnerable to a major disease outbreak. As evidenced by annual infectious disease reports and reports of investigations completed by the NDDoH, many counties experience one or multiple disease outbreaks each year. The percentage of uninsured North Dakotans for 2016 was 7% compared to 8.6% nationally according to the U.S. Census Bureau (U.S. Census Bureau, 2017). Potential casualty losses are anticipated to be greatest in counties with higher populations, higher pediatric populations, and higher elderly populations.

Source: 2018 ND Department of Emergency Services Enhanced Mitigation Plan

Communicable Disease Information Resources:

- The ND Department of Health identifies mandatory reportable diseases and conditions: https://www.health.nd.gov/diseases-conditions https://www.health.nd.gov/sites/www/files/documents/Files/MSS/FactSheet/ReportableConditions.pdf
- Disease history reporting is also available on the ND Department of Health website at https://www.health.nd.gov/condition-data
- Community Health reports for Bismarck/Burleigh area are available at: https://ruralhealth.und.edu/projects/community-health-needs-assessment/reports#burleigh
- Seasonal Flu Monitoring Website: https://www.health.nd.gov/flu http://www.ndflu.com/DataArchive/

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Communicable Disease (Pandemic Influenza Scenario)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Catastrophic	Catastrophic	Significant	Significant

Foodborne Illness

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Minor	Minor	Minor	None/Negligible

Climate Change Impact:

Changes in weather and climate can degrade air and water quality; affect the geographic range, seasonality, and intensity of transmission of infectious diseases through food, water, and disease-carrying vectors (such as mosquitoes and ticks); and increase stresses that affect mental health and well-being. Changing weather patterns also interact with demographic and socioeconomic factors, as well as underlying health trends, to influence the extent of the consequences of climate change for individuals and communities. While all Americans are at risk of experiencing adverse climate-related health outcomes, some populations are disproportionately vulnerable. The risks of climate change for human health are expected to increase in the future, with the extent of the resulting impacts dependent on the effectiveness of adaptation efforts and on the magnitude and pattern of future climate change.	NCA4 Vol II *Chapter 14* *Executive Summary*

Vulnerability Assessment (1 of 2)

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario:	Communicable Disease	Pandemic Influenza	Bio-Terrorism
Probability	Likely	Possible	Possible
Speed of Onset	May be a "no-notice" event or slow onset depending on location of origin	May be a "no-notice" event or slow onset depending on location of origin	May be a "no-notice" event or slow onset depending on location of origin
Geographic Area	Local, regional…. worldwide	Local, regional…. Worldwide	Local, regional…. worldwide
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Reportable Communicable Diseases. See charts within Description section. A. Those with underlying medical conditions or suppressed immune systems. B. Elderly and young A. Those living or working in close proximity. • Schools, universities, assisted living, nursing homes	1. Reportable Communicable Diseases. See charts within Description section. B. Those with underlying medical conditions or suppressed immune systems. C. Elderly and young D. Those living or working in close proximity. • Schools, universities, assisted living, nursing homes	1. Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. A. Those who come in direct contact with the bio-agent (i.e.: targeted victims, first responder community and hospital staff). B. Those in close proximity to location of dispersal C. As bio-agent dissipates, risk and vulnerability are reduced.
Mass Casualty Incident	Yes Possible	Yes Probable	Yes Likely

Scenario:	Communicable Disease	Pandemic Influenza	Bio-Terrorism
Property Losses (points of vulnerability – high priority)	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.
Environmental (points of vulnerability – high priority)	1. Incident Specific • Water, Soil, Air, Food	1. Incident Specific • Water, Soil, Air, Food	2. 1. Incident Specific • Water, Soil, Air, Food
COG/COOP (points of vulnerability – high priority)	1. Employee/Family Illness 2. Orders of Succession all departments. 3. Public Health Department, response capability compromised 4. Emergency Services staffing, services, and capabilities compromised.	1. Employee/Family Illness 2. Order of Succession all departments 3. Public Health Department, response capability compromised 4. Emergency Services staffing, services, and capabilities compromised.	1. First Response Emergency Services • Fire • EMS • Police 2. Public Health
Critical Facilities (points of vulnerability – high priority)	1. Hospitals 2. Clinics 3. Other Emergency Service Providers 4. Airport 5. Civic Center 6. Prison, jail and other institutional facilities	1. Hospitals 2. Clinics 3. Other Emergency Service Providers 4. Airport 5. Civic Center 6. Prison, jail and other institutional facilities	1. Federal/State Agencies 2. Hospitals - may be treating victims with unknown bioterrorism agent 3. HVAC systems of Critical Facilities 4. Emergency Services 5. USPS Warehouse sorting facility
Critical Infrastructure (points of vulnerability – high priority)	1. Availability and capability to restore services may be impacted: such as Water, Food, Medication, Sanitation, Communications. 2. Transportation – Airport	1. Availability and capability to restore services may be impacted: such as Water, Food, Medication, Sanitation, Communications. 2. Transportation - Airport	1. Transportation - Airport

Scenario:	Communicable Disease	Pandemic Influenza	Bio-Terrorism
Schools (points of vulnerability – high priority)	1. Entire school population is of high vulnerability. 2. School facilities may require decontamination, delayed use, or may be needed for alternative purposes.	1. Entire school population is of high vulnerability. 2. School facilities may require decontamination, delayed use, or may be needed for alternative purposes.	
High Risk Facilities (chemical) (points of vulnerability – high priority)	1. Facilities containing hazardous materials may pose a greater risk depending on impact to staffing and on-site safety and security personnel.	1. Facilities containing hazardous materials may pose a greater risk depending on impact to staffing and on-site safety and security personnel.	
Specific Populations: Public Assembly, Vulnerable / Special Populations (points of vulnerability – high priority)	1. Elderly 2. Young 3. School population 4. Universities 5. Day Cares 6. Those living or working in close proximity 7. Senior Citizen Facilities 8. Nursing Home 9. Assisted Living 10. Incarcerated, institutional settings 11. Indoor/Outdoor Events 12. Malls/Stores 13. Churches 14. Social Gathering	1. Elderly 2. Young 3. School population 4. Universities 5. Day Cares 6. Those living or working in close proximity 7. Senior Citizen Facilities 8. Nursing Home 9. Assisted Living 10. Incarcerated, institutional settings 11. Indoor/Outdoor Events 12. Malls/Stores 13. Churches 14. Social Gathering	1. Non-specific, depends on terrorism group and motives. May involve special populations and motives relating to government or religion for example.
Economy (community wide)			
OTHER: (points of vulnerability – high priority)	1. Those NOT vaccinated for vaccine preventable diseases.	1. Those NOT vaccinated for vaccine preventable diseases.	

Vulnerability Assessment (2 of 2)

Scenario:	Food Borne Illness	Rec Water Illness	West Nile Outbreak
Probability	Likely	Likely	Likely
Speed of Onset	No notice	No notice	No notice
Geographic Area	Statewide/nationwide	Statewide/nationwide	Statewide/nationwide
Death / Injury 1. Primary Causes A. Highest Vulnerability	1. Consuming food or drink that contains a pathogen (i.e.: bacteria, virus or parasite) or harmful chemical or substances A. Young, elderly and Immuno-compromised	1. Swallowing, breathing in mists or aerosols of, or having contact with contaminated water A. Young, elderly and Immuno-compromised	1. Getting bit by an infected mosquito A. People with certain medical conditions such as cancer, diabetes, hypertension and kidney disease are also at greater risk for serious illness.
Mass Casualty Incident	Yes, potentially	Most likely not	Yes, potentially
Property Losses	NA	NA	NA
Environmental	NA	NA	NA
COG/COOP	NA	NA	NA
Critical Facilities	NA	NA	NA
Critical Infrastructure	NA	NA	NA
Schools	NA	NA	NA
High Risk Facilities (chemical)	NA	NA	NA
Specific Populations: Public Assembly, Vulnerable / Special Populations	Those affected are likely to have consumed a common meal from a common source (ie: donated or intentional act)	Those recreating in untreated water – lakes, rivers, reservoirs.	Those who work outside or participate in outdoor activities
Economy (community wide)	Medical costs Lost productivity	Medical costs Lost productivity	Medical costs Lost productivity
OTHER:			

Vulnerability Assessment

The most significant impacts of communicable disease are to the population affected and the healthcare organizations involved. Disease can spread rapidly through schools, health facilities, and communities. The entire state population plus visitors are at risk to contracting a communicable disease that surfaces in North Dakota. Although infectious diseases are not subject to geographic boundaries, several populations in North Dakota are specifically at higher risk to infectious diseases. Communicable diseases are most likely to spread quickly in institutional settings such as dormitories, long-term care facilities, day care facilities, schools, correctional institutions, etc. The number of infections and fatalities in the state depends on the transmission and mortality rates. The statewide economy relies heavily on the agriculture, health care, travel, and utility industries, and therefore, human or livestock diseases would negatively affect the economy. With respect to human diseases, an outbreak would most certainly limit travel and impact the service and tourism industries. The trickle-down economic impacts to nearly all industries could be overwhelming. Workers who become ill, need to care for loved ones, or are fearful of contracting the disease may not show up for work. The impact to critical industries and services could be severe. Examples of industries and services that could be significantly impacted in North Dakota include health care, education, utility services, and emergency response.

The North Dakota Department of Health monitors the rate of vaccination among children, specifically the percentage of children completing the 4:3:1:3:3:1:1 vaccination series at age 2 years. Vaccination rates have been rising slowly since 2007. Although better than US rates for this indicator, the coverage rate is below the target of 90 percent. In 2011, the rate of vaccination for North Dakota children was 82.8 percent and 72.7 percent nationally. Achieving high vaccination levels among two year olds is dependent on the cooperation of parents. Different parents have different reasons for not vaccinating their children. For instance, even though the risks associated with vaccination are far below the risk of serious illness if a child is not vaccinated, some parents remain reluctant to vaccinate their children due to anxiety about serious adverse effects. But serious reactions to childhood vaccination are very rare. Other parents don't perceive vaccination to be a high priority, partly because vaccine preventable diseases are relatively uncommon. Consequently, parents who don't vaccinate their children are in essence depending on the vaccination of other children to protect their child from getting vaccine preventable diseases.

The magnitude of an infectious disease outbreak is related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause catastrophic numbers of deaths are infectious in nature, meaning that they are spread from person to person. The key to reducing the catastrophic nature of the event is to stop the spread of disease. This is generally done in three ways: (1) identification and isolation of the ill, (2) quarantine of those exposed to the illness to prevent further spread, and (3) education of the public about methods to prevent transmission. The public health and health care providers in North Dakota routinely utilize all three methods to reduce morbidity and mortality from infectious disease. However, the capacity of the health care system is limited. For example, local health jurisdictions have specific pandemic influenza response plans, and mass prophylaxis plans, but most jurisdictions have only a few staff members. Many local health jurisdictions would need to rely on volunteers, pre-scripted messages and procedures and the cooperation of the public in order to respond effectively to a large scale pandemic. Similarly, hospitals in North Dakota have emergency response and pandemic influenza plans, but little excess capacity exists to care for and/or isolate hundreds, even thousands of patients. Because of these limitations in personnel, facilities, and equipment, the health care community is planning to utilize social distancing measures. These measures which could include closure of schools, day cares and other public events would have far-reaching economic impacts on communities and might shutdown facilities for 30 days or more. Closure of the day cares or schools would have a serious impact on the economy as parents might not be able to find child care elsewhere.

The entire state is vulnerable to a major disease outbreak. As evidenced by annual infectious disease reports and reports of investigations completed by the North Dakota Department of Health, many counties experience one or multiple disease outbreaks each year. Potential casualty losses are anticipated to be greatest in counties with higher populations, higher pediatric populations and higher elderly populations as well as larger populations living in group quarters.

2016 Census Data for Population, Under Age 5, Over Age 65 Burleigh County						
Total Population 2010	Under Age 5	% Under Age 5	Over Age 65	% Over 65	Total Population Under 5 and Over 65	% Under 5 and over 65
90,560	6,249	6.90%	13,041	14.40%	19,290	21%

Source: U.S. Census Bureau, 2016 American Community Survey

According to the 2019 Burleigh county Community Health Profile from the State Department of Health (http://www.ndhealth.gov/HealthData/CommunityHealthProfiles/Burleigh%20County%20Community%20Profile.pdf?v=7) the county's total population in group quarters is 2,753. The county's population was 83,523 that year, making about 3.3 percent of the county's total population in group quarters.

The percentage of uninsured North Dakotans for 2016 was 7% compared to 8.6% nationally according to the U.S. Census Bureau (U.S. Census Bureau, 2017).

Bio-Terrorism:
The following biologic agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. (Centers for Disease Control and Prevention, 2010)

Loss Estimates

It will take time to determine the total impact from the COVID-19 as it relates to total cases, hospitalizations, deaths, as well as impact to economy, health, and other impacts. The 2018 ND Department of Emergency Services Enhanced Mitigation Plan states "… the NDDoH's Pandemic Influenza Planning has developed the following vulnerability estimate: It has been estimated that a medium-level pandemic, using the CDC scenario estimates of a 30% attack rate, a 0.8% hospitalization rate among the ill, and a 0.2% mortality rate among the ill, based on the 2015 estimated population in North Dakota":

- 227,078 persons would become ill and may require outpatient care
- 6,055 persons may require hospitalization
- 1,514 individuals may die

The majority of these deaths, hospitalizations, etc. would occur in more highly populated counties. Using these CDC estimates, the potential statewide and local losses are described within the table that follows.

Medium-level Pandemic Potential Losses in North Dakota, Statewide (projections for planning purposes)			
Statewide	**Number**	**Dollar Loss per day/visit**	**Source of Data**
Illness	228,023	$19,381,955 (one visit per ill person)	Estimate of $85 per visit for out of pocket expenses related to co-pays for physician visit, laboratory and prescription drugs
Hospitalization	1,824	$2,626,560 per DAY	Kaiser State Health facts Average cost per inpatient day in 2010. North Dakota private hospitals - $1440/day
Deaths	456	$ 3,876,000 (one funeral per dead person)	Headstones.usa Average cost of a funeral in North Dakota is $8,500.

Source: North Dakota Department of Health, Pandemic Flu Loss Estimates

Medium-level Pandemic Potential Losses				
	Population	**Ill**	**Hospitalized**	**Deaths**
North Dakota	760,077	228,023	1,824	456
Burleigh	95,030	28,509	228	57

Loss Estimates: Facilities/Critical Facilities

Vulnerabilities from communicable disease are not to the structures themselves but rather to the occupants. In some instances, the accessibility and functionality of a facility can be compromised. Contamination of a building could render the facility unusable until it is decontaminated or the threat has passed. Should a building become contaminated by some disease agent, clean-up costs and the loss of use of the building could result. Such costs could be significant. For example, the cleanup of anthrax in several congressional offices on Capitol Hill in September and October of 2001 cost the Environmental Protection Agency about $27 million. (US General Accounting Office, 2003) For this reason, all state-owned buildings are assumed to be at some risk from communicable disease.

The structural integrities of critical facilities are not threatened by communicable disease. If facilities supporting emergency response lost their functionality because of contamination, delays in emergency services could result. Additionally, with a significant human disease outbreak, resources such as the ambulance services, hospitals, and medical clinics could quickly become overwhelmed. Diseases can spread quickly in special needs facilities such as schools, colleges, universities, and assisted living. Often these facilities, as well as the hospitals and medical clinics, are the first places where diseases are identified and treated.

In most cases, critical infrastructure would not be affected by communicable disease. Scenarios that would affect infrastructure include the contamination of the water supplies and diseases that require special provisions in the treatment of wastewater. Should an epidemic necessitate quarantine or incapacitate a significant portion of the population, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

Changes in Development

Changes in development will affect the rate of human disease spread in North Dakota. Higher populations will expose more people to diseases and higher population densities may lead to faster transmission of a disease. According to future population projections, the state has experienced population growth since 2010, and expects this growth to continue. The North Dakota projected population for 2030 is 931,506 people, up 38% from the 2010 Census. Cass County is projected to have the largest population by 2030, with 214,719 people, followed by Burleigh County with 110,932 people. Age also impacts vulnerability to human disease. With many diseases, the oldest and youngest members of society tend to be the most vulnerable. From 2010 to 2030, the statewide population over 65 years old is projected to increase by 56%. Additionally, the population under 10 years old is projected to increase by 64% from 2010 to 2030. More people in these age groups can increase the vulnerability to human disease statewide.

Source: 2018 ND Department of Emergency Services Enhanced Mitigation Plan

Influenza and Pandemic Influenza Overview - Historical Occurrences

The remainder of hazard profile provides basic data/statistics for the following influenza events:

- 1918 "Spanish Flu" Pandemic.
- 2009 H1NI
- 2017 Seasonal Flu
- COVID-19

What is influenza (also called flu)?
The flu is a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs. It can cause mild to severe illness, and at times can lead to death. The best way to prevent the flu is by getting a flu vaccine each year. An average of 2,800 North Dakotans are reported as having lab-identified flu every year--the number of actual cases occuring in North Dakota each year is likely much higher. http://www.ndflu.com/AboutInfluenza.aspx

1918 Spanish Flu

Following World War I, the Spanish influenza pandemic of 1918 killed 20-40 million people worldwide, including 675,000 Americans. (Billings, 1997) In North Dakota, about 2,700 people died and around 6,000 people were infected. Schools, churches, and businesses were closed for a time, and public gatherings were banned. Transporting influenza patients by train was a crime. (US Department of Health and Human Services, 2006) Previous to that, in 1837, a smallpox epidemic virtually annihilated the village of Mandan Native Americans near Fort Clark. (State Historical Society of North Dakota, 2007)

The magnitude of a communicable disease outbreak varies from every day disease occurrences to widespread infection. During the 1918 Influenza Pandemic, infection rates approached 28 percent in the United States. (Billings, 1997) Other pandemics produced infections rates as high as 35 percent of the total population. (World Health Organization, 2010) Such a pandemic affecting North Dakota represents a severe magnitude event. Almost any highly contagious, incapacitating disease that enters the North Dakota population would quickly overwhelm local and state health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.

In 1900 nearly all of the leading causes of death were infectious; now only pneumonia and influenza remain among the top 10 causes of death. The number of deaths due to pneumonia and influenza are tracked by the North Dakota Department of Health (NDDoH) by influenza year, which begins in September. The rate is age adjusted to the standard 2000 census. NDDoH's goal is less than 60 deaths per 100,000 people.

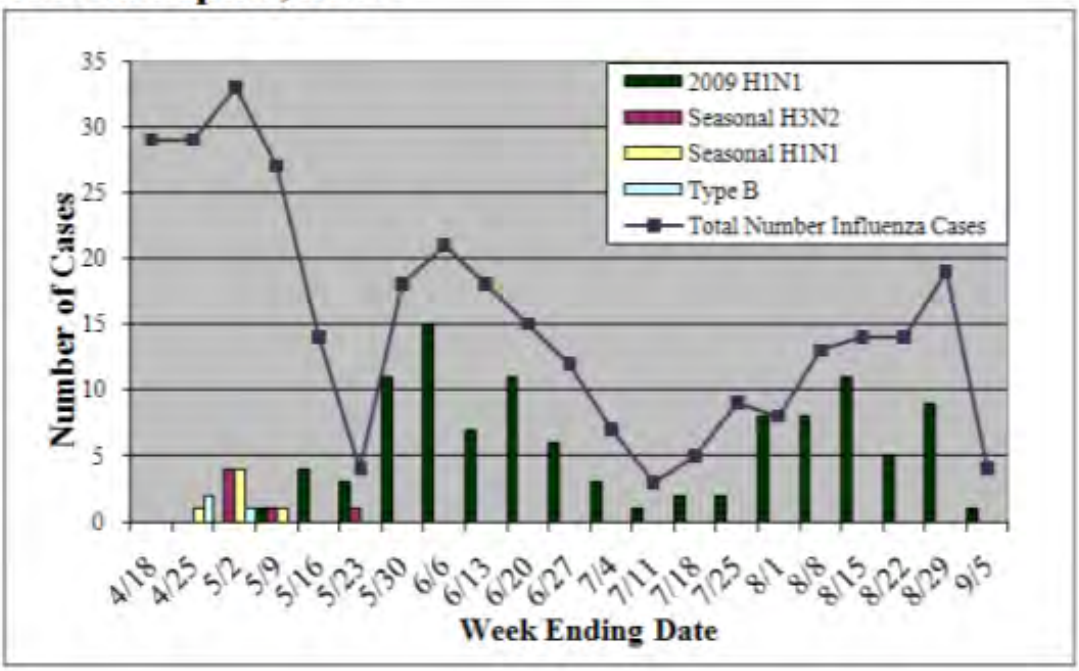
2009 H1N1

2009-2010 **H1N1 Pandemic** Report:
https://www.health.nd.gov/sites/www/files/documents/Files/MSS/Publications/EpiReport/Apr-Jun10.pdf

On April 15, 2009, the U.S. Centers for Disease Control and Prevention (CDC) confirmed the first novel influenza A H1N1 virus infection in a U.S. patient. As the next few cases were identified, it became evident that person-to-person transmission of the virus was occurring. On June 11, 2009, the World Health Organization raised the pandemic alert level to phase 6 to reflect the ongoing spread of the virus in multiple countries around the world.

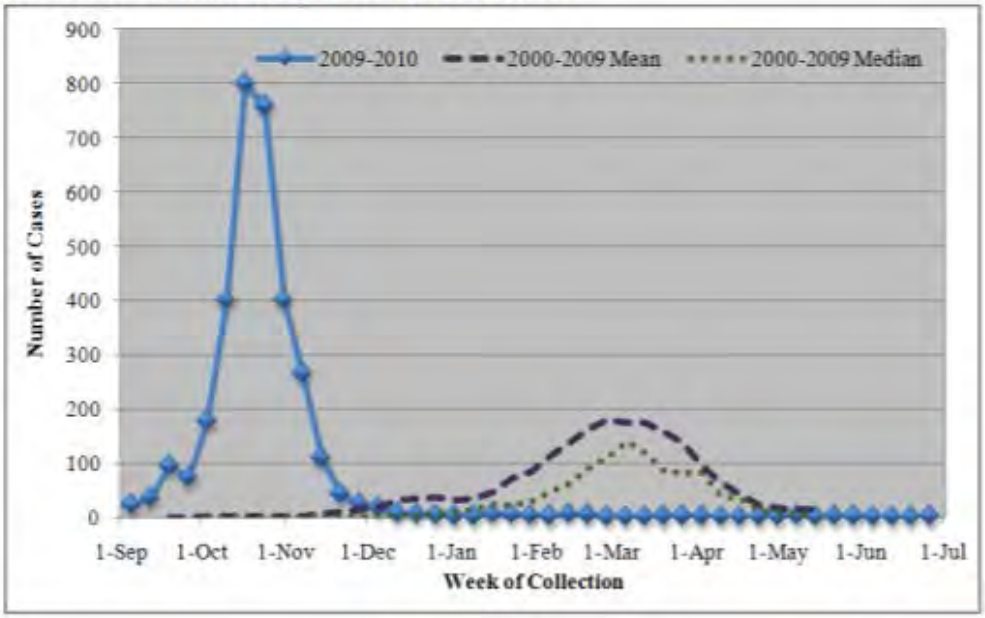
The first case of novel H1N1 in a North Dakota resident was confirmed May 8, 2009. This marked the beginning of the first wave of 2009 H1N1 influenza illness in North Dakota (Figure 1). Seasonal influenza strains continued to co-circulate through the month of May but soon transitioned to only 2009 H1N1 influenza being detected by PCR testing methodologies.

Figure 1. Distribution of confirmed influenza cases using PCR and total reported laboratory identified cases by week of collection, North Dakota, April 18, 2009 to Sept. 5, 2009



A much larger second wave of 2009 H1N1 influenza illness occurred in the fall following the first spring wave of illness. In contrast to non-pandemic influenza seasons, influenza reached peak activity in the state the week ending October 17, 2009. Influenza activity usually peaks in January, February or March (Figure 2).

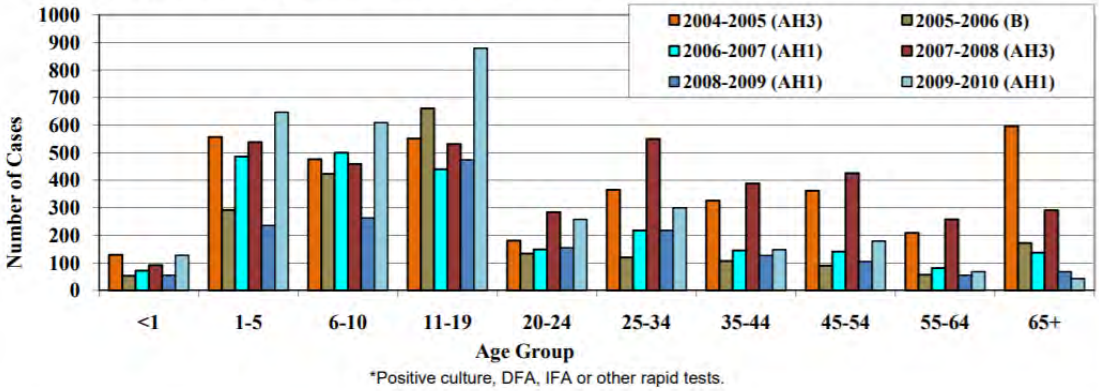
Figure 2. Number of reported influenza cases 2000-2001 to 2008-2009 influenza seasons, 2009-2010 influenza season, North Dakota



Children and teens were the age groups more affected by 2009 H1N1 influenza compared to all other age groups. The largest number of positive influenza cases was reported in the 11- to 19-year-old age range (877). Those ages 19 and younger comprised 69 percent of the total cases reported during the 2009- 2010 influenza season. The median age of reported cases was 12.96 years and ranged from 0.01 to 87.76 years.

Even during non-pandemic seasons, the age groups largely impacted when influenza A H1N1 viruses are the predominant type are the younger age groups. In contrast, during influenza A H3N2 seasons, the impact of the virus is similar across all age groups, with most of the cases being reported in the very young and old (Figure 3).

Figure 3. Number of Reported Influenza Cases* by Age Group With Predominant Influenza Type, 2004-2005 Through 2009-2010 Influenza Seasons, North Dakota



*Positive culture, DFA, IFA or other rapid tests.

Influenza type A was the predominant type identified during the 2009-2010 flu season, with 99 percent (3,219) of the cases being type A. The Division of Laboratory Services sub-typed 544 influenza isolates, with 543 identified as type A-2009 H1N1 and one identified as type A-H3 (one type B was also identified). Figure 4 summarizes the 2009-2010 influenza cases by age group and type.

Figure 4. All Influenza cases by age group and type, North Dakota, 2009-2010 influenza season.

		TYPE			
		A	B	Unspecified	Total
AGE GROUP	<1	127	0	1	128
	1-5	640	6	1	647
	6-10	604	5	0	609
	11-19	869	7	1	877
	20-24	254	3	1	258
	25-34	294	1	4	299
	35-44	143	3	2	148
	45-54	178	0	1	179
	55-64	67	1	0	68
	65+	43	0	0	43
	Total	3219	26	11	

The 2009 H1N1 influenza virus caused a disproportionate number of pediatric deaths than seen during regular influenza seasons. In the United States, approximately 90 pediatric influenza deaths occur in a typical influenza season; however, during the 2009- 2010 season, 276 deaths were reported. Influenza associated pediatric deaths are part of the National Notifiable Diseases Surveillance System (NNDSS). During the 2009-2010 influenza season, no influenza associated deaths among children were identified in North Dakota.

The emergence of this virus caused the first influenza pandemic in more than 40 years. In order to describe the burden of illness in the United States, the CDC developed a model to estimate the number of cases, hospitalizations and deaths contributed to the 2009 H1N1 influenza pandemic virus. The CDC estimates demonstrate the burden of 2009 H1N1 influenza illness in people younger than 65 (Figure 6).

Figure 6. CDC estimates of 2009 H1N1 influenza by age group, April 2009 – April 10, 2010, United States[2]

2009 H1N1	Mid-Level Range*	Estimated Range*
Cases		
0-17 years	~20 million	~14 million to ~28 million
18-64 years	~35 million	~25 million to ~52 million
65 years and older	~6 million	~4 million to ~9 million
Cases Total	~61 million	~43 million to ~89 million
Hospitalizations		
0-17 years	~87,000	~62,000 to ~128,000
18-64 years	~160,000	~114,000 to ~235,000
65 years and older	~27,000	~19,000 to ~40,000
Hospitalizations Total	~274,000	~195,000 to ~403,000
Deaths		
0-17 years	~1,280	~910 to ~1,880
18-64 years	~9,570	~6,800 to ~14,040
65 years and older	~1,620	~1,160 to ~2,380
Deaths Total	~12,470	~8,870 to ~18,300

*deaths rounded to nearest ten/hospitalizations to the nearest thousand/cases to the nearest million. 1. CDC. 2009-2010 Influenza Season Week 20 ending May 22, 2010. Accessed August 2, 2010. www.cdc.gov/flu/weekly/fluactivity.htm 2. CDC. Estimates of 2009 H1N1 Influenza Cases, Hospitalizations and Deaths in the United States, April 2009 – April 10, 2010. Accessed August 2, 2010. www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm

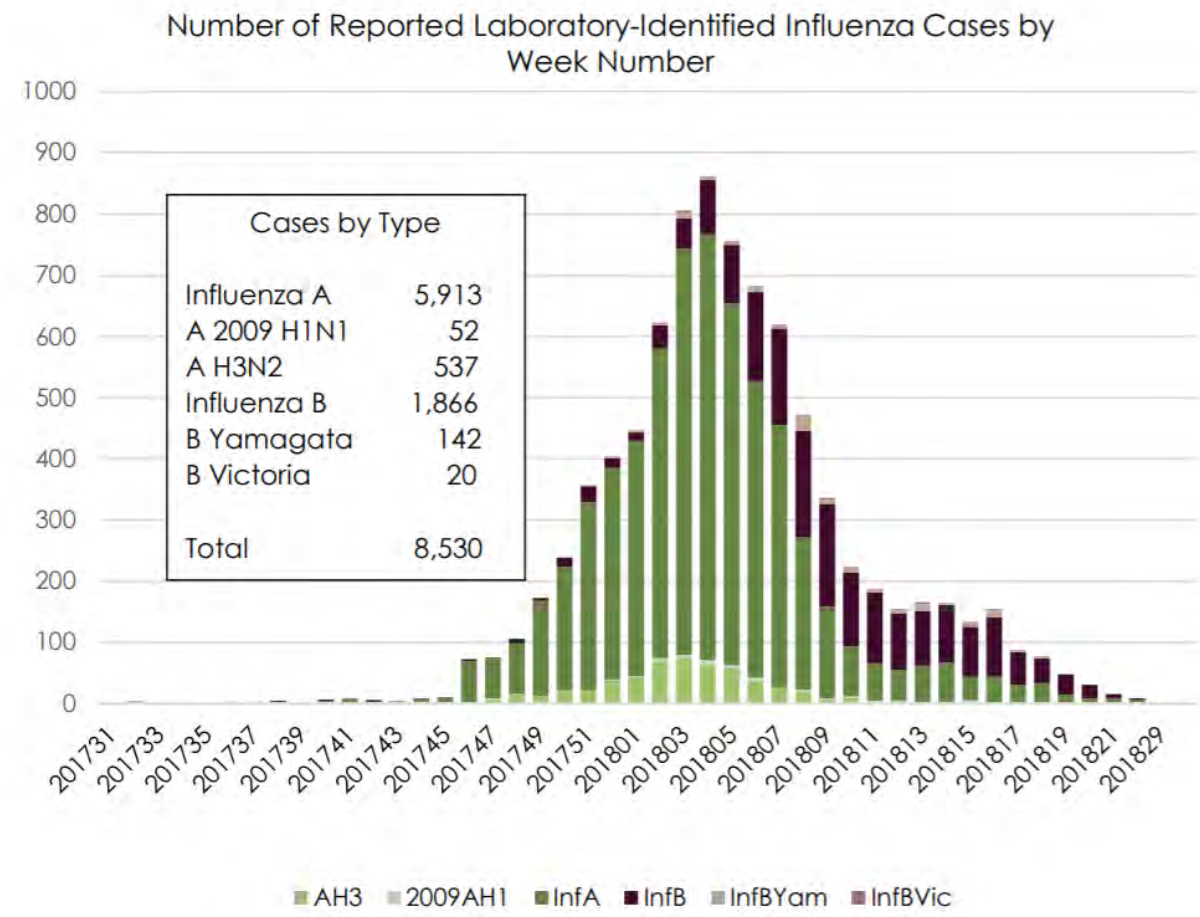
618 influenza cases were from Burleigh County for the 2009-10 season which was the highest count in ND. Cass had the 2nd highest reported with 305. The report does not identify the number of deaths specific to ND other than the statement "no influenza associated deaths among children were identified in North Dakota."
https://www.health.nd.gov/sites/www/files/documents/Files/MSS/Publications/EpiReport/Apr-Jun10.pdf)

2017 Influenza Season

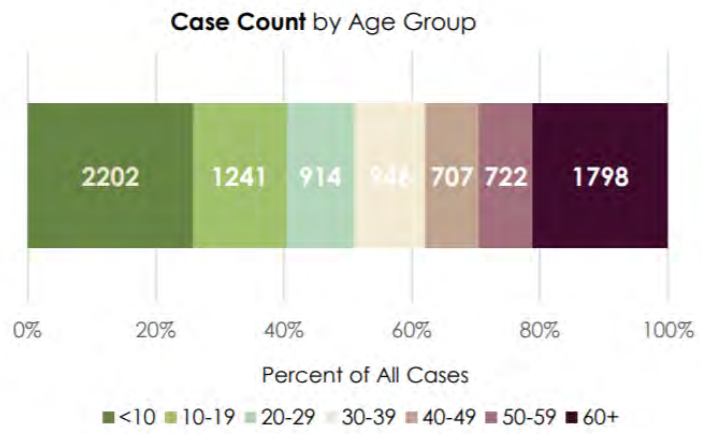
North Dakota's population in 2017 was 755,176 people. According to the CDC, (https://www.cdc.gov/nchs/pressroom/sosmap/flu_pneumonia_mortality/flu_pneumonia.htm) 147 people died from Influenza/Pneumonia that year, at a death rate of 15.3 deaths per 100,000 people.

http://www.ndflu.com/DataArchive/

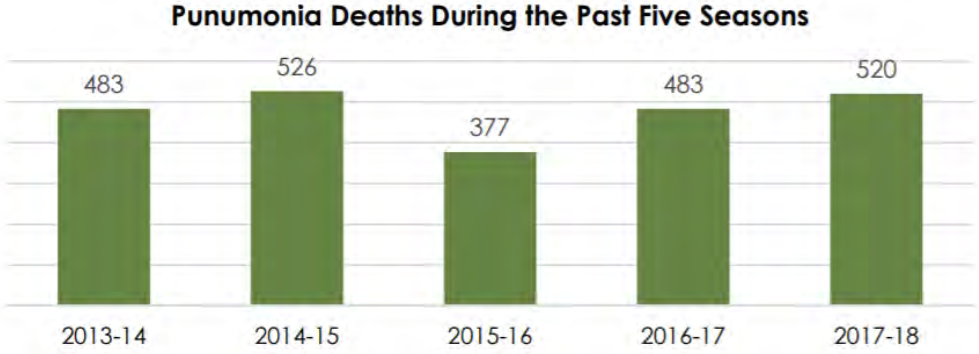
According to the Centers for Disease Control and Prevention, the 2017-18 season was one of the most severe seasons on records, and the most severe since the 2009 pandemic. As usual, the influenza A 2009 H1N1 pandemic strain circulated as well, in much lower numbers. As did both influenza B lineages, with B Yamagata making up a large majority of the influenza B cases.



Burleigh County Case Count for 2017-2018 Season was 955 which was the 2nd highest in ND with Cass County reporting the most cases. The report also notes: "Influenza cases were reported for all counties in North Dakota. An increase in the number of hospitals and clinics sending influenza reports electronically likely contributed to the high case count for this season."



Deaths For the 2017-18 influenza season: 31 deaths were reported in North Dakota. This data is gathered using Vital Records data, as well as physician reports. Influenza deaths in North Dakota are not reportable. In addition, 520 pneumonia deaths were identified in the death record. The NDDoH tracks pneumonia deaths because influenza generally contributes significantly to the number of deaths due to pneumonia during the influenza season. Because influenza is not always diagnosed with a laboratory test, tracking pneumonia deaths is another way to illustrate the magnitude of the influenza season. Although a record number of cases were reported this year, 2014-15 had more deaths than this season. This is not a trend that was repeated nationally. At the national level, there were more deaths in 2017-18 than in 2014-15, according to national vital records data.



Deaths Due to Influenza and Pneumonia per 100,000 People, 2005-2011						
Number of deaths due to influenza and pneumonia among all causes of death per 100,000 population	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
	60	78	62	76	67	55

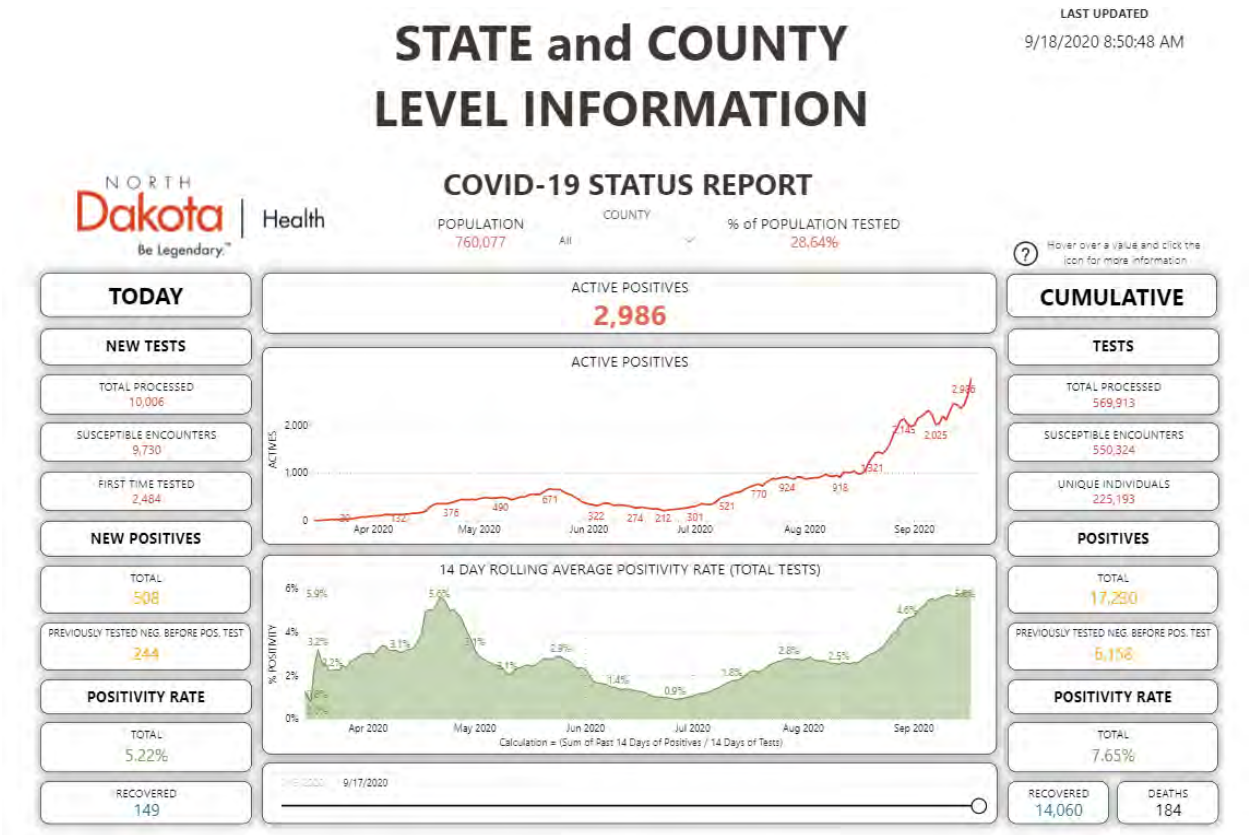
COVID-19 Pandemic Influenza

The first two cases of COVID-19 within Burleigh County were reported on March 17, 2020. Both Burleigh County individuals were considered travel related. One individual, a male in his 50's, had traveled domestically. The other individual, a woman in her 20's, had travelled internationally. The first case of COVID-19 was identified in Ward County on March 12, 202. In total, North Dakota had five confirmed cases of COVID-19 as of March 17, 2020. Bismarck Public Schools closed on March 23, 2020 and did not re-open that school year.

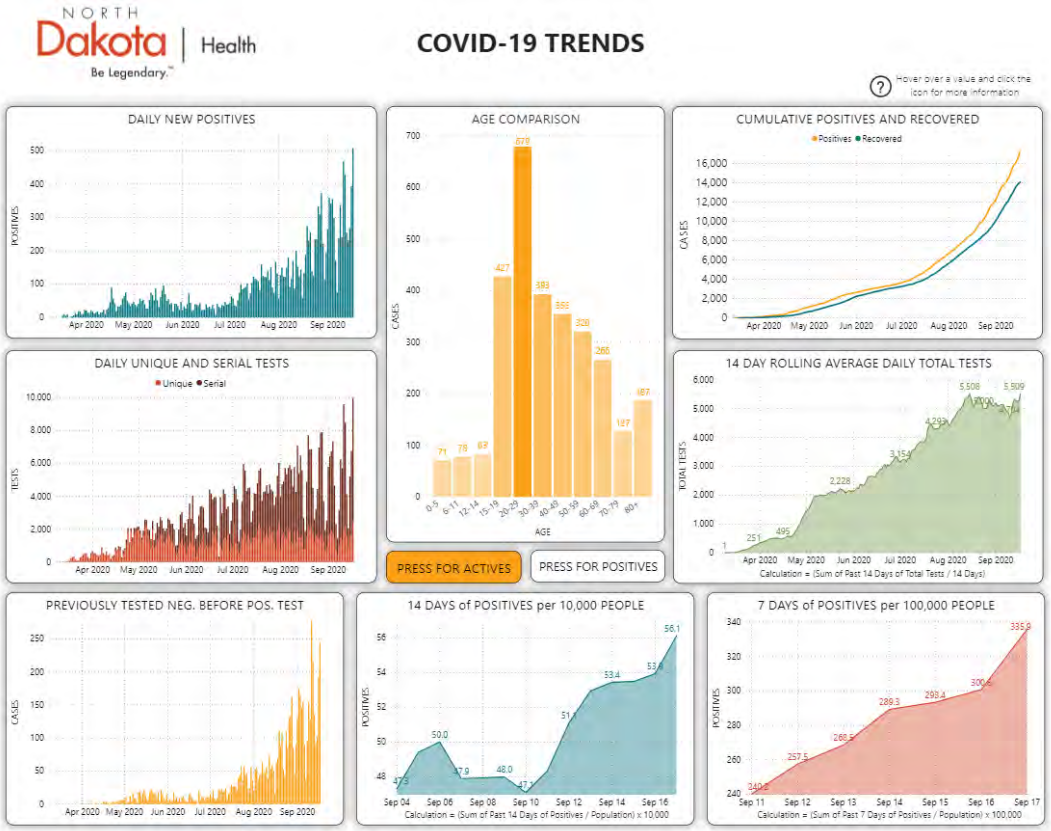
The summary data/statistics regarding COVID-19 impacts identified throughout the remainder of this hazard profile are limited in scope to number of cases, positivity rates, number of deaths, and hospitalization. Also, the data/statistics provided here are limited to a snapshot in time (September 18, 2020).

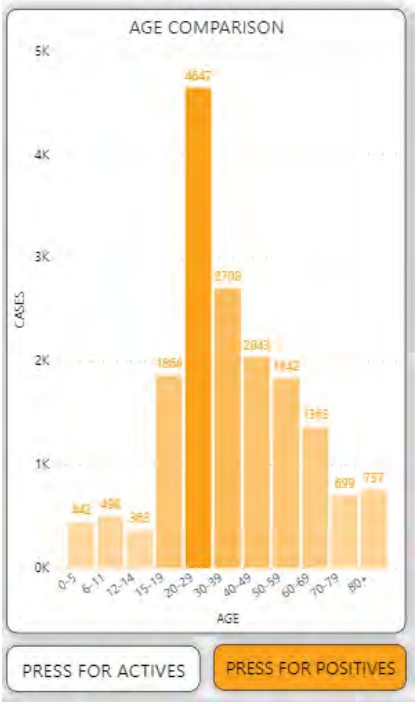
State Level summary data is provided first, followed by Burleigh County specifics.

State Level Data as of September 18, 2020:

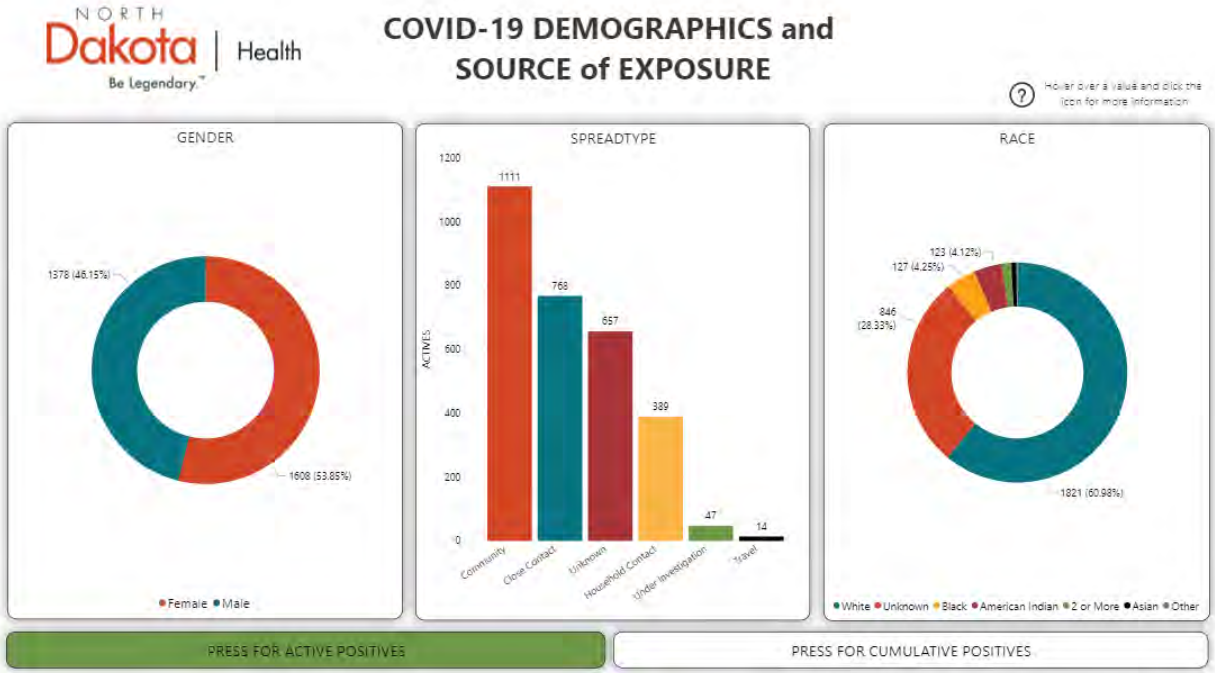


State Level Data as of September 18, 2020:

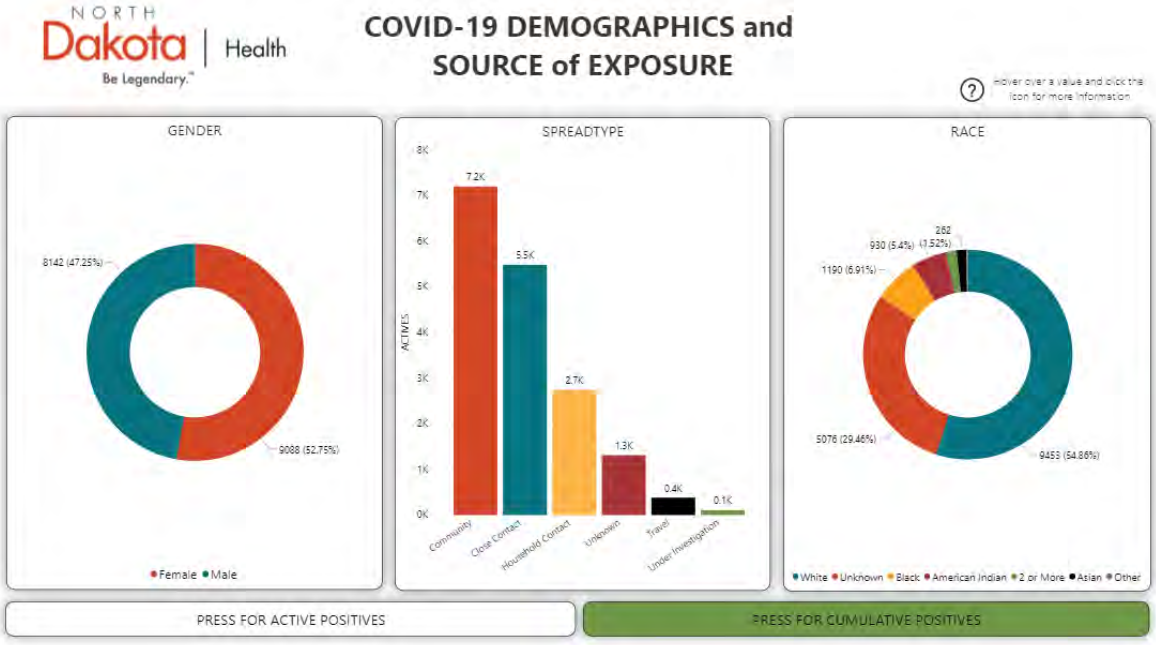


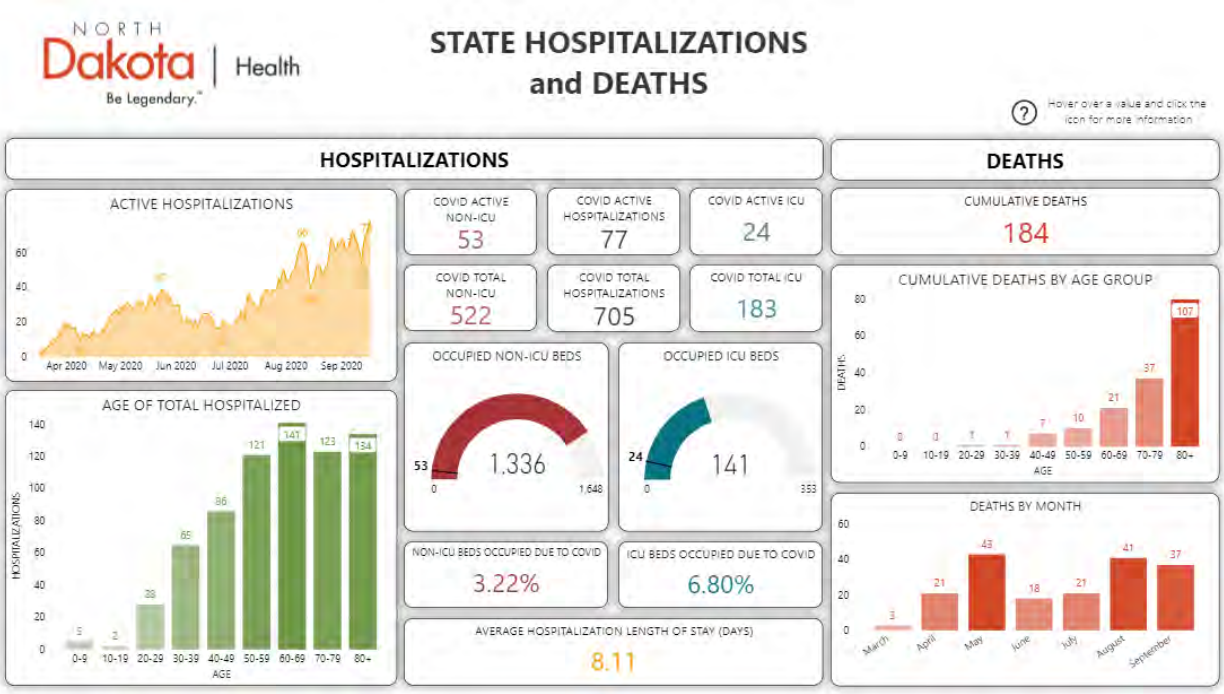


STATE LEVEL INFORMATION

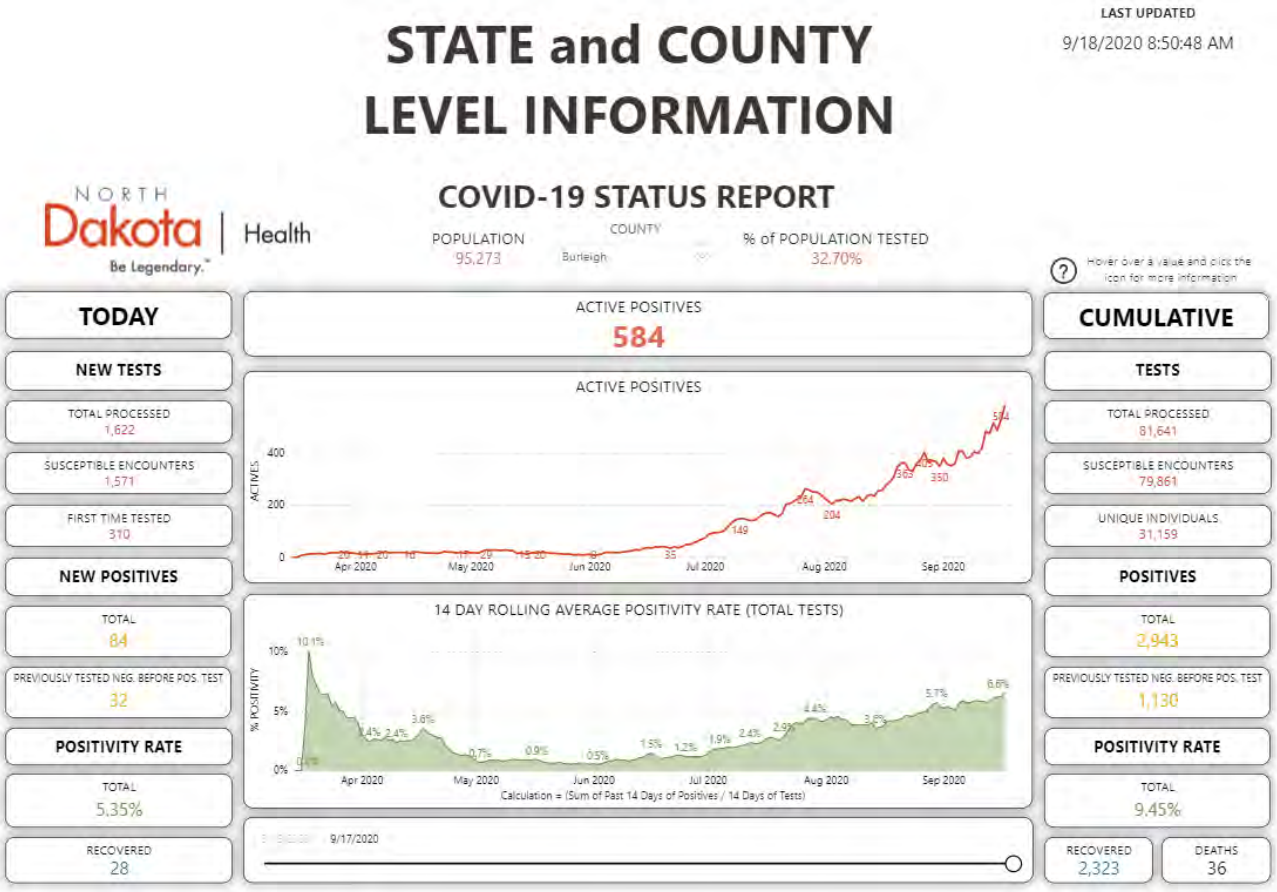


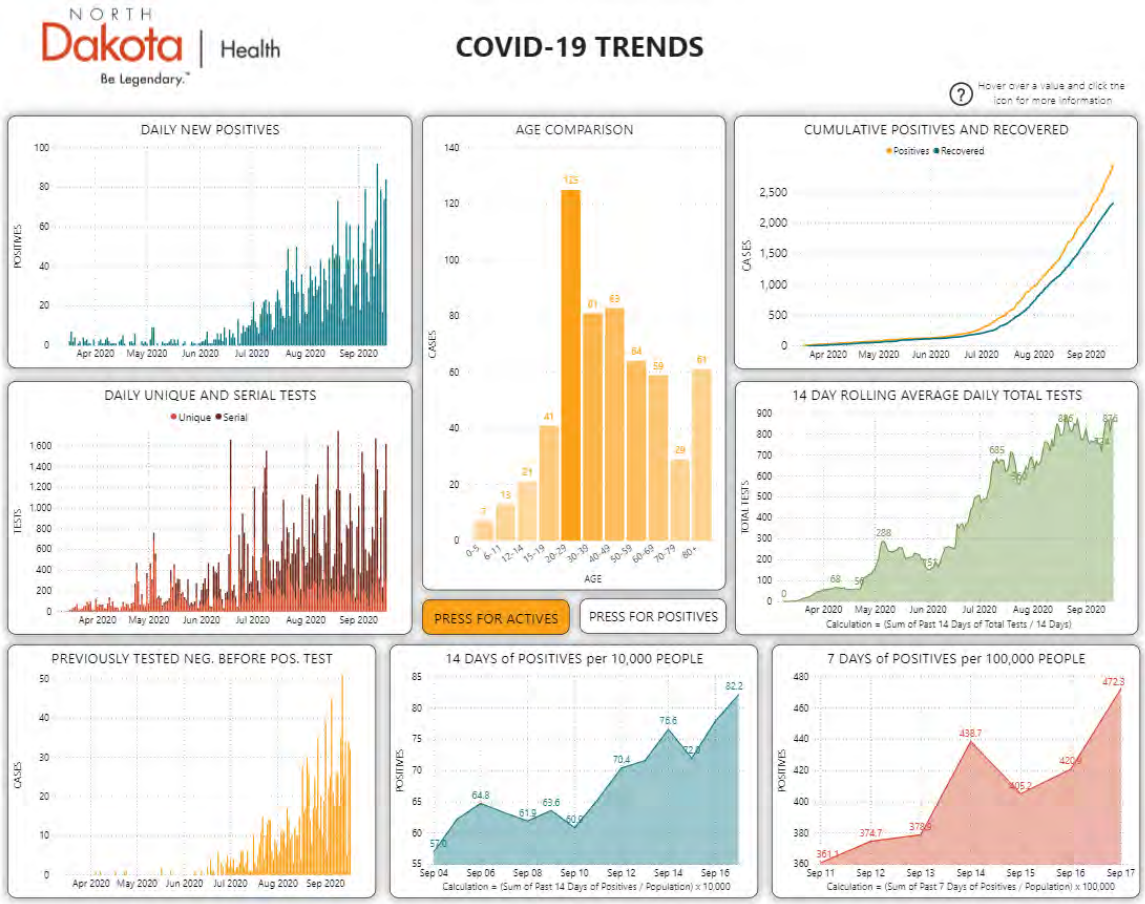
STATE LEVEL INFORMATION

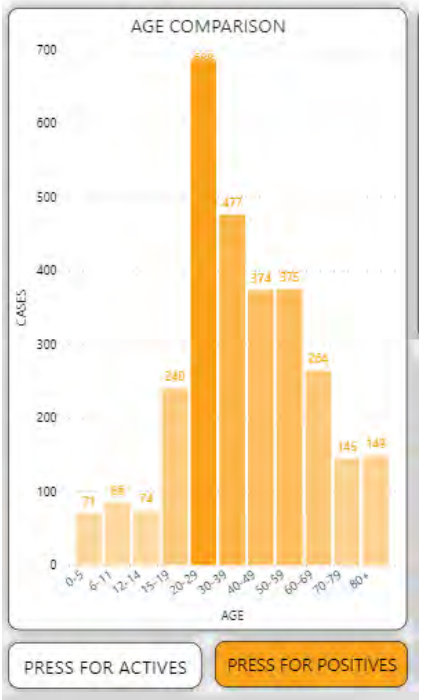


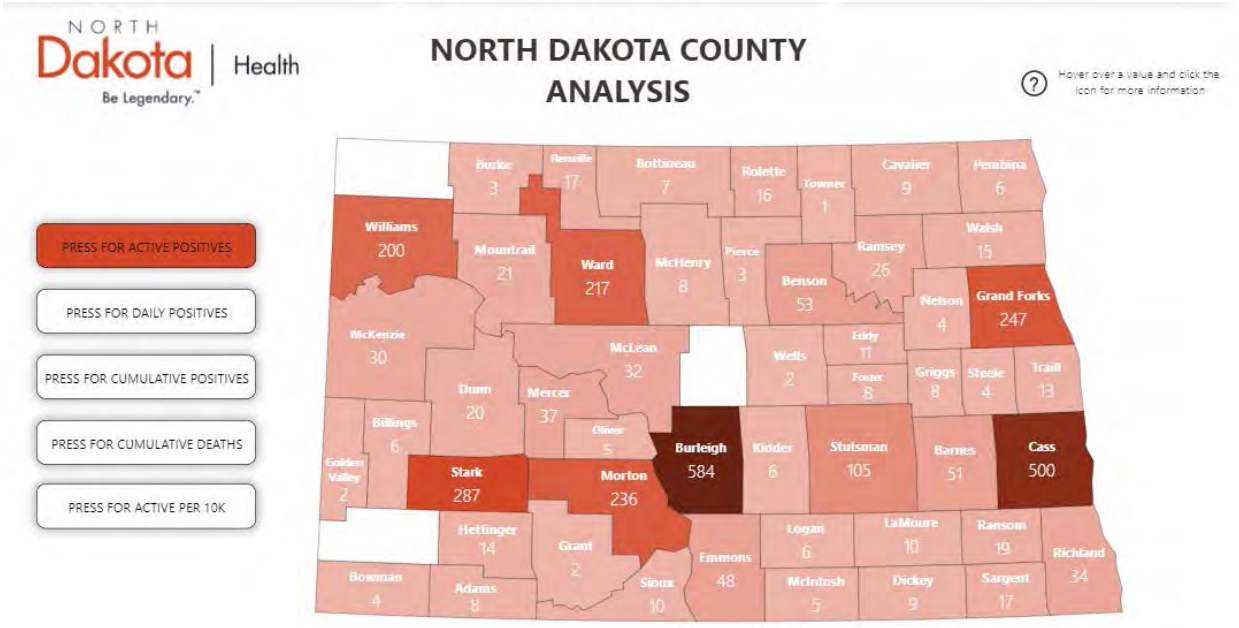

NORTH Dakota | Health
Be Legendary.
STATE HOSPITALIZATIONS and DEATHS
Hover over a value and click the icon for more information
HOSPITALIZATIONS
DEATHS
ACTIVE HOSPITALIZATIONS
Apr 2020 May 2020 Jun 2020 Jul 2020 Aug 2020 Sep 2020
AGE OF TOTAL HOSPITALIZED
HOSPITALIZATIONS
AGE
0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+
COVID ACTIVE NON-ICU 53
COVID ACTIVE HOSPITALIZATIONS 77
COVID ACTIVE ICU 24
COVID TOTAL NON-ICU 522
COVID TOTAL HOSPITALIZATIONS 705
COVID TOTAL ICU 183
OCCUPIED NON-ICU BEDS
53 1,336 0 1,648
OCCUPIED ICU BEDS
24 141 0 353
NON-ICU BEDS OCCUPIED DUE TO COVID 3.22%
ICU BEDS OCCUPIED DUE TO COVID 6.80%
AVERAGE HOSPITALIZATION LENGTH OF STAY (DAYS) 8.11
CUMULATIVE DEATHS 184
CUMULATIVE DEATHS BY AGE GROUP
DEATHS
AGE
0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+
DEATHS BY MONTH
March April May June July August September

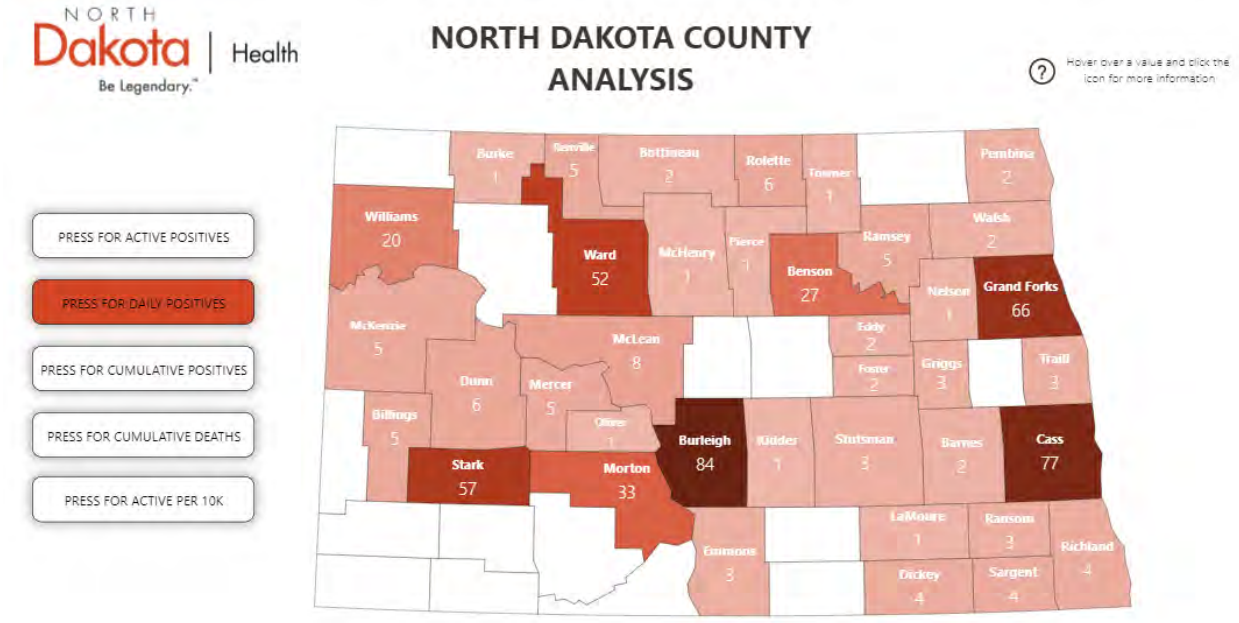
County Level Data as of September 18, 2020:

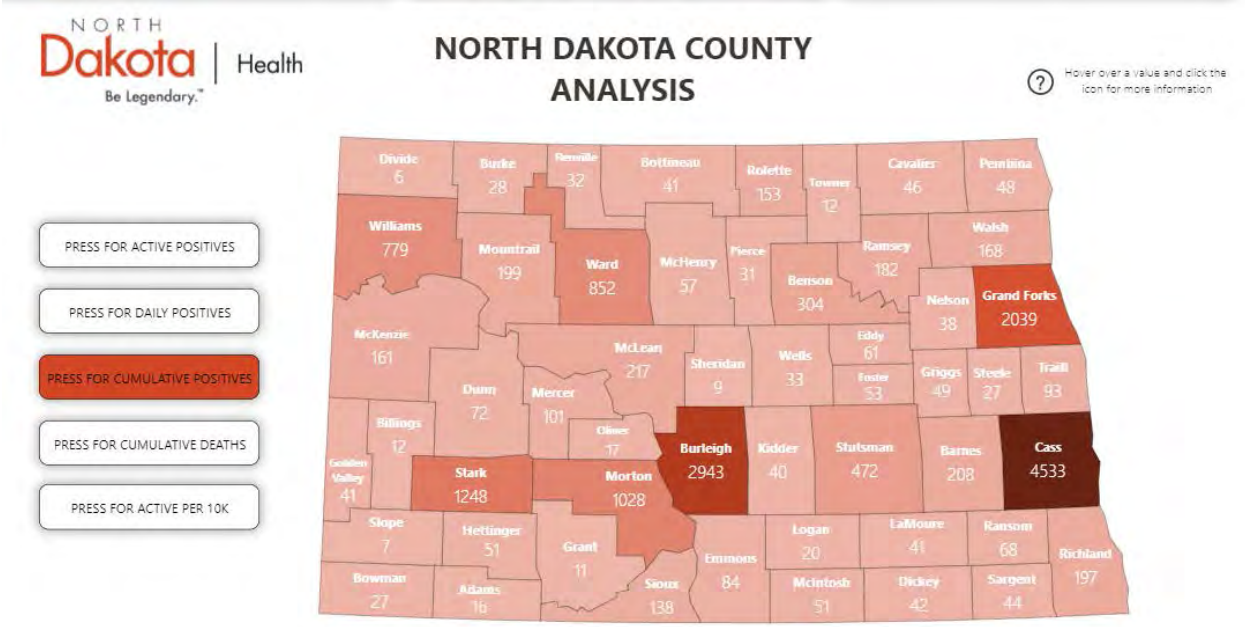


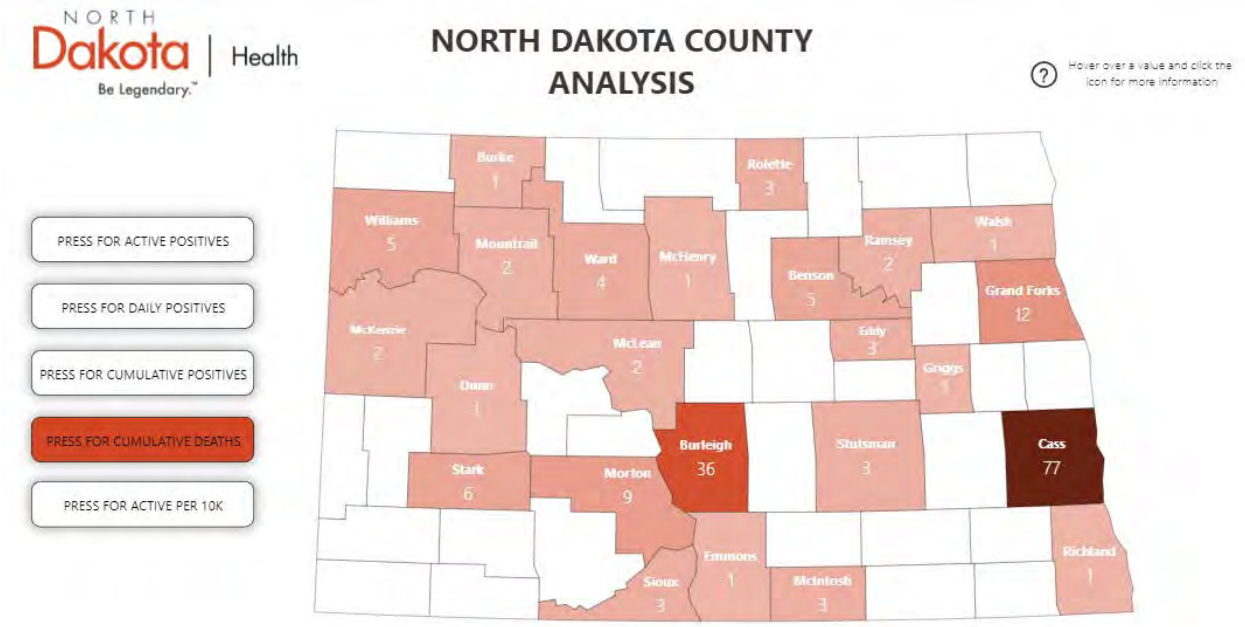

NORTH Dakota | Health
Be Legendary.
COVID-19 TRENDS
Hover over a value and click the icon for more information
DAILY NEW POSITIVES
POSITIVES
Apr 2020 May 2020 Jun 2020 Jul 2020 Aug 2020 Sep 2020
AGE COMPARISON
CASES
AGE
PRESS FOR ACTIVES
PRESS FOR POSITIVES
CUMULATIVE POSITIVES AND RECOVERED
Positives Recovered
CASES
DAILY UNIQUE AND SERIAL TESTS
Unique Serial
TESTS
14 DAY ROLLING AVERAGE DAILY TOTAL TESTS
TOTAL TESTS
Calculation = (Sum of Past 14 Days of Total Tests / 14 Days)
PREVIOUSLY TESTED NEG. BEFORE POS. TEST
CASES
14 DAYS of POSITIVES per 10,000 PEOPLE
POSITIVES
Calculation = (Sum of Past 14 Days of Positives / Population) x 10,000
7 DAYS of POSITIVES per 100,000 PEOPLE
POSITIVES
Calculation = (Sum of Past 7 Days of Positives / Population) x 100,000

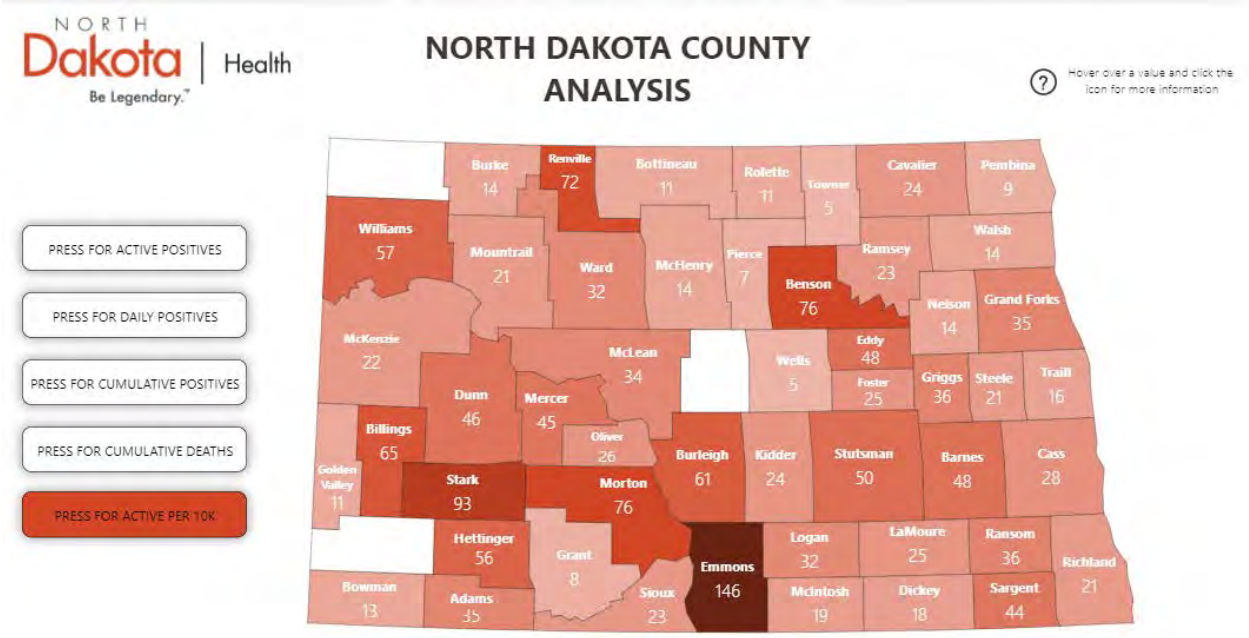

AGE COMPARISON
CASES
AGE
PRESS FOR ACTIVES
PRESS FOR POSITIVES


NORTH Dakota | Health
Be Legendary.
NORTH DAKOTA COUNTY ANALYSIS
Hover over a value and click the icon for more information
PRESS FOR ACTIVE POSITIVES
PRESS FOR DAILY POSITIVES
PRESS FOR CUMULATIVE POSITIVES
PRESS FOR CUMULATIVE DEATHS
PRESS FOR ACTIVE PER 10K
Burke 3
Renville 17
Bottineau 7
Rolette 16
Towner 1
Cavalier 9
Pembina 6
Williams 200
Mountrail 21
Ward 217
McHenry 8
Pierce 3
Benson 53
Ramsey 26
Walsh 15
Nelson 4
Grand Forks 247
McKenzie 30
McLean 32
Wells 2
Eddy 11
Foster 8
Griggs 8
Steele 4
Traill 13
Dunn 20
Mercer 37
Billings 6
Oliver 5
Burleigh 584
Kidder 6
Stutsman 105
Barnes 51
Cass 500
Golden Valley 2
Stark 287
Morton 236
Hettinger 14
Grant 2
Emmons 48
Logan 6
LaMoure 10
Ransom 19
Richland 34
Bowman 4
Adams 8
Sioux 10
McIntosh 5
Dickey 9
Sargent 17


NORTH Dakota | Health
Be Legendary.
NORTH DAKOTA COUNTY ANALYSIS
Hover over a value and click the icon for more information
PRESS FOR ACTIVE POSITIVES
PRESS FOR DAILY POSITIVES
PRESS FOR CUMULATIVE POSITIVES
PRESS FOR CUMULATIVE DEATHS
PRESS FOR ACTIVE PER 10K
Burke 1
Renville 5
Bottineau 2
Rolette 6
Towner 1
Pembina 2
Williams 20
Ward 52
McHenry 1
Pierce 1
Benson 27
Ramsey 5
Walsh 2
Nelson 1
Grand Forks 66
McKenzie 5
McLean 8
Eddy 2
Foster 2
Griggs 3
Traill 3
Dunn 6
Mercer 5
Billings 5
Oliver 1
Burleigh 84
Kidder 1
Stutsman 3
Barnes 2
Cass 77
Stark 57
Morton 33
Emmons 3
LaMoure 1
Ransom 3
Richland 4
Dickey 4
Sargent 4


NORTH Dakota | Health
Be Legendary.
NORTH DAKOTA COUNTY ANALYSIS
Hover over a value and click the icon for more information
PRESS FOR ACTIVE POSITIVES
PRESS FOR DAILY POSITIVES
PRESS FOR CUMULATIVE POSITIVES
PRESS FOR CUMULATIVE DEATHS
PRESS FOR ACTIVE PER 10K
Divide 6
Burke 28
Renville 32
Bottineau 41
Rolette 153
Towner 12
Cavalier 46
Pembina 48
Williams 779
Mountrail 199
Ward 852
McHenry 57
Pierce 31
Benson 304
Ramsey 182
Walsh 168
Nelson 38
Grand Forks 2039
McKenzie 161
McLean 217
Sheridan 9
Wells 33
Eddy 61
Foster 53
Griggs 49
Steele 27
Traill 93
Dunn 72
Mercer 101
Oliver 17
Billings 12
Golden Valley 41
Stark 1248
Morton 1028
Burleigh 2943
Kidder 40
Stutsman 472
Barnes 208
Cass 4533
Slope 7
Hettinger 51
Grant 11
Sioux 138
Emmons 84
Logan 20
LaMoure 41
Ransom 68
Richland 197
Bowman 27
Adams 16
McIntosh 51
Dickey 42
Sargent 44


NORTH Dakota | Health
Be Legendary.
NORTH DAKOTA COUNTY ANALYSIS
Hover over a value and click the icon for more information
PRESS FOR ACTIVE POSITIVES
PRESS FOR DAILY POSITIVES
PRESS FOR CUMULATIVE POSITIVES
PRESS FOR CUMULATIVE DEATHS
PRESS FOR ACTIVE PER 10K
Burke 1
Rolette 3
Williams 5
Mountrail 2
Ward 4
McHenry 1
Ramsey 2
Walsh 1
Benson 5
Grand Forks 12
McKenzie 2
McLean 2
Eddy 3
Griggs 1
Dunn 1
Burleigh 36
Stutsman 3
Cass 77
Stark 6
Morton 9
Emmons 1
Richland 1
Sioux 3
McIntosh 3


NORTH Dakota | Health
Be Legendary.
NORTH DAKOTA COUNTY ANALYSIS
Hover over a value and click the icon for more information
PRESS FOR ACTIVE POSITIVES
PRESS FOR DAILY POSITIVES
PRESS FOR CUMULATIVE POSITIVES
PRESS FOR CUMULATIVE DEATHS
PRESS FOR ACTIVE PER 10K
Burke 14
Renville 72
Bottineau 11
Rolette 11
Towner 5
Cavalier 24
Pembina 9
Williams 57
Mountrail 21
Ward 32
McHenry 14
Pierce 7
Benson 76
Ramsey 23
Walsh 14
Nelson 14
Grand Forks 35
McKenzie 22
McLean 34
Wells 5
Eddy 48
Foster 25
Griggs 36
Steele 21
Traill 16
Dunn 46
Mercer 45
Oliver 26
Billings 65
Golden Valley 11
Stark 93
Morton 76
Burleigh 61
Kidder 24
Stutsman 50
Barnes 48
Cass 28
Hettinger 56
Grant 8
Emmons 146
Logan 32
LaMoure 25
Ransom 36
Richland 21
Bowman 13
Adams 35
Sioux 23
McIntosh 19
Dickey 18
Sargent 44

Dam Failure – Hazard Profile

Description

A dam is any artificial barrier, including appurtenant works, which impounds or diverts water. Dam failure is defined as a sudden, rapid, and uncontrolled release of impounded water that can create a potentially significant downstream hazard.

The storage capacity of Garrison Dam ranges from the 18-24 million acre-feet (Lake Sakakawea). The purpose of this dam includes storage of water for irrigation, hydroelectric power generation, flood control, water supply, recreation, and wildlife habitat. Should the dam fail, the consequences can be devastating.

Most dams are classified based on the potential hazard to life and property should the dam suddenly fail. Note the hazard rating is not an indicator of the condition of the dam or its probability of failure. The following hazard categories have been established for North Dakota according to the North Dakota Design Handbook (North Dakota State Engineer, June 1985:

Low Hazard: These dams are located where there is little possibility of future development such as rural or agricultural areas. Failure of low hazard dams may result in damage to agricultural land, township and county roads, and non-residential farm buildings. No loss of life is expected if failure occurs.
Medium Hazard: These dams are located in predominately rural or agricultural areas where failure may damage isolated homes, main highways, railroads, or cause interruption of minor public utilities. The potential for the loss of a few lives exists if the dam fails.
High Hazard: These are dams located upstream of developed and urban areas where failure may cause serious damage to homes, industrial and commercial buildings, and major public utilities. There is a potential for the loss of more than a few lives if the dam fails.
(North Dakota State Engineer, 1985)

High Hazard Dams affecting Bismarck

Dam Name	River	Location	Owner
Garrison Dam *Maximum storage:* *23.8 million acre feet*	Missouri River	McLean County	US Army Corps of Engineers
Jackman Coulee Dam 2	Jackman Coulee	Bismarck	Bismarck
The Jackman Coulee Dam structure is required to pass a 0.5 PMP event (10.7" 6-hour rainfall) without overtopping. PMP= Probable Maximum Precipitation.			
Fort Peck Dam *Maximum storage:* *19.1 million acre feet*	Missouri River	McCone County, Montana	USACE

Currently, dams with a storage capacity greater than 1,000 acre-feet are required to have an Emergency Action Plan, in accordance with the ND Century Code and ND Administrative Code.

Jackman Coulee Dam 2 in Bismarck is not required to have an EAP (Emergency Action Plan).
Source: North Dakota State Water Commission, 2013.

There are many potential causes for dam failure including hydrologic inadequacy, seepage related issues, structural problems, mechanical problems, operational errors, earthquakes, and terrorism. The causes behind a dam failure can be interrelated and complex. The most common causes of dam failure are hydrologic inadequacy and seepage related issues.

Hydrologic Failures

Hydrologic failures are typically associated with flood events. A hydrologic failure may occur due to dam overtopping or excessive spillway erosion. A dam can be overtopped during a flood event due to insufficient reservoir storage and insufficient spillway capacity. Earthen dams are particularly susceptible to failure when overtopped since earthen material may erode relatively easily. Some dams have an earthen auxiliary spillway designed to carry excess flows during a flood event. Since these are earthen spillways, some erosion can be expected, but under the right conditions excessive erosion can occur. (North Dakota State Water Commission, 2007)

Seepage Failures

All dams have some seepage occurring through the structure and foundation. Seepage, if uncontrolled, can erode material from the embankment of an earthen dam and lead to complete failure of the dam. Piping is a special seepage problem where erosion starts at the point where seepage is exiting the downstream slope or foundation, then works backwards toward the upstream slope. Internal erosion, another type of seepage failure, occurs when water flowing through the dam causes erosion along a crack in the embankment or foundation, or along some other discontinuity or preferential flow path in the embankment, such as along a spillway conduit. Tree roots and animal burrows can also provide paths for seepage. Seepage failures can occur during the course of normal operations, but can also occur during flood conditions when reservoir levels are abnormally high. (North Dakota State Water Commission, 2007)

Garrison Dam Profile

(Source Data: US Army Corps of Engineers, Omaha District)

Garrison Dam is the fifth largest earthen dam in the world. It was constructed as part of the Pick-Sloan Plan for development of the upper Missouri River Basin. Construction of the $294 million dam project began in 1947 and closure of the embankment occurred in April 1953.

Project Statistics

The main features of Garrison Dam are the embankment power plant, spillway and outlet works. The embankment is 2-1/2 miles long and stands 210 feet high. The dam is 2,050 feet wide at the base and tapers off to 60 feet wide at the top. It contains 66.5 million cubic yards of earth fill and 1.5 million cubic yards of concrete.

Power Plant

The power plant consists of five generating units with a total capacity of 515,000 kilowatts. These generators produce 1.8 to 2.6 billion kilowatt-hours of electricity a year. Electrical power is transmitted from the project through seven transmission lines to various substations and is marketed by Western Area Power Administration at the Watertown Dispatch Office in South Dakota.

Intake

The purpose of the Intake Structure is to house the necessary hoisting equipment, gates and auxiliary equipment for the eight water tunnels. Five of the tunnels are for power generation and three are for regulating water releases.

- Height 249 Feet
- Length 540 Feet
- Width 170 Feet

The structure is 7 feet, 8 inches higher than the 18 story N.D. State Capitol building; its base slab is 540 feet long compared to the Capitol's 402 foot length. This structure regulates and directs water flow into the eight water tunnels. The water in the reservoir covers most of the structure, rising nearly to the top of the service bridge piers.

Spillway

The purpose of the Spillway is to control the water level during an emergency situation. The Spillway has 28 gates. Each gate is 29 feet high by 40 feet wide. The total length of the Spillway is almost 3200 feet and was designed for a maximum discharge capacity of 827,000 cubic feet per second at an elevation of 1858.5 mean sea level (MSL). Water released through the gates can reach a speed of 75 miles per hour en route to the stilling basin. The spillway chute contains 42 acres of concrete 18 inches thick. The stilling basin at the end of the chute contains 20 acres of concrete up to a thickness of 5 feet.

> ***2011 Flooding**: During this flood event, the spillway gates at Garrison Dam were opened for the first time since the dam was built in the 1950s. As of June 1, the Spillway was used to release flood waters. The maximum release was 151,000 CFS on June 25, 2011. While the dam was not in any danger of failure, the record water levels were an historic event. Garrison Dam is a high hazard dam on the Missouri River owned by the US Army Corps of Engineers.*
>
> *Video: Garrison Dam Historic Spillway Gate Opening:*
> *http://www.dvidshub.net/video/153064/garrison-dam-historic-spillway-gate-opening#.VAhr-fMo6Uk*
> *Shortly before 8 a.m. on June 1, 2011, the U.S. Army Corps of Engineers opened the gates to pass flood waters for the first time from the Garrison Dam spillway. Seven gates were opened to the height of one foot each to release some 7,500 cubic feet per second of floodwaters. By Kevin Wingert, U.S. Army Corps of Engineers, Omaha District.*

The Lake

Lake Sakakawea, formed behind Garrison Dam, is one of the largest man-made lakes in the United States, extending 178 miles from the dam northwest to Williston, N.D.

The lake averages between two and three miles in width and is six miles wide at its widest point. The maximum depth of the lake is 180 feet at the face of the dam. At normal operating pool (1850 feet mean sea level), the lake covers 368,000 acres, has 1,300 miles of shoreline, and can store nearly 23 million acre-feet of water. That amount of water would cover the entire state of North Dakota with about six inches of water. The drainage area of the lake is about 181,400 square miles.

Garrison Project Statistics:

http://www.nwo.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/2034/Article/487634/garrison-project-statistics.aspx

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Catastrophic Dam Failure (Garrison Dam)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Catastrophic	Catastrophic	Significant	Catastrophic

Note: Jackman Coulee Dam 2 risk and vulnerability are addressed separately from the Garrison Dam risk and vulnerability analysis. See page 16 for Jackman Coulee Dam 2 risk and vulnerability analysis.

Climate Change Impact:
An increase in high intensity precipitation events in North Dakota from climate change may put more dams at risk to conditions that exceed the original design criteria of aging dams. *Source: ND DES Mitigation Plan (2018).*

However, that statement is not specific to the dams which are relevant (Garrison Dam and Jackman Coulee Dam #2) to the City of Bismarck.

HISTORY:
North Dakota does not have a history of significant dam failures in the state.

The dam failure probability is somewhat low based on a minimal history of significant events and the regular inspection and upkeep of the high hazard dams. Should a high or significant hazard dam fail, that event would be considered a high magnitude event. The loss of property, services, and even life could result.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: For vulnerability analysis relating to partial failure, see Flood Hazard – refer to 100 and 500 Year flood information.

Scenario	Garrison Dam Catastrophic Failure
Probability	Unlikely (THIRA rating)
Speed of Onset	10-23 Hours See page 12
Geographic Area	See maps: pages 13 - 15
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Drowning or "stranded" for a long period of time without necessary supplies and ability to communicate the need for help. A. Those who choose not to evacuate – or do not have the means to evacuate – and do not receive assistance. B. Those who do not receive warnings and other emergency public information in a timely manner. C. Prison Population – ND State Penitentiary
Mass Casualty Incident	Yes, potentially Catastrophic due to special populations requiring evacuation
Property Losses (points of vulnerability – high priority)	1. All Structures within affected area. See Dam Failure maps pages 13-15. See pages 6 -7 for loss estimates.
Environmental	1. All Structures within affected area – all contents and building materials contribute to environmental hazards

	2. Debris / hazardous materials, contaminated flood waters 3. Septic systems 4. Hazmat facilities 5. Household hazardous materials released
COG/COOP	1. Bismarck PD 2. Waste Water Treatment Plant 3. Water Treatment Plant 4. Public Works 5. Public Health 6. South Fire Station 7. Employee / Family impact – availability of personnel
Critical Facilities	1. See COG/COOP above. 2. See pages 8-9 for list of critical facilities.
Critical Infrastructure	1. All Critical Infrastructure within the inundated areas would be destroyed or inaccessible. See pages 10-11 for list of critical infrastructure within dam failure impact area.
Schools	1. All Schools south of Rosser. See page 9 for list of schools within dam failure impact area. 2. Schools, if open, may be overwhelmed with additional student population. Many families, however, may have evacuated Bismarck and relocated to other communities.
High Risk Facilities (chemical)	1. There are approximately 145 facilities storing hazardous materials within the dam failure impact area. The majority are NOT Tier II facilities.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Dakota Zoo – not likely to be able to relocate. 2. Non-ambulatory population requiring evacuation assistance. 3. State Penitentiary population. 4. Bismarck Transition Center 5. Crescent Manor 6. Hospital (patient) population
Economy (community wide)	Catastrophic – years/decades to recover
OTHER:	Bismarck Population Displaced as a result of catastrophic dam failure: Approximately **20,356** based on 2010 Census Block information.

Bismarck Critical Facilities and Infrastructure Values Note: Values identified in the table below are additional impacts beyond those identified within the previous table entitled "Impact Analysis – Catastrophic Dam Failure." Properties within this table are limited to those within the inundation area as mapped.			
Group	**Building Property**	**Personal Property**	**Outdoor Property**
Airport	$31,374,921.00	$1,247,496.00	$70,186.00
Bis-Man Transit	$6,115,317.00	$152,965.00	$0.00
Bismarck Public Health Center	$6,137,221.00	$749,215.00	$0.00
Civic Center	$96,225,286.00	$2,651,686.00	$307,961.00
Emergency Management	$1,562,806.00	$1,224,435.00	$971,532.00
Fire Department - South	$2,992,131.00	$802,723.00	$0.00
Multi-Tenant Retail Building	$1,657,072.00	$0.00	$0.00
Northern Plains Commerce Centre	$561,762.00	$13,147.00	$0.00
Parking Authority	$23,223,256.00	$17,806.00	$0.00
Police Department	$9,421,669.00	$1,161,392.00	$924,004.00
Public Works	$15,190,932.00	$655,839.00	$23,281.00
Wastewater Treatment Plant	$7,909,929.00	$4,838,887.00	$436,457.00
Water & Sewer	$4,402,943.00	$0.00	$0.00
Water Treatment Plant	$47,112,487.00	$316,050.00	$233,100.00
Totals	**$253,887,732.00**	**$13,831,641.00**	**$2,966,521.00**
GRAND TOTAL			**$270,685,894.00**

Source: 2014-2015 State Fire and Tornado Insurance Data. Values reflect only properties within Dam Failure Spillway.

Impact Analysis – Catastrophic Dam Failure	
Values within this table reflect 6,506 parcels of 7,376. The remaining 870 parcels are tax exempt properties and are not reflected in the totals within this table.	
Land Value	$447,683,000
Building Value Impact	$1,628,219,000
Total Property Impact	**$2,075,902,000**

Source: Bismarck GIS, 2014

Tax Exempt Property Values NOT included in the total above include parcels with the following designations: 5-year remodeling, blind, charitable, county, disabled person, disabled veteran, Federal, fire levy, graveyard, hospital or homes, lodges, municipal, municipal parks, new business, non-profit, paraplegic wheelchair, religious, school district, state assessed, state owned, homestead credit, payment in lieu of taxes, and renaissance zone project.

CRITICAL FACILITIES
Within Dam Failure Impact Area

Facility	Location
City of Bismarck	
Bismarck Airport	2301 UNIVERSITY DR UNIT 17
Bismarck Event Center	315 S 5TH ST
Bismarck Police Department	700 S 9TH ST
City / County Office Building	221 N 5TH ST
Fire Station 2 - South	835 E BISMARCK
Public Health -Bismarck/Burleigh	500 E FRONT AV
Burleigh County	
Burleigh County Courthouse	514 E THAYER AV
Burleigh County Social Services	316 N 5TH ST
Regional Jail (future development)	
State and Federal Government	
Air Guard	3410 AIRWAY AV
Federal Aviation Agency	2000 UNIVERSITY DR
Federal Building (old)	304 E BROADWAY AV
National Guard - Fraine Barracks	432 FRAINE BARRACKS RD
National Weather Service	2301 UNIVERSITY DR
ND Department Of Health Lab	2635 E MAIN AV
ND Department Of Transportation	218 AIRPORT RD
ND Dept of Health Warehouse	1200 INDUSTRIAL DR, 2
ND DES	35 FRAINE BARRACKS RD
ND State Forensics	2637 E MAIN AV
ND State Lab	2641 E MAIN AV
Post Office	220 E ROSSER AV
State Penitentiary	3303 E MAIN AV
US Postal Processing & Distribution	2220 E BISMARCK EX
Medical and Emergency Services	
Family Practice Center UND	701 E ROSSER AV
Medical Arts Building	810 E ROSSER AV
Metro Area Ambulance South	1139 MEMORIAL HY
Mid Dakota Clinic	401 N 9TH ST
MRI Center	720 E ROSSER AV
Q & R Clinic	222 N 7TH ST
Salvation Army	601 S WASHINGTON ST
Sanford Clinic - South	1040 TACOMA AV
Sanford Health Center	300 N 7TH ST
Sanford Health Powerhouse	310 N 8TH ST
Sanford Health Warehouse	1112 S 12TH ST
CHI Hospital	900 E BROADWAY AV
CHI Purchasing / Warehouse	1300 INDUSTRIAL DR
Communications and Utility Facilities	
Century Link	220 N 5TH ST
MDU	909 AIRPORT RD
Public/Private Critical Facilities	
Bismarck Lumber	2200 E MAIN AV
Bismarck Public School Facilities & Transportation	705 S 9TH ST
Bismarck Transition Center	2001 LEE AV
Bismarck Tribune	707 E FRONT AV
Cash Wise Foods	1144 E BISMARCK
Community Access TV	307 N 4TH ST
Dan's Supermarket - South	835 S WASHINGTON ST
United Way (Shelter location) formerly Open Door	1140 South 12th Street
Vitalent (formerly United Blood Services)	517 S 7TH ST

CRITICAL FACILITIES Within Dam Failure Impact Area	
City of Bismarck	
Railroad Transportation Facility	
DMVW RR	3501 E ROSSER AV
Schools	
Victor Solheim Elementary South Central High School Dorothy Moses Elementary Jeanette Myhre Elementary Wachter Middle School St. Mary's Elementary United Tribes – Daycare United Tribes – Elementary School (2 buildings) United Tribes Technical College Prairie Rose Elementary Ascension Church School First Presbyterian Church – Daycare Noah's Ark Daycare Emmanuel Christian School ECLC Sanford College of Nursing Shepherd of the Valley School Super Kids Jr. Academy Shepherd of the Valley Preschool Hair Academy Angel Academy Discovery Daycare Preschool Program - House of Prayer	

CRITICAL INFRASTRUCTURE Within Dam Failure Impact Area	
City of Bismarck	
Facility	**Location**
Wastewater Treatment Plant	601 W LONDON AV
Water Treatment Plant	615 RIVER RD
Sanitary Sewer Pump Station	100 E INDIANA AV
Sanitary Sewer Pump Station	2516 RIVER RD
Sanitary Sewer Pump Station	850 E WACHTER AV
Sanitary Sewer Pump Station	810 S 26TH ST
Sanitary Sewer Pump Station	3701 E BISMARCK EX
Sewer Lift Station	511 South Washington
Sewer Lift Station	1203 Memorial Highway
Sewer Lift Station	2200 South Washington
Sewer Lift Station	125 East Reno
Sewer Lift Station	525 West Reno
Sewer Lift Station	1740 South Reno
Sewer Lift Station	3108 Manchester Street
Sewer Lift Station	1700 River Road
Sewer Lift Station	3701 Morrison Avenue
Sewer Lift Station	300 Santa Fe
Sewer Lift Station	4053 Downing Street
Sewer Lift Station	3200 Rutland Drive
Transportation	
Bis-Man Transit	3750 E ROSSER AV
Communications	
Clear Channel Radio - KFYR/Y93	3500 E ROSSER AV
CellularTower	2301 UNIVERSITY DR
CellularTower	WEST OF 2301 UNIVERSITY DR
Utility	
MDU Operations	400 N 4TH ST
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd
Western Area Power Administration - Bismarck Substation	
Substation – South Washington Street	South of Burleigh Ave, North of Glenwood Dr.
4th and Front Substation	Front Avenue
Kirkwood Substation	South 7th Street and Arbor Avenue
Sweet Avenue Junction Substation	402 East Sweet Avenue
26th & Expressway Substation	26th Street and Expressway
Pipeline at Missouri River	WEST OF 4051 SANDY RIVER RD
Power Line at Missouri River	WEST OF 6948 BURNT CREEK LP
Power Line at Missouri River	WEST OF 5716 MISTY WATERS DR
Boat Ramps	
Fox Island Boat Ramp	NORTH OF 2650 MILLS AV
Grant Marsh Bridge Boat Ramp	NORTH OF 1103 RIVER RD
Bridge Locations	
Bridge: 3rd St over drainage ditch	SOUTHEAST OF 1922 S 3RD ST
Bridge: Bismarck Ex over Missouri River	BISMARCK EXPRESSWAY BRIDGE OVER MISSOURI RIVER
Bridge: Bismarck Ex over Railroad	WEST OF 3310 E BISMARCK EX
Bridge: east bound I-94 over Railroad	I-94 OVER RAILROAD
Bridge: Lincoln Rd over Apple Creek	WEST OF 5151 LINCOLN RD

CRITICAL INFRASTRUCTURE Within Dam Failure Impact Area	
City of Bismarck	
Bridge: Main Av over Missouri River	WEST OF 100 RIVERSIDE PARK RD
Bridge: Main Av over Washington St	WEST OF 311 W MAIN AV
Bridge: Railroad over 7th St	SOUTHWEST OF 705 E MAIN AV
Bridge: Railroad over 9th St	SOUTHWEST OF 901 E MAIN AV
Bridge: Railroad over Apple Creek	SOUTH OF 7301 APPLE CREEK RD
Bridge: Railroad over Main Av	SOUTH OF 906 MISSOURI AV
Bridge: Railroad over River Rd and Missouri River	NORTH OF 1103 RIVER RD
Bridge: Railroad over Washington St	NORTHWEST OF 260 W FRONT AV
Bridge: Riverwood Dr	2300 RIVERWOOD DR
Bridge: Rosser Av Over Hay Creek	NORTH OF 3605 E ROSSER AV
Bridge: Southport Lp	1500 SOUTHPORT LP
Bridge: Tavis Rd	3300 TAVIS RD
Bridge: University Dr Apple Creek	WEST OF 5701 APPLE CREEK DR
Bridge: Wachter over Drainage Ditch	800 WACHTER AV E
Bridge: Washington over Drainage Ditch	2201 WASHINGTON ST
Bridge: West Bound I-94 over Railroad	I-94 OVER RAILROAD
Railroad / Railroad Crossing Locations	
Railroad Crossing at 12th St	SOUTHEAST OF 1131 E MAIN AV
Railroad Crossing at 24th St	WEST OF 2407 RAILROAD AV
Railroad Crossing at 24th St	NW OF 2400 E FRONT AV
Railroad Crossing at 24th St N	SE OF 2321 E BROADWAY AV
Railroad Crossing at 26th St	SOUTHWEST OF 207 S 26TH ST
Railroad Crossing at 26th St	SE OF 210 S 26TH ST
Railroad Crossing at 26th St	EAST OF 114 N 26TH ST
Railroad Crossing at 3rd St	SOUTHWEST OF 1003 S 3RD ST
Railroad Crossing at 5th St	SOUTHWEST OF 113 S 5TH ST
Railroad Crossing at 66th St	NORTHEAST OF 1580 66TH ST SE
Railroad Crossing at 93rd St	NORTH OF 1800 93RD ST SE
Railroad Crossing at Airport Rd	SOUTHEAST OF 1833 E MAIN AV
Railroad Crossing at Divide Av	SE OF 3500 DIVIDE AV E
Railroad Crossing at Eastdale Dr	SW OF 109 EASTDALE DR
Railroad Crossing at Fraine Barracks	EAST OF 600 RIVER RD
Railroad Crossing at Front Av	EAST OF 2201 E FRONT AV
Railroad Crossing at Main Av	NORTH OF 2409 E MAIN AV
Railroad Crossing at Morrison Av	3810 MORRISON AV
Railroad Crossing at Railroad Av	SE OF 2516 RAILROAD AV
Railroad Crossing at Rosser Av	EAST OF 3422 E ROSSER AV
Railroad Crossing at Vermont Av	NW OF 2220 VERMONT AV
Railroad Crossing at Yegen Rd	EAST OF 1200 YEGEN RD
Railroad Crossing at Yegen Rd	SE OF 910 YEGEN RD
Railroad Over Hay Creek	EAST OF 3120 E CAPITOL AV
Railroad Over Hay Creek	SE OF 2920 E CAPITOL AV

Garrison Dam Failure - Inundation Map

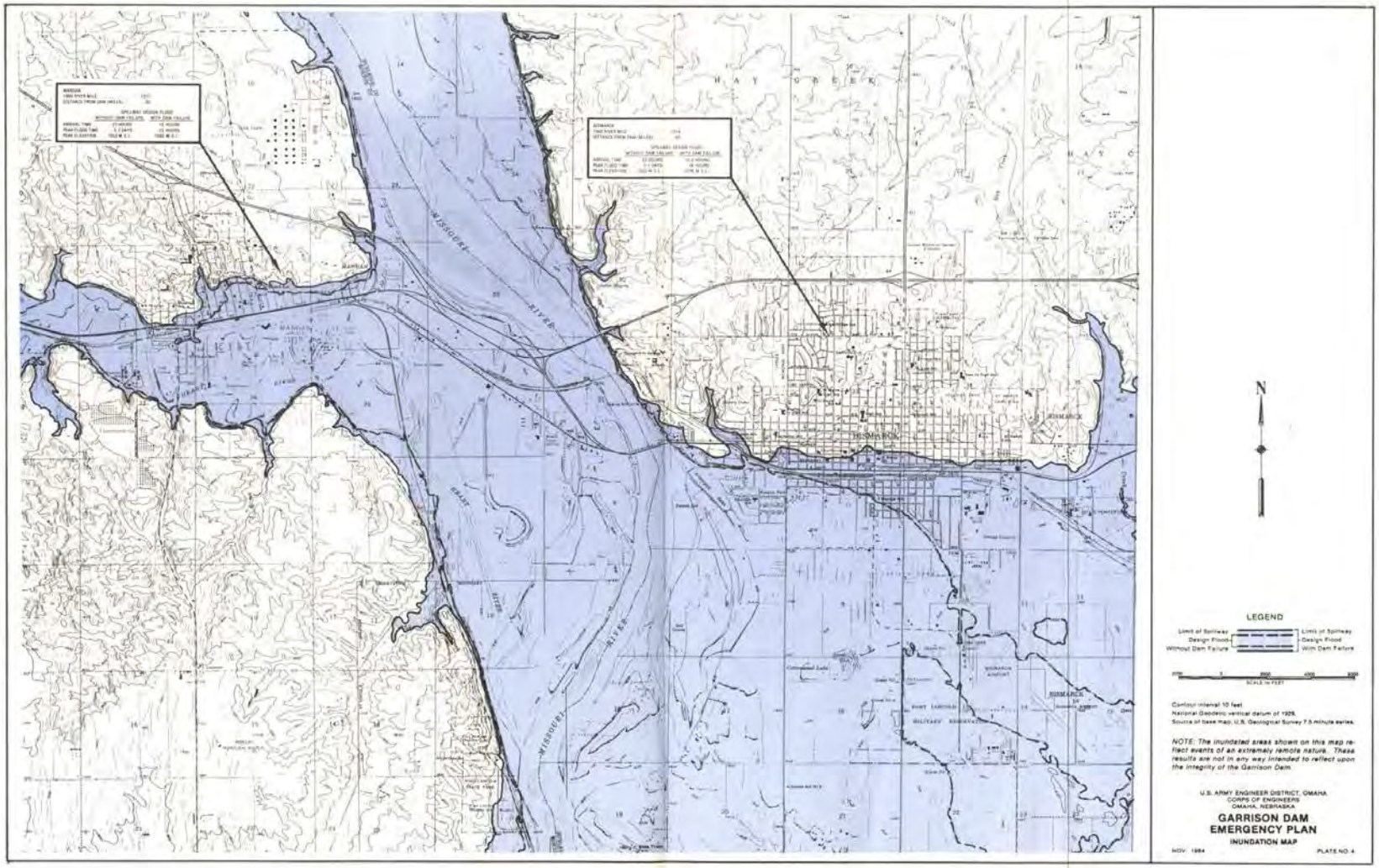
See Garrison Dam Emergency Plan Inundation Map developed by US Army Corp of Engineers, Omaha District. Publish date: November 1984. Information regarding Bismarck is enlarged and included below.
(See map - next page)

Bismarck
1960 River Mile: 1314
Distance From Dam: 65

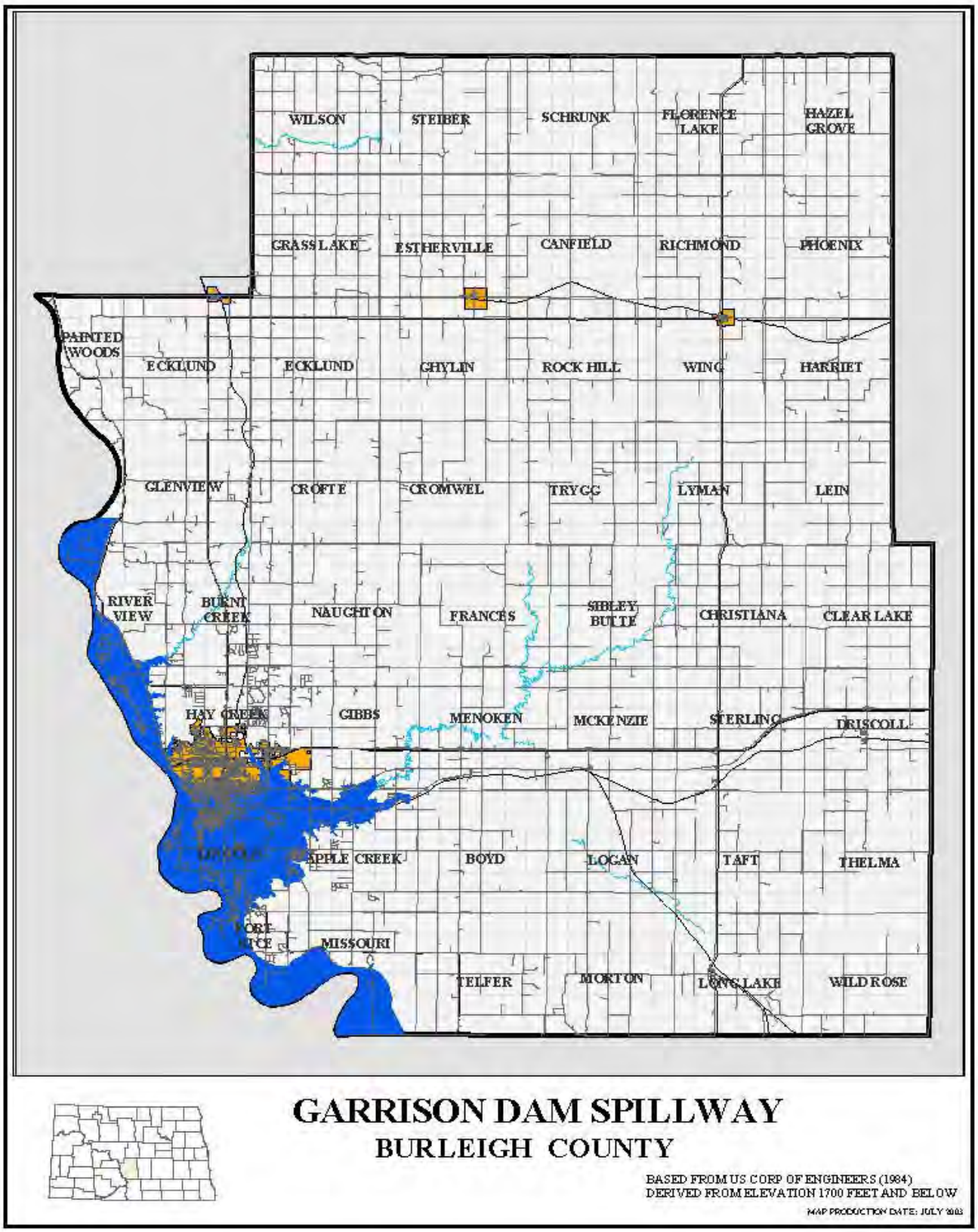
Spillway Design Flood

	Without Dam Failure	With Dam Failure
Arrival Time	23 hours	10.3 hours
Peak Flood Time	5.7 days	24 hours
Peak Elevation	1650 MSL	1675 MSL

Note: The information regarding the Garrison Dam Spillway and inundation maps are intended to be used as a general guideline. The information and mapping regarding the Garrison Dam Spillway contained in this plan was developed by the US Army Corp of Engineers, Omaha District. The information and related maps were published in November of 1984. Changes in topography, new construction, and other various factors may influence or alter the data and inundation maps.


HAY CREEK
MISSOURI RIVER
BISMARCK
N
LEGEND
Limit of Spillway Design Flood Without Dam Failure
Limit of Spillway Design Flood With Dam Failure
Contour interval 10 feet
National Geodetic vertical datum of 1929.
Source of base map: U.S. Geological Survey 7.5 minute series.
NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Garrison Dam.
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
GARRISON DAM
EMERGENCY PLAN
INUNDATION MAP
NOV. 1984
PLATE NO. 4


Bismarck
Garrison Dam
Inundation Map
Garrison Dam Spillway
Source: US COE - Omaha District - November 1984
Map Production Date: June 5, 2006
ADOBE DR
64TH AV NW
OAKFIELD DR
57TH AV NW
RIVER RD
FERNWOOD DR
ASH COULEE DR
MEDORA AV
SLATE DR
HALIFAX ST
RIDGEDALE ST
SOURIS ST
83 HY NE
VALHALLA DR
26TH ST NE
57TH AV NE
BOUNDARY RD
43RD AV NE
CENTENNIAL RD
52ND ST NE
62ND ST
15TH ST N
26TH ST N
GLENDALE DR
VALLEY DR
BUCKSKIN AV
MONTREAL ST
STATE ST
CHISHOLM TR
CLAIRMONT RD
VALLEY DR
CODY DR
ASPEN AV
CENTURY AV W
CENTURY AV E
NEBRASKA DR
YORKTOWN DR
ROOSEVELT DR
INTERSTATE 94 HY
TYLER PY
I-94
INTERSTATE AV E
WASHINGTON ST N
19TH ST N
CAPITOL AV E
DIVIDE AV E
DIVIDE AV W
CANARY AV
EDWARDS AV
WARD RD
3RD ST N
15TH ST N
23RD ST N
LILAC LN
33RD ST N
BISMARCK EX N
20TH AV NE
17TH AV NE
66TH ST NE
52ND ST N
66TH ST N
BOULEVARD AV E
F AV E
E AV E
D AV E
4TH ST N
1ST ST N
9TH ST N
26TH ST N
35TH ST N
A AV W
B AV W
A AV E
ROSSER AV E
MEMORIAL HY
MAIN AV E
BROADWAY AV E
MAIN HY E
MAIN ST E
SOUTH VIEW LN
66TH ST S
BOWEN AV W
3RD ST S
7TH ST S
10TH ST S
15TH ST S
22ND ST S
26TH ST S
BURLINGTON DR
BISMARCK EX W
BISMARCK EX E
APPLE CREEK RD
PARK AV
LEE AV
FULLER AV
UNIVERSITY DR
AIRPORT RD
AIRWAY AV
SYKES ST
YEGEN RD
SABER DR
MUNICH DR
RENO DR S
BILLINGS DR
NAPA LP
12TH ST S
HARBOR DR
RIVERWOOD DR
WASHINGTON ST S
LARSON RD
FAR WEST DR
BURLEIGH AV E
HIGH PLAINS RD
12TH ST SE
AIRWAY AV
LINCOLN RD
SANTEE RD
ECKLESON RD
CUSTER DR
PRESTON LP
66TH ST SE
ENGLAND ST
LANCASHIRE ST
ASHLEE AV
HUBER DR
48TH AV SW
48TH AV SE
GLENWOOD DR
CENTURION DR
S WASHINGTON ST
S 12TH ST
52ND ST SE
62ND AV SE
SIBLEY DR
APPLE CREEK DR
MCDONALD DR
N RILLING RD
SOUTHRIDGE LN
SCENIC DR


WILSON
STEIBER
SCHRUNK
FLORENCE LAKE
HAZEL GROVE
GRASS LAKE
ESTHERVILLE
CANFIELD
RICHMOND
PHOENIX
PAINTED WOODS
ECKLUND
ECKLUND
GHYLIN
ROCK HILL
WING
HARRIET
GLENVIEW
CROFTE
CROMWEL
TRYGG
LYMAN
LEIN
RIVER VIEW
BURNT CREEK
NAUGHTON
FRANCES
SIBLEY BUTTE
CHRISTIANA
CLEAR LAKE
HAY CREEK
GIBBS
MENOKEN
MCKENZIE
STERLING
DRISCOLL
APPLE CREEK
BOYD
LOGAN
TAFT
THELMA
FORT RICE
MISSOURI
TELFER
MORTON
LONG LAKE
WILD ROSE
GARRISON DAM SPILLWAY
BURLEIGH COUNTY
BASED FROM US CORP OF ENGINEERS (1984)
DERIVED FROM ELEVATION 1700 FEET AND BELOW
MAP PRODUCTION DATE: JULY 2003

Jackson Coulee Dam #2 (Tom O'Leary Golf Course) – Vulnerability Assessment:

The letter from Houston Engineering regarding Jackman Coulee Storm Water Facility Improvements and Tom O'Leary Storm Water Detention Applications dated September 4, 2002 describes the low probability: "…It seems appropriate to note the breach failures and methods requested are reflective of a catastrophic, or instantaneous, failure of both embankments simultaneously. Such failures would require these embankments to be fully saturated or have significant structural defects. The probability of a multiple breach is extremely remote since embankment saturation during events lasting six hours and a complete erosive failure event associated with spillway flows of three hours is unreasonable, though it is worst case. We understand these embankments are being held to a very high standard and in our opinion the proposed designs now comply with the required criteria. It is important to understand, however, that if all future and/or existing embankments, including roadways, are held to this level of jurisdictional authority or design criteria some may be impractical to construct and the cost to evaluate the potential failure impacts extensive…"

The inserted map on the following page identifies five residential properties at potential risk for flooding on either a 0.5 PMP (probable maximum precipitation) flood event or a 0.5 PMP flood event with a multiple breach. The 6 hour precipitation event for the 0.5 PMP is 10.7 inches.

The first residence is located on the west side of Jackman Coulee just to the west of Ward Road. The potential risks to this residence were determined using a selected channel section and a conveyance capacity rating based on downstream backwater conditions.
This rating indicates the maximum elevation on a 0.5 PMP event, using a peak flow of 3,400 cfs, is approximately 1698.5 msl. The upstream elevation at Ward Road on this event is 1706.6 and would transition from the overflow back into the channel at this location. Using the City of Bismarck's 2-foot aerial topography was determined the ground level at this residence is at or above elevation 1704. While a finished floor elevation could not be determined this is a slab on grade structure. Based on a projected multiple breach peak flow of 5,355 cfs the water surface elevation in the channel increases to 1700.5 with the elevation over Ward Road at 1707.4. Again the projected water surface elevation in the channel at the residence is below the estimated floor elevation. The unknown, however, is the actual boundary of the transition from overflows on Ward Road into the channel. Reviewing the topography it appears there is a moderate risk for shallow water flooding to reach the north side of this residence on a multiple breach 0.5 PMP event.

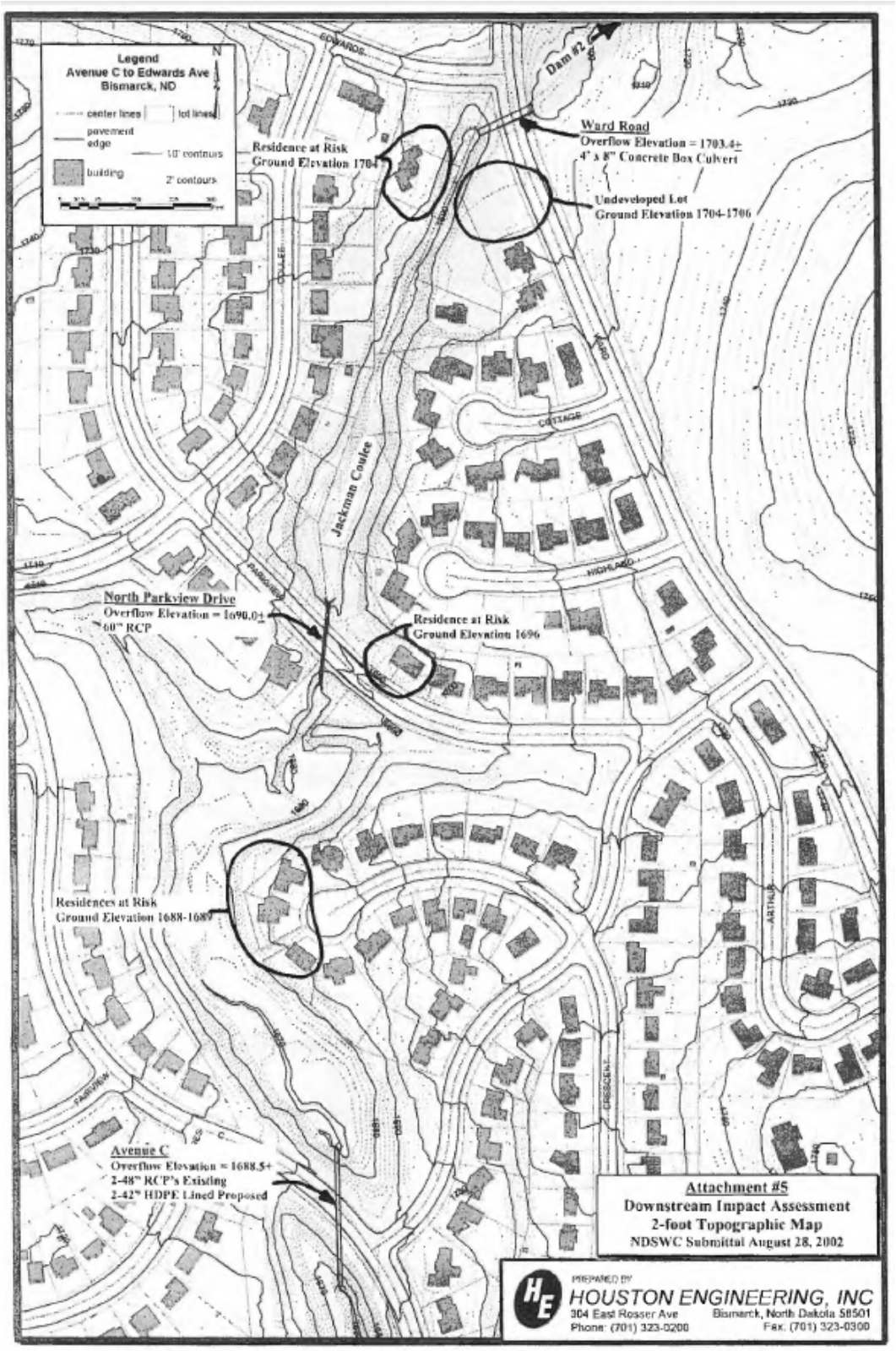
The second impact site is an undeveloped lot located on the west side of Ward Road south of the channel. This lot is not at risk for flooding on a 100-year event and has been removed from the current FIRM. This lot and any future residence are, however, at potential risk for flooding on events greater than the 100-year event, especially a 0.5 PMP or multiple breach event. While this lot and any future residence could be raised this action would restrict the overflows on Ward Road and flows around the structure into the channel would not be desirable. The City has been informed about this situation and will need to carefully consider the associated risks when reviewing any building permit request for this lot. The option to purchase this lot is should also be reviewed.

The third impact site is a residence located on the east side of Jackman Coulee just north of North Parkview Drive. The 0.5 PMP flood event and 0.5 PMP multiple breach flood event yielded elevations of 1693.7 and 1694.I respectively at this crossing. Using the City of Bismarck's 2-foot aerial topography the ground level around this is residence was determined to be at or above elevation 1696. Therefore, this residence is not deemed at risk for flooding on these events.

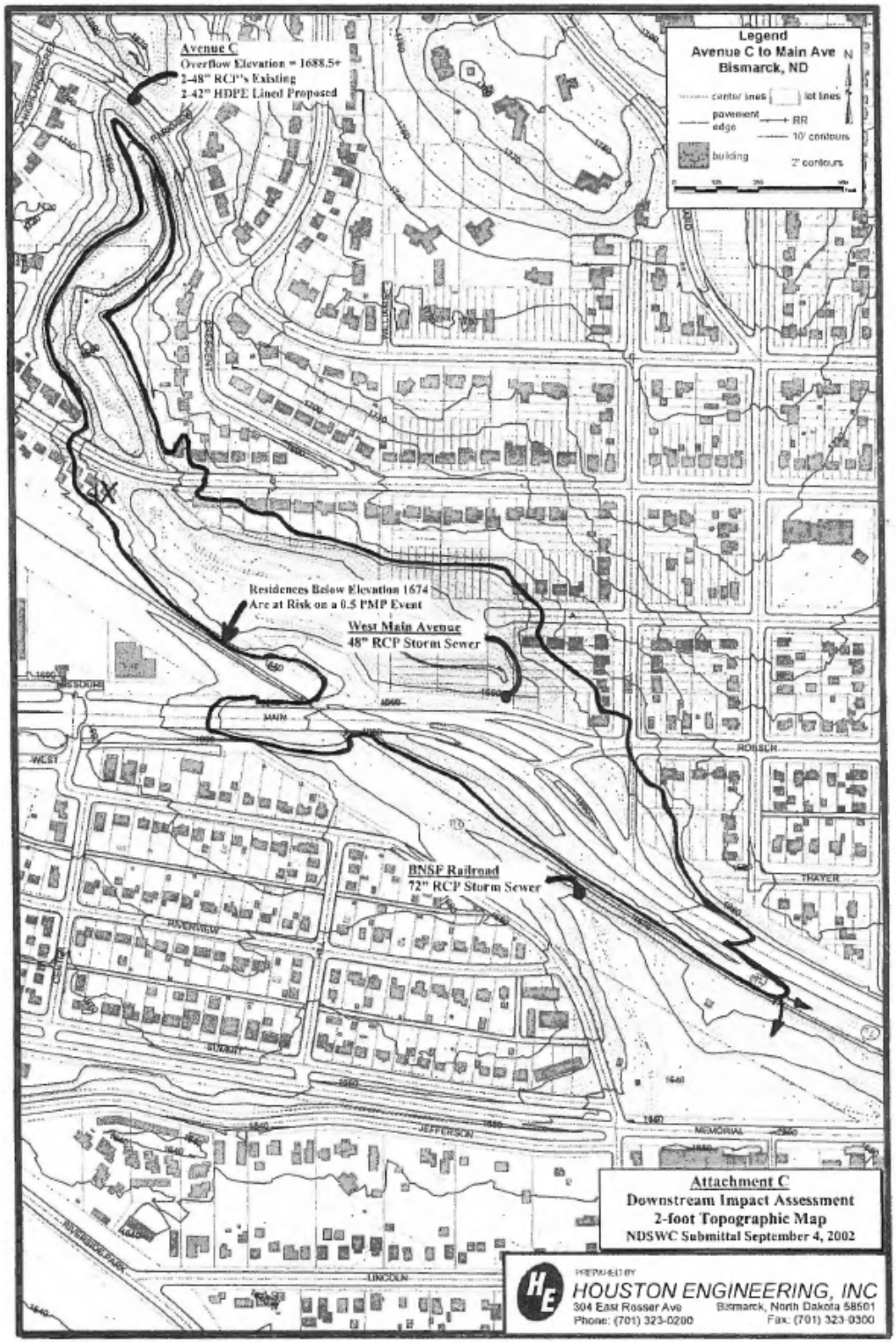
The fourth impact site contains three residences located on the east side of Jackman Coulee at the west end of Crescent Lane. Using the City of Bismarck's 2-foot aerial topography the ground level around these residences was determined to be between elevation 1688 and 1690. This potentially places the finished floor elevations of these walkout basements below the overflow elevation on Avenue C, which are approximately 1688.5. Based on the tables in Attachment #3 these residences are potentially first affected by shallow flooding on about a 500-year event under existing conditions, flood elevation 1688.3. They would however be provided additional protection under projected conditions, which lowers the 500-year flood elevation to 1685.8. In all cases these residences will be affected by floodwaters on events larger than a 500-year event. Since the 0.5 PMP flood event and 0.5 PMP multiple breach event yielded the same flood elevation at Avenue C the incremental impacts are deemed to be minimal. It should be noted that the most likely change would be a slight increase in the potential for shallow water flooding.

The next impact area is between Avenue C and West Main Avenue as illustrated within the inserted map labeled as "Attachment C." This is a confined storage area with a discharge capability limited to 350-450 cfs. Therefore, no matter when the floodwaters arrive from the 0.5 PMP event, breach overflows or not, the maximum flood elevation will not change appreciably as the total inflow volume is too significant to be discharged in a timely manner. Based on the City of Bismarck's aerial topography, the estimated overflow elevation at the BNSF railroad tracks or east along the south side of West Main Avenue is around 1672.5+. Using an estimated maximum water surface elevation of 1674, approximately twelve residences surrounding this area could be affected, most with shallow flooding with the exception basement impacts. Reviewing the path for overflows from Avenue C no residences will be impacted along the reach from Avenue C and Avenue B. The principal impact of all overflows will be from increased floodwater elevations from Avenue B south to West Main Avenue.

Jackman Coulee – Houston Engineering Attachment #5



Jackman Coulee Map Attachment C.



Drought – Hazard Profile

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 wind 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. Prolonged droughts have caused severe economic hardships in North Dakota.

The following is an excerpt from the National Drought Mitigation Center:
Drought is an insidious hazard of nature. Although it 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.
(National Drought Mitigation Center, 2007)

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 streamflow 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.
(National Drought Mitigation Center, 2007)

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 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.

Hydrological droughts affecting tourism/recreation, energy development, food processing, and other industries are usually related to surface water levels in area lakes and rivers that serve as water sources. Reduced water levels can lower production and threaten the ability to produce energy at an acceptable rate, thus, having significant economic ramifications. Water-related recreation can become less desirable or even impossible with the effects of such extending into the economic well-being of tourism and recreation businesses.

A number of secondary hazards are generally associated with drought. Rural grassland fires increase due to dry vegetation. Reduction in vegetation will expose the soil to wind erosion. Reduced flow characteristics adversely affect chemical quality of lakes and rivers. Sediment transport regimes in streams and rivers are altered. Deterioration of water quality results in 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.

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. Drought causes serious economic problems for the entire State of North Dakota.

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 table below lists the more 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 time scale.
Palmer Drought Severity Index (PDSI)	The Palmer is a soil moisture algorithm calibrated for relatively homogeneous regions.
Crop Moisture Index (CMI)	A Palmer 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 Palmer 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 temperature 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.
Drought Severity and Coverage Index (DSCI)	DSCI is useful tool to combine both drought coverage and drought severity for a given geographical area (county, climate division, state or the country). It allows the given drought a historical comparison among other years.
Accumulated Drought Severity and Coverage Index (ADSCI)	It is useful to assess the accumulated impact of the ongoing drought since the inception of the drought in terms of areal coverage and intensity combined. It captures the impact of multi-year droughts.
Evaporative Demand Drought Index (EDDI)	The EDDI maps use atmospheric evaporative demand anomalies across a timescale of interest relative to its climatology to indicate the spatial extent and severity of drought. Unlike the other indices, EDDI utilizes temperature data but not precipitation.
Quick Drought Response Index (QuickDRI)	QuickDRI represents a drought "alarm" indicator of emerging or rapidly changing drought conditions that can support drought severity assessment in combination with traditional, longer-term and/or application-specific drought indicators.

Source: ND Department of Emergency Services 2018 Enhanced Mitigation Plan

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: Product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Drought (severity = *D4 "exceptional drought" via US Drought Monitor)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	None/Negligible	Moderate	Minor	None/Negligible

*D4 Exceptional Drought Exceptional and widespread crop or pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.

- Palmer Drought Index -5.5 or less
- Standard Precipitation Index -2.0 or less
- CPC Soil Moisture Model 0-2 percentile
- USGS Weekly Streamflow 0-2 percentile
- Objective Short and Long-term Drought Indicator Blends 0-2 percentile

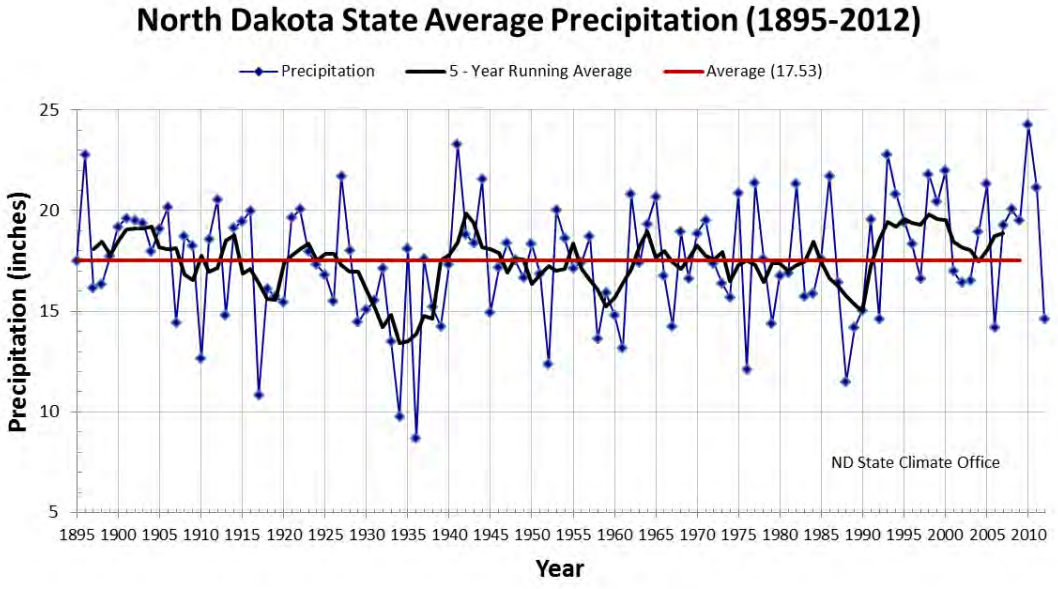
Droughts cannot be defined with certainty as extremely dry periods often alternate with wetter than normal periods. Since 1930, North Dakota has suffered drought in the 1930s, 1950s, early 1960s, mid 1970s, early 1980s, 1988 through 1991, 2002 through 2004, 2006, 2012, and 2017.

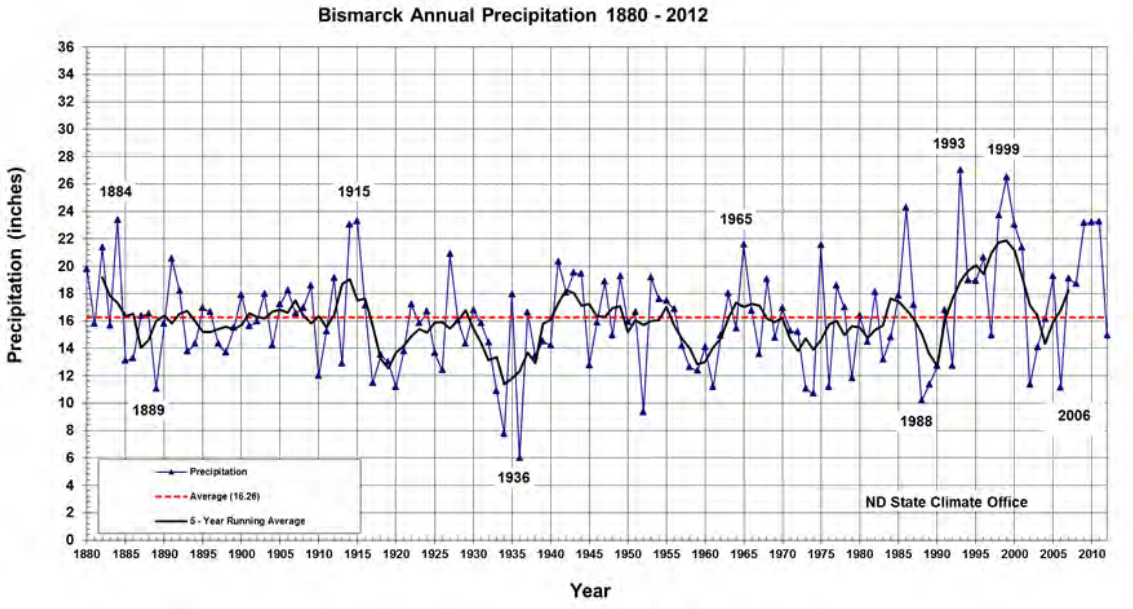
See additional historical occurrence information, page 15.

Climate Change Impact:

The intensity of droughts is projected to increase: Droughts are a natural part of the climate system and because precipitation increases are projected to occur during the cooler months, North Dakota will remain vulnerable to periodic drought. Higher temperatures will increase the rate of depletion of soil moisture during dry conditions in the warm season, leading to more serious conditions during future droughts. Mid-summer through early fall wildfires may also become more common. Higher temperatures will increase the rate of warm season soil moisture depletion, leading to more serious conditions during future naturally occurring droughts. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease.	NOAA Climate Summary (ND)
Major flooding across the basin in 2011 was followed by severe drought in 2012, representing new and unprecedented variability that is likely to become more common in a warmer world.	*NCA Volume II Chapter 22 Northern Great Plains)*

The Great Plains/Midwest drought of 2012 was the most severe summer meteorological drought in the observational record for that region. An unfortunate string of three different patterns of large-scale meteorology from May through August 2012 precluded the normal frequency of summer thunderstorms and was not predicted by the NOAA seasonal forecasts. Significant U.S. seasonal precipitation deficits are not confidently projected outside of the Southwest. However, future higher temperatures will *likely* lead to greater frequencies and magnitudes of agricultural droughts throughout the continental United States as the resulting increases in evapotranspiration outpace projected precipitation increases.	NCA4 Volume I Chapter 8





Source: North Dakota State Climate Office, 2014.

Probability and Magnitude

The NOAA's Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, the paleoclimatic record of past droughts is a better guide than what is provided by the instrumental record alone for what we should expect in terms of the magnitude and duration of future droughts. For example, paleoclimatic data suggest that droughts as severe as the 1950s drought have occurred in central North America several times per century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago. This data indicates that we should be aware of the possibility of such droughts occurring in the future as well. The occurrence of such sustained drought conditions today would be a natural disaster of a magnitude unprecedented in the 20th century. Based on this research, the 1950s drought situation could be expected approximately once every 50 years or 20% chance every ten years. An extreme drought, worse than the 1930s Dust Bowl, has an approximate probability of occurring once every 500 years or a two percent chance of occurring each decade. Therefore, there is approximately a one percent to 49.9% probability that a drought could occur in a given year.
Source: 2018 ND DES Enhanced Mitigation Plan

Drought is usually a regional hazard and any part of the state could be impacted in any given year. Mapping of the current drought status is published by the US Drought Monitor each Thursday at https://droughtmonitor.unl.edu/. North Dakota also has an extensive network of ground monitoring wells and surface water gauges. Ground water information, including hydrographs, recent water levels and chemistry conditions, can be found at http://mapservice.swc.state.nd.us/ Daily streamflow conditions are maintained by the US Geological Survey and can be found at http://waterdata.usgs.gov/nd/nwis/rt.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Drought	**Extreme Drought**
Probability	Likely	Possible
Drought is a recurring feature of nearly every climate on the planet. In many parts of the world, including North America, we have very little ability to predict exactly when drought will happen next. But if we look at history and climate data, we can be sure that drought will happen again at some point. Source: National Drought Mitigation Center		
Speed of Onset	Slow. Warning time is up to a year	Slow. Warning time is up to a year
Duration	Weeks, Months, Years	Months, Years, Decades
Geographic Area	Multiple counties or States	Multiple counties or states
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Heat Wave A. Elderly and young – based on lack of cooling (HVAC) indoors or excessive outdoor activity	1. Heat Wave 2. Dust 3. Stress / Depression /Suicide/violence 4. Lack of Food / Nutrition A. Elderly and young B. Those with lung / health issues C. Farmers, agricultural workers, others impacted greatly by economic impact D. Economically disadvantaged E. Increased risk to first responders due to heat stress F. Outdoor workers (construction, etc.)
Mass Casualty Incident	Unlikely	Possible, but not likely to require mass casualty response
In the United States, a well-developed economy and agricultural system generally protect citizens from the most critical effects of drought such as shortages of food and water. However, drought still causes extreme hardship for farm and ranch families, and individual wells may run dry. *Source: National Drought Mitigation Center*		
Property Losses (points of vulnerability – high priority)	Not likely	1. Abandoned property due to economic issues faced by individual families 2. Properties at Wildland/Urban Interface (due to increase in fire)
Environmental	1. Soil Erosion 2. Lower Lake & River levels	1. Soil Erosion 2. Lower Lake/river levels 3. Increase in turbidity and salinity levels 4. Air Quality (dust / pollutants increase) – decreased visibility 5. Loss of wetlands 6. Loss of vegetation 7. Loss of fish and game habitat

	Drought	Extreme Drought
		8. Stressed vegetation and wildlife more vulnerable to disease 9. Insect infestations 10. Plant infestations
COG/COOP		
Critical Facilities		
Critical Infrastructure	1. Water Restrictions may be necessary	1. Diminished food supply and increase in food prices 2. Strain on financial institutions 3. Commercial Food Service Operations
Schools		
High Risk Facilities (chemical)		
Specific Populations: Public Assembly, Vulnerable / Special Populations		1. Farm Families 2. Elderly/Young 3. Increase in Respiratory Ailments 4. Economically disadvantaged (higher food prices) 5. Agribusiness employees
Economy (community wide)	1. Agricultural businesses Impacted 2. Tourism – loss of revenue 3. Recreational facilities / businesses impacted	1. Agricultural businesses impacted 2. Tourism – loss of revenue 3. Recreational facilities / businesses impacted 4. Industrial Users a. Energy production (i.e.: use of water for cooling or hydro-electric power) b. Those that draw directly from the river 5. Financial Institutions 6. Transportation 7. Unemployment 8. Loss of Property Tax revenues 9. Out-migration of affected residents
OTHER:	1. Increased risk of fire 2. Migration of wildlife animals to urban areas seeking food/water (and potential for disease)	Public Safety Concerns: 1. Conflicts over water / water use / water rights 2. Increased risk of fire 3. Firefighting and issues related to requirements for water (quantity / pressure) 4. Migration of wildlife animals to urban areas seeking food/water (and potential for disease)

Categories of Potential Drought Losses (Statewide/Regional)

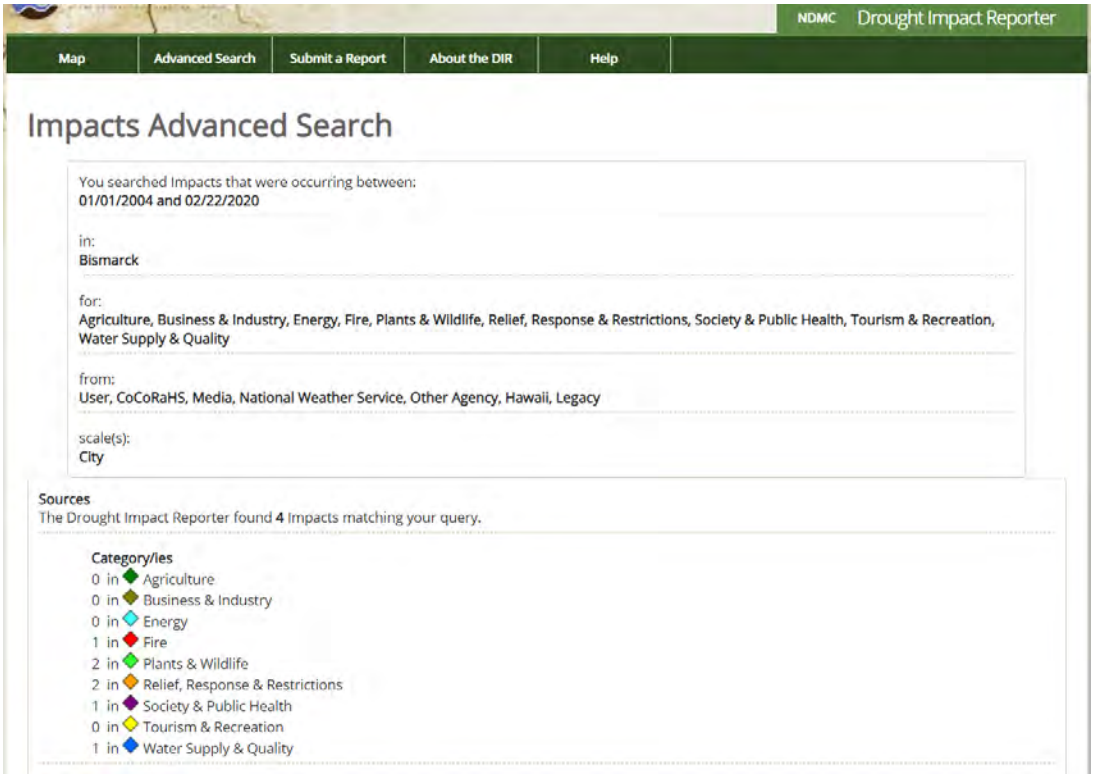
Drought Type	Loss Type	Causes
Agricultural	Costs and losses to agricultural producers	- Annual and perennial crop losses - Damage to crop quality - Reduced crop yields - Reduced productivity (wind erosion, loss of organic matter) - Insect infestation - Plant disease - Wildlife damage to crops - Increased irrigation costs - Water resource development (wells, dams, pipelines)
Agricultural	Costs and losses to livestock producers	- Reduced productivity of rangeland - Reduced milk production - Forced reduction of foundation stock - Closure/limitation of public lands to grazing - High cost/unavailability of water/feed for livestock - Water resource development (wells, dams, pipelines) - Increased feed transportation costs - High livestock mortality rates - Disruption of reproduction cycles - Decreased stock weights - Increased predation - Range fires
Agricultural	Loss from timber production	-Wildland fires - Tree disease - Insect infestation - Impaired productivity of forest land - Direct loss of tress, especially young ones
Agricultural	General economic effects	Decreased land prices - Loss to industries directly dependent on agricultural production (machinery, fertilizer, food processors, dairies) - Unemployment from declines in production

Drought Type	Loss Type	Causes
		- Strain on financial institutions (foreclosures, more credit risk, capital shortfalls) - Revenue losses to government (reduced tax base) - Reduction of economic development - Fewer agricultural producers (due to bankruptcies, new occupations) - Rural population loss
Hydrological	Loss from fish production	- Damage to fish habitat - Loss of fish and other aquatic organisms due to decreased flows
Hydrological	Loss to recreation and tourism industry	- Loss to manufacturers and sellers of recreational equipment - Losses related to curtailed activities: hunting, fishing, bird watching, boating
Hydrological	Damage to animal species	- Reduction and degradation of fish and wildlife habitat - Lack of feed and drinking water - Greater mortality (increased contact with producers) - Disease - Increased predations - Migration and concentration - Increased stress to endangered species - Loss of biodiversity
Hydrological	Hydrological effects	- Lower water levels in reservoirs, lakes, and ponds - Reduced flow from springs - Reduced streamflow - Loss of wetlands - Increased groundwater depletion, land subsidence, reduced recharge - Water quality effects (salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)
Socioeconomic	Energy-related effects	- Increased energy demand and reduced supply because of power curtailments - Costs associated with substituting more expensive fuels for hydroelectric power
Socioeconomic	Water suppliers	- Revenue shortfalls and/or windfall profits - Cost of water transport or transfer

Drought Type	Loss Type	Causes
		- Water resource development (wells, dams, pipelines)
Socioeconomic	Decline in food production/disrupted food supply	- Increase in food prices - Increased importation of food (higher costs)
Socioeconomic	Damage to plant communities	- Loss of biodiversity - Loss of trees from urban landscapes, shelterbelts, wooded conservation areas
Socioeconomic	Health and values	- Mental and physical stress - Low-flow problems - Reductions in nutrition - Loss of human life (heat stress, suicides) - Public safety from forest and range fires - Increased respiratory ailments - Increased disease caused by wildlife concentrations - Increased conflicts (water use, political, management) - Increased poverty in general - Population migrations - Loss of aesthetic values - Reduction or modification of recreational activities - Disruption of cultural belief systems - Reevaluation of social values - Dissatisfaction with government response - Perceptions of inequity in relief - Loss of cultural sites - Increased data/informational needs - Recognition of institutional restraints on water use

Source: National Drought Mitigation Center, 2007.

Drought Impacts to Bismarck ND as recorded by the National Drought Mitigation Center 2004-2020
https://droughtreporter.unl.edu/advancedsearch/impacts.aspx



Trees in Bismarck, North Dakota stressed by drought

Dates of Impact: 2017-08-30 to unknown
Summary:
Bismarck's trees have begun to change color already or drop leaves as drought stresses the trees. The city forester urged the public to water their trees until the first freeze.
KFYR-TV NBC 5 Bismarck (N.D.), Aug. 30, 2017
Affected Area(s): Bismarck, ND
Categories:
Plants & Wildlife
Sources: Media

- **Media Trees begin changing color early due to stress from drought - KFYR-TV NBC 5 Bismarck (ND)**
  KFYR-TV NBC 5 Bismarck, 2017-08-30

Community garden producing less food in Bismarck, North Dakota

Dates of Impact: 2017-08-11 to unknown
Summary:
The Community Garden at Basin Electric Community Cooperative in Bismarck would have produced about 250 pounds of food for a local food pantry, but this year has made just 50 pounds.
KFYR-TV NBC 5 Bismarck (N.D.), Aug. 11, 2017
Affected Area(s): Bismarck, ND
Categories:
Plants & Wildlife
Society & Public Health
Sources: Media

- **Media Drought dries up community gardens - KFYR-TV NBC 5 Bismarck (ND)**
  KFYR-TV NBC 5 Bismarck, 2017-08-11

Water conservation urged in Bismarck and Lincoln, North Dakota

Dates of Impact: 2017-06-05 to unknown

Summary:

Water customers in Bismarck and Lincoln were asked to not use water outdoors because reservoirs levels were low, as was water pressure. Water supplies in Lincoln's water towers were down due to lawn watering, but the community also followed Bismarck's lead on water conservation because they get their water from Bismarck. Customers of the South Central Water District were also urged to conserve.

Bismarck Tribune (N.D.), June 5, 2017

Affected Area(s): Burleigh County, ND, Bismarck, ND, Lincoln, ND

Categories:

Relief, Response & Restrictions

Water Supply & Quality

Sources: Media

- **Media Voluntary water restrictions expanded throughout Bismarck, Lincoln - Bismarck Tribune (ND)**
  Bismarck Tribune, 2017-06-05
- **Media City water usage reaching highs during drought - Bismarck Tribune (ND)**
  Bismarck Tribune, 2017-06-06
- **Media Bismarck-area residents being urged to conserve water - Fresno Bee (CA)**
  Fresno Bee, 2017-06-07

Care recommended with use of fire around Bismarck, North Dakota

Dates of Impact: 2017-06-05 to unknown

Summary:

Dry conditions led the Bismarck rural fire chief to urge the public to be cautious with fire since five to eight acres burned south of Bismarck on the evening of June 4.

Bismarck Tribune (N.D.), June 5, 2017

Affected Area(s): Burleigh County, ND, Bismarck, ND

Categories:

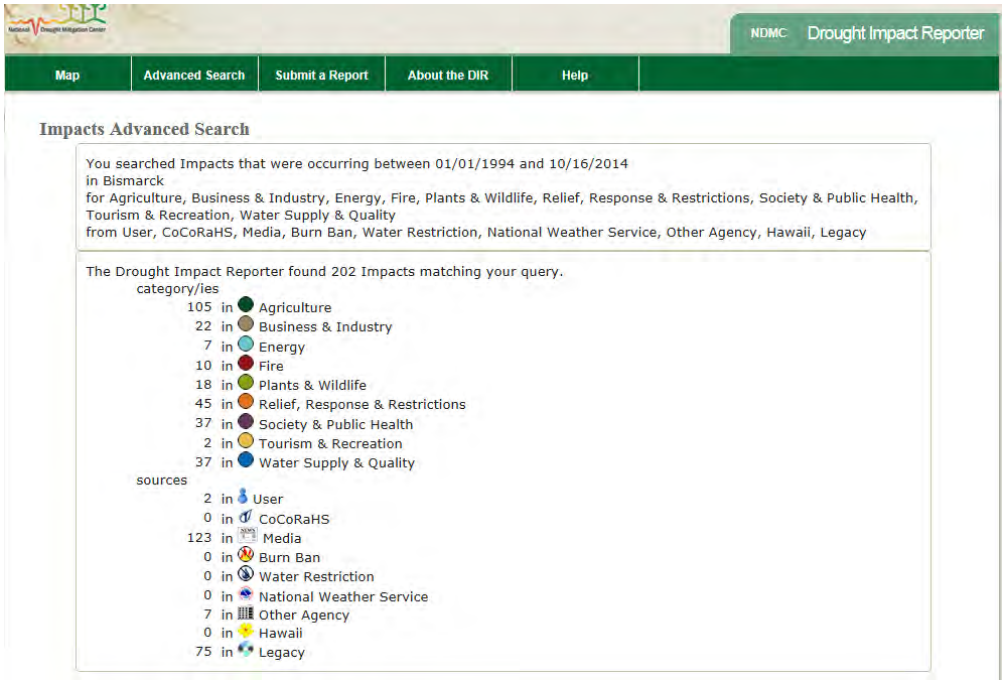
Fire

Relief, Response & Restrictions

Sources: Media

- **Media Voluntary water restrictions expanded throughout Bismarck, Lincoln - Bismarck Tribune (ND)**
  Bismarck Tribune, 2017-06-05

Drought Impacts to Bismarck ND as recorded by the National Drought Mitigation Center 1994-2014



Source: **http://droughtreporter.unl.edu/**

Bismarck Water Supply Vulnerability Assessment

Bismarck has had voluntary lawn watering restrictions in the last 20 years. These restrictions have been based on reduced capacity due to construction and repair of infrastructure, or higher demands for lawn watering. In the drought conditions of 2019, there were no issues with water supply. Voluntary water restrictions were put in place on the following dates:

- July 26, 2018
- June 5, 2017
- June 18, 2014
- June 1, 2010
- July 22, 2008
- August 7, 2006

The water supply from the Missouri River in North Dakota is regulated by a prior appropriations water rights system managed by the State Water Commission. Bismarck has 3 water permits for municipal use, 1951 priority date for 16,950 acre feet, 1955 priority date for 56,005 acre feet, and 2007 for 3,800 acre feet. Low recorded flows on the Missouri River during dry conditions are far greater than the water appropriations of the Missouri River in this stretch of the system. There is adequate supply to sustain the community during an extended drought.

Data Limitations

The greatest data limitation with drought is the inability to pinpoint the start and end of drought periods and the associated correlation with economic losses.

HISTORY:

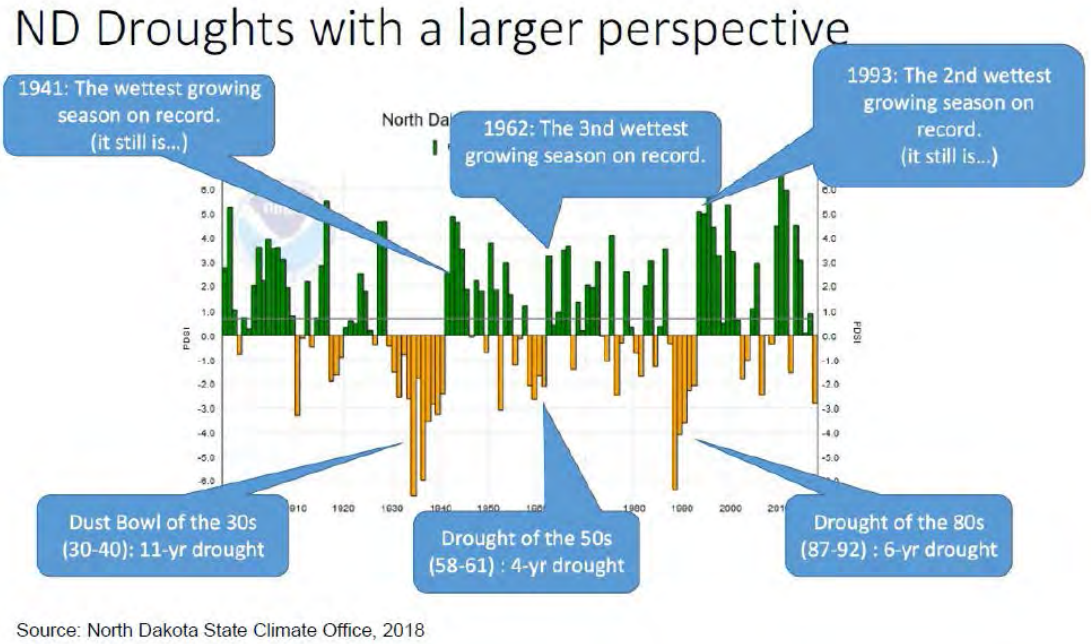


Diagram above from the ND Department of Emergency Services 2018 Enhanced Mitigation Plan

1930's Dust Bowl: June 1929 was one of the driest on record in North Dakota, followed by continuing drought conditions throughout the 1930s. In 1936, North Dakota recorded its highest temperature of 121°F at Steele, ND on July 6. (State Historical Society of North Dakota, 2007)

The "Dust Bowl", as it is called, resulted in widespread drought conditions, soil erosion, and grasshopper infestations. This drought was exacerbated by poor farming practices, low market prices, and a depressed economy. Lessons learned during the 1930s drought stimulated the creation of governmental agencies to promote conservation, increased irrigation, and education stressing more flexible and diverse operations using improved management practices. The Federal Crop Insurance Program was established and institutions liberalized credit. The United States Department of Agriculture (USDA), the North Dakota State Agricultural Experiment Station System, and agricultural colleges and universities began an intensified research effort. This resulted in technologies for control of soil erosion, soil moisture conservation, higher yielding grain varieties that could better withstand dry conditions, improved fertilizers, and better farm management techniques.

1950s: The impact of drought in the early 1950s was less severe than the 1930s. The widespread financial distress, interstate migration, and regional disruption characteristic of the Dust Bowl era were largely absent. Strong emphasis was placed on water conservation and augmentation, weather modification research, weather prediction and control, groundwater recharge, irrigation and river basin development, evaporation control, desalination, phreatophyte control, and irrigation canal lining.

1970s and 1980s: 1976 was the driest year in North Dakota since the 1930s. (State Historical Society of North Dakota, 2007) By 1988, the North Dakota Governor declared a statewide emergency because of the drought. Damages were not limited to agricultural losses. Public water systems and individual wells also began to dry up. (North Dakota State Water Commission, 1994) Disaster damage in 1988 was estimated to be $3.5 billion, not including the cost of indirect impacts. In the 1970s and 1980s, response to drought by state and federal governments was characterized by provisions for livestock feed assistance, crop loss financial aid packages (deficiency and disaster payments), commodity stock adjustments, disaster credit and forbearance programs for agriculture producers and related small businesses, and some water-related assistance.

1976: Presidential Emergency Declaration (DR 3016 declared July 21, 1976) for North Dakota including Burleigh County. Driest year in North Dakota since 1936.

2000-2007: North Dakota soils were under some degree of drought and ruled for 78 consecutive months from December 2000 until mid-June 2007. The most severe drought occurred during July 2006 when 100 percent of the state experienced at least moderate drought status on the drought monitor scale.

2012: Governor Jack Dalrymple declared an agricultural emergency for the state due to drought conditions on August 14, 2012. The declaration included 49 counties (including Burleigh) and the five reservations.

Most locations across western and central North Dakota this year experienced it as one of the top ten warmest years on record, drier than normal conditions, and a snowfall deficit of over 10 inches. Several locations had their warmest March average temperature on record. The average temperatures in March were 12 to 14 degrees Fahrenheit above normal. The drought conditions deteriorated throughout the summer and fall, with below normal precipitation and abnormally dry conditions. In August and September, there were very high and extreme fire dangers in portions of southwest and south central North Dakota. The west to northwest wind gusts were reported between 45 to 51 mph on several days. The drought conditions improved during November and December as the weather pattern transitioned into wetter than normal conditions.

May, 2017: Voluntary water restrictions requested in City of Bismarck and City of Lincoln due to low water reservoirs as a result of a period of increased temperatures.

July, 2017: Burleigh County issued a drought emergency declaration on July 26, 2017. On July 27, 2017 Gov. Doug Burgum declared a drought disaster for nearly all of North Dakota. The U.S. Drought Monitor's weekly report (July 27) rated nearly 46 percent of North Dakota in extreme (D3) or exceptional (D4) drought. About 16 percent of the state was in severe drought (D2) and 18 percent is in moderate drought (D1). More than 300 wildfires had been reported to the North Dakota Department of Emergency Services since April 1.

Fire – Hazard Profile

Description

Fire by definition is a rapid, self-sustaining oxidization process accompanied by the evolution of heat and light of varying intensities. (Essentials of Fire Fighting 4 addition) In other words, fire is a form of oxidation. On the slow end of oxidation you have rusting which can take months to occur and on the fast end of oxidation you have an explosion that happens in micro-seconds, with fire at a rate of just seconds. If fire occurs in a structure it can increase in size very rapidly and be out of control within seconds.

Urban fire departments are one of the oldest continuing institutions in the United States. Professional firefighters are well trained in the latest skills for preserving life and applying their abilities to limit property damages. Fire departments conduct regular inspections to identify and help reduce the fire risk that businesses may have. In addition, public education programs have been implemented within the community to educate businesses and the citizens on the importance of fire safety awareness in the prevention and reduction of fires.

The overall picture of fire safety information reveals that, per capita, the United States has one of the highest death rates in the industrialized world. Bismarck, North Dakota averages approximately 124 fires per year. Records show that Bismarck has less than one fire-related death per year and less than 2 fire-related injuries per year on average. Cooking related fires account for approximately 20% of all fires within the community.

Although structure fires are usually individual disasters and not community wide ones, the potential exists for widespread urban fires that can displace several businesses or families and exceed local resources. Urban blocks, commercial structures, and apartment buildings are vulnerable, especially the downtown area which consist of older buildings that have been renovated several times. Fires in the downtown area can have a significant economic impact.

While building and fire code enforcement have contributed to improved fire and life safety in new and existing buildings in recent years, fire prevention and awareness of the owners and occupants of buildings is key. Smoke detectors, automatic fire alarm systems, automatic sprinkler systems, fire doors, and fire extinguishers can all aid in preventing and reducing deaths, injuries, and damage from fire.

Fire Causes – City of Bismarck				
2010	**2011**	**2012**	**2013**	**2014**
101 Total Fires	*96 Total Fires*	*126 Total Fires*	*96 Total Fires*	*111 Total Fires*
Operating equipment 30%	Cooking 29%	Undetermined ignition source 26%	Cooking 28%	Cooking 44%
Cooking 23 %	Operating Equipment 21%	Cooking 21%	Operating Equipment 25%	Operating Equipment 20%
Undetermined ignition source 17%	Undetermined ignition source 20%	Operating Equipment 20%	Undetermined ignition source 15%	Undetermined ignition source 11%
Ember 8%	Open Flame Source 8%	Cigarettes 7%	Open Flame Source 8%	Open Flame Source 7%
Electrical Arcing 7%	Electrical Arcing 7%	Ember 6%	Ember 8%	Ember 7%
Cigarettes 6%	Cigarettes 5%	Electrical Arcing 3%	Electrical Arcing 6%	Chemical Reaction 5%
Open Flame Source 4%	Ember 5%	Chemical Reaction 3%	Cigarettes 6%	
Other Causes 5%	Other Causes 5%	Other Causes 14%	Other Causes 4%	Other Causes 6%

Summary of Changes in Demand for Service: 2015 thru 2019:

Demand For Service

Priority Calls
Change from 2015 to 2019

NWB – 50% 50 to 75

5E – 138% 39 to 93

5D – 58% 24 to 38

3C – 51% 204 to 309

2G 95% 24 to 47



NA – 63% 43 to 70

5F – 89% 44 to 83

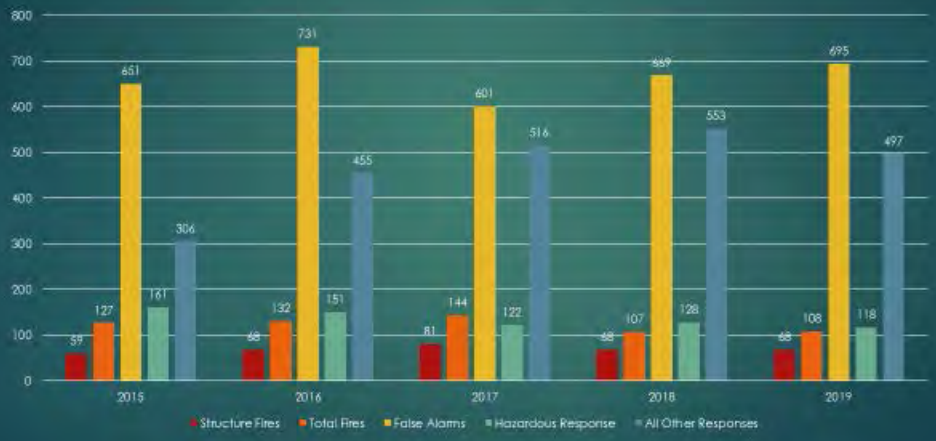
4C – 44% 107 to 155

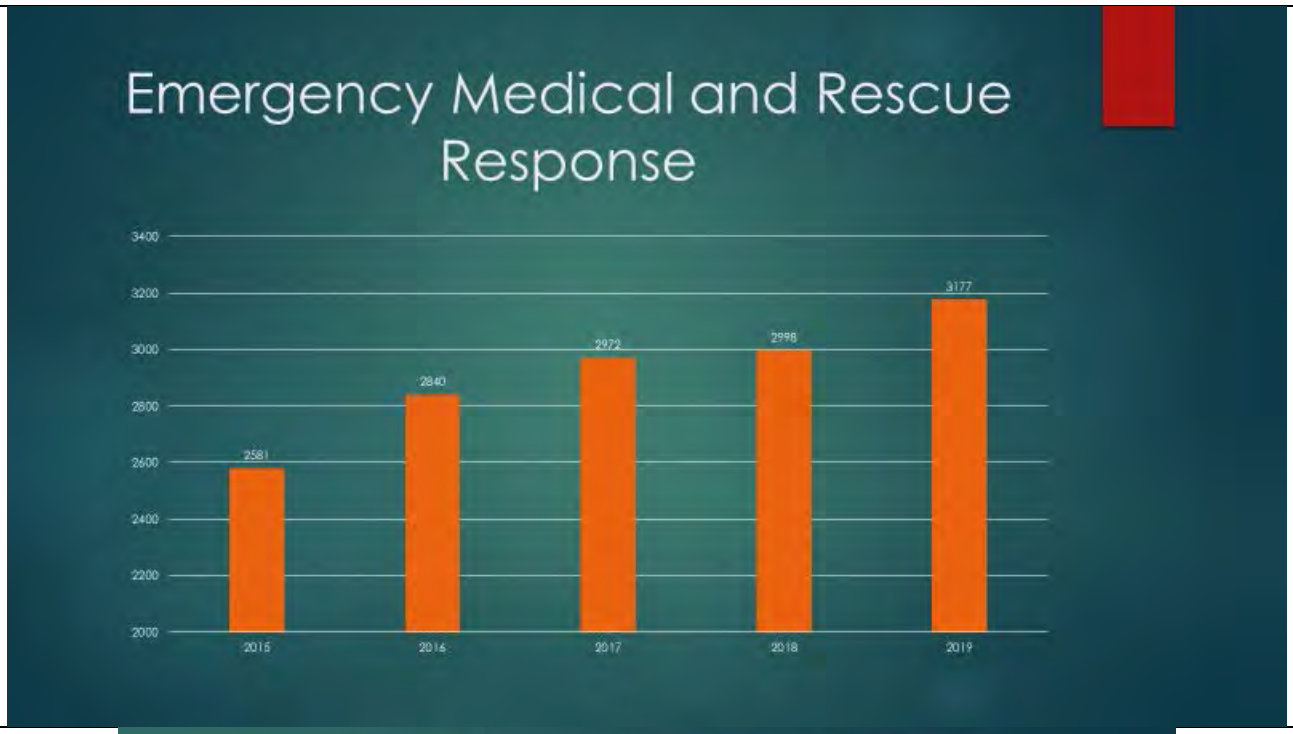
4D – 224 % 25 to 81

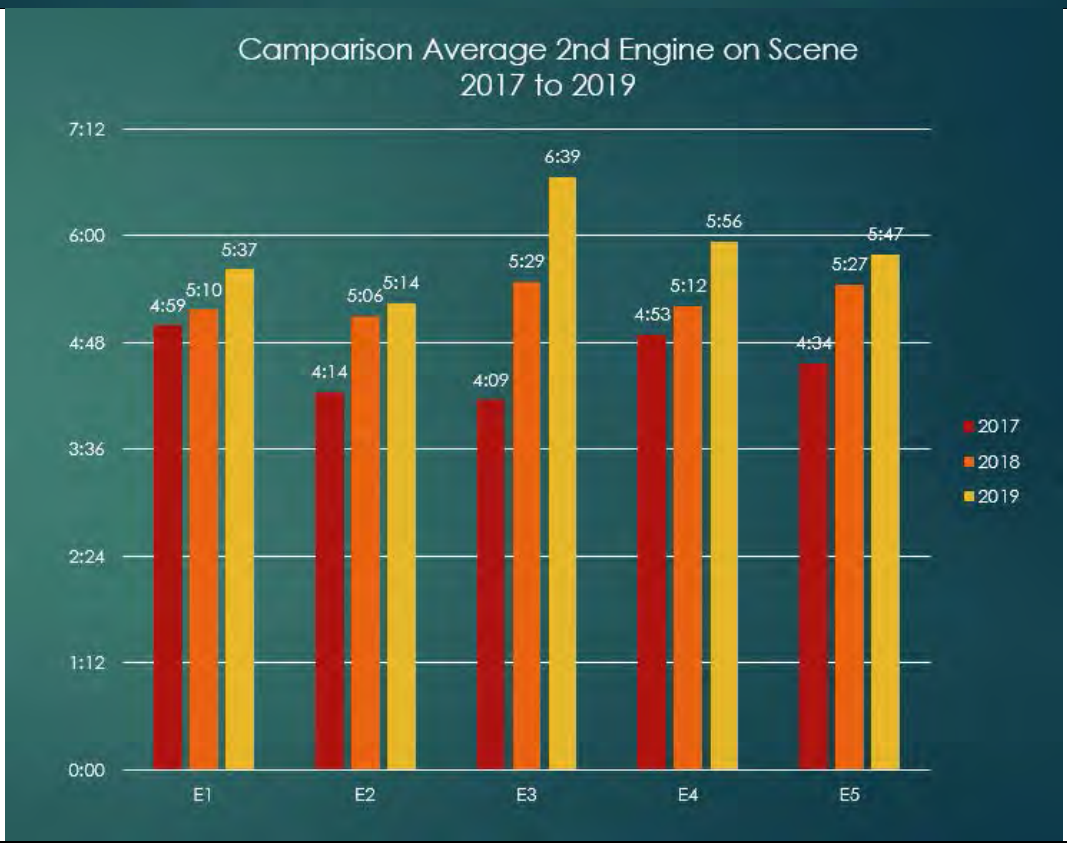
SE2A – 633% 3 to 22

Overall change from 2015 to 2019 = 26%

Fire/Hazardous Response




Emergency Medical and Rescue Response
3400
3200
3000
2800
2600
2400
2200
2000
2581
2840
2972
2998
3177
2015
2016
2017
2018
2019


Camparison Average 2nd Engine on Scene 2017 to 2019
7:12
6:00
4:48
3:36
2:24
1:12
0:00
4:59
5:10
5:37
4:14
5:06
5:14
4:09
5:29
6:39
4:53
5:12
5:56
4:34
5:27
5:47
E1
E2
E3
E4
E5
2017
2018
2019

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Fire (Conflagration)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Moderate	Catastrophic	Moderate	Minor

THIRA Ratings – Fire (Residential)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Minor	None/Negligible

Vulnerability Assessment

Scenario	Residential Fire	Commercial	Conflagration
Probability	Very Likely	Very Likely	Unlikely
Speed of Onset	No Notice Event	No Notice Event	Possible escalation event
Geographic Area	Localized Event – may impact any area	Localized Event – may impact any area	May spread to city blocks
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Smoke inhalation or direct flame contact A. Residents in older apartment bldgs. The elderly and very young.	1. Smoke inhalation or direct flame contact A. The elderly and very young.	1. Smoke inhalation or direct flame contact if evacuation is not completed in a timely manner A. The elderly and very young.
Mass Casualty Incident	Low probability	Low to Moderate probability	Low probability Explosion / collapse may cause mass casualty
Property Losses (points of vulnerability – high priority)	1. Room and contents to the entire structure. 2. Mobile homes	1. Room and contents to the entire structure	1. Multiple Structures
Environmental	1. Toxic smoke and other gases released 2. Water run-off	1. Toxic smoke and other gases released possibly hazardous materials depending on the business. 2. Run-off from water used to suppress fire.	1. Toxic smoke and other gases. 2. Water run-off. 3. Possible hazmat releases. 4. Possible gas main issues.
COG/COOP		1. City/County building content and records. 2. FD structures and equipment.	1. City/County building content and records. 2. FD structures and equipment.

Scenario	Residential Fire	Commercial	Conflagration
Critical Facilities		1. City/County Bldg. 2. Qwest Communications 3. Power substations 4. Capital Complex 5. Water Treatment Plant 6. Fraine Barracks 7. Waste Water Treatment Plant	1. City/County Bldg. 2. Qwest Communications 3. Power substations 4. Capital Complex 5. Water Treatment Plant 6. Fraine Barracks 7. Waste Water Treatment Plant
Critical Infrastructure		1. Qwest Communications 2. Power substations 3. Water Treatment Plant 4. Waste Water Treatment Plant	1. Qwest Communications 2. Power substations 3. Water Treatment Plant 4. Waste Water Treatment Plant
Schools		1. Unsprinklered schools and portable classrooms.	1. All schools
High Risk Facilities (chemical)		1. Praxair 2. Ferrell Gas 3. Exide Battery 4. Interstate Battery 5. R&J Refrigeration 6. Dean Foods 7. Dry Cleaners 8. Qwest Communication 9. Food Service of America 10. Super Value Warehouse	1. Praxair 2. Ferrell Gas 3. Exide Battery 4. Interstate Battery 5. R&J Refrigeration 6. Dean Foods 7. Dry Cleaners 8. Qwest Communication 9. Food Service of America 10. Super Value Warehouse

Scenario	Residential Fire	Commercial	Conflagration
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. St. Vincent Nursing Home 2. Marillac Manor 3. Missouri Slope Nursing Home 4. Valley View 1 & 2 5. Edgewood Vista Retirement Community (Dominion and Colorado) 6. St. Gabriel Care Center 7. Good Samaritan Care Center 8. Maple View Memory Care 9. Baptist Home 10.	1. Belle Mehus 2. Dakota Stage 3. Memorial Bldg. 4. FW All Seasons Arena 5. Schamberg Ice Arena 6. Churches 7. Bars and Restaurants with occupant loads of less than 300	1. Properties and populations in closer proximity to each other are more vulnerable. 2. Otherwise, all sections of the city are of equal vulnerability.
Economy (community wide)	Minor impact (THIRA rating)	Moderate impact (THIRA rating) Downtown Business District	Catastrophic Impact (THIRA rating)
OTHER:		FD equipment due to response.	FD equipment and personnel due to response.

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Flood – Hazard Profile

Description

Floods are naturally occurring hazards that happen frequently throughout the world. The National Flood Insurance Program (NFIP), which is administered by the Federal Emergency Management Agency (FEMA), defines floods in the following way:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from:
    - Overflow of inland or tidal waters; or
    - Unusual and rapid accumulation or runoff of surface waters from any source; or
    - Mudflow; or
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining, caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Floods are a natural phenomenon; however, human activities often intensify flood hazards because of the alteration of natural conditions. Floods often occur along rivers and streams, in poor drainage areas, or in oversaturated soils.

Flooding is North Dakota's most costly and repetitive natural hazard. All 53 counties have experienced severe damages and losses to public and private properties due to floods. The floodplain in Bismarck is developed with housing, streets, railroads, businesses, and recreational facilities. Hazardous materials (fixed facilities) in the floodplain leads to the potential for contamination and complicates and increases the extent of damage caused by flooding.

Surface water is that water found on the land surface, and includes overland flow and flow in distinct channels. The three major sources of surface water include streams and rivers flowing into the state, precipitation, and groundwater discharge along streambeds. Surface water leaves the state in out-flowing streams and rivers, by evaporation, and by percolating downward into the subsurface into the groundwater flow system.

Many floods in North Dakota occur because the ground is frozen and/or saturated with moisture and cannot absorb any further moisture. This moisture can come from several different sources and circumstances. One source is a heavy snowpack, which is affected by a rapid warming trend as well as spring rain falling directly on the snow pack.

The spring flood danger period generally occurs during March and April. The magnitude of the flooding varies from year to year depending on such factors as characteristics of the snow cover, soil moisture conditions, frost depth, winter temperatures, temperatures during spring melting, spring precipitation, and the extent of ice jams. 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. Smaller streams are more susceptible to flooding in the summer with peak flows resulting from thunderstorms.

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 in Bismarck are 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 has a 1% chance of exceedance in any given year. Over a 100-year period, a flood of this magnitude or greater has a 63.5% chance of occurring. Structures in the 100-year floodplain are 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, 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. Because river levels of the Missouri River at Bismarck are controlled to a large extent by the COE via the Garrison Dam, flood forecast products (NWS) do not exist for the Missouri River near Bismarck.

Ice Jams

Flooding can also result from **ice jamming or blockage** along streams and rivers. 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 Corp 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 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 man-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.

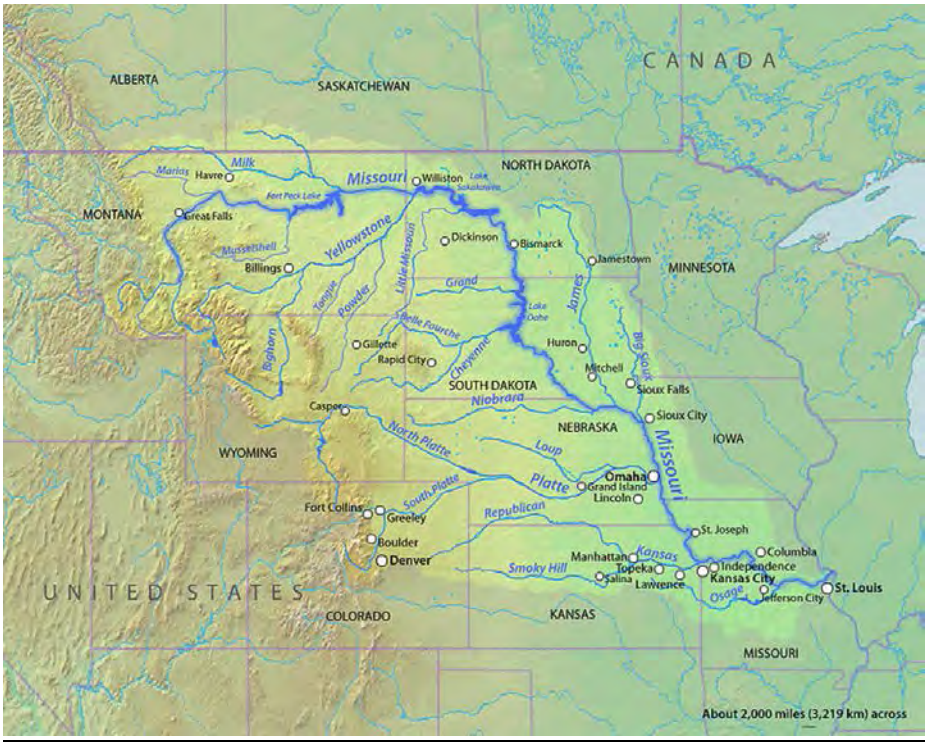
A flash flood is usually caused by severe thunderstorms, heavy rains on snowpack, slow moving storms, dam, dike, or levee failures, or ice jam releases. Flash floods can occur anywhere when a large volume of water inundates an area over a short time period. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. 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 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. *Note: When property damage does not occur, these events are technically referred to as "urban ponding."* 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 150 people annually. Flooding is one of the most deadly hazards nationwide and in North Dakota. 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 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 floodflow 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.

Missouri River Basin



Comprised of seven major sub-basins, the Missouri River Basin, the state‘s largest, drains nearly 48 percent of the state‘s total area. The seven subdivisions included in the Missouri River Basin are the Grand, the Cannonball, the Heart, the Knife, the Little Missouri, the Missouri, and the Yellowstone rivers and direct, minor tributaries. The climate is mostly semiarid. Buttes, hills, and smaller valleys characterize the topography and are most prominent in the Badlands along the Little Missouri River. The area east of the Missouri River is marked with numerous small lakes and wetlands. Annual mean precipitation ranges from 13 inches in the northwest to 17 inches in the east.

Flood control measures in the basin include Fort Peck Dam located in northeast Montana, the Garrison Dam which forms Lake Sakakawea, Oahe Dam in South Dakota which forms Lake Oahe, and the Heart Butte and Dickinson Dams on the Heart River.

Lake Sakakawea was formed by the construction of the Garrison Dam in 1953. Lake Sakakawea covers 368,000 surface acres, can store a maximum of 24.5 million acre-feet, and has 1,600 miles of shoreline in six counties. Lake Oahe Dam in South Dakota covers 40,000 to 80,000 surface acres in North Dakota, with an average storage of 989,605 acre-feet and a maximum storage of 1,626,588 acre-feet, depending upon the management elevation of the lake. The two projects required a total of 550,000 acres of land in North Dakota, including shoreline acres needed for flood conditions.

Risk Assessment

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Urban Flooding**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	None/Negligible	Minor	Minor	Minor

THIRA Ratings – **Ice Jam**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	Minor	Minor	Moderate

THIRA Ratings – **500 Year Flood**

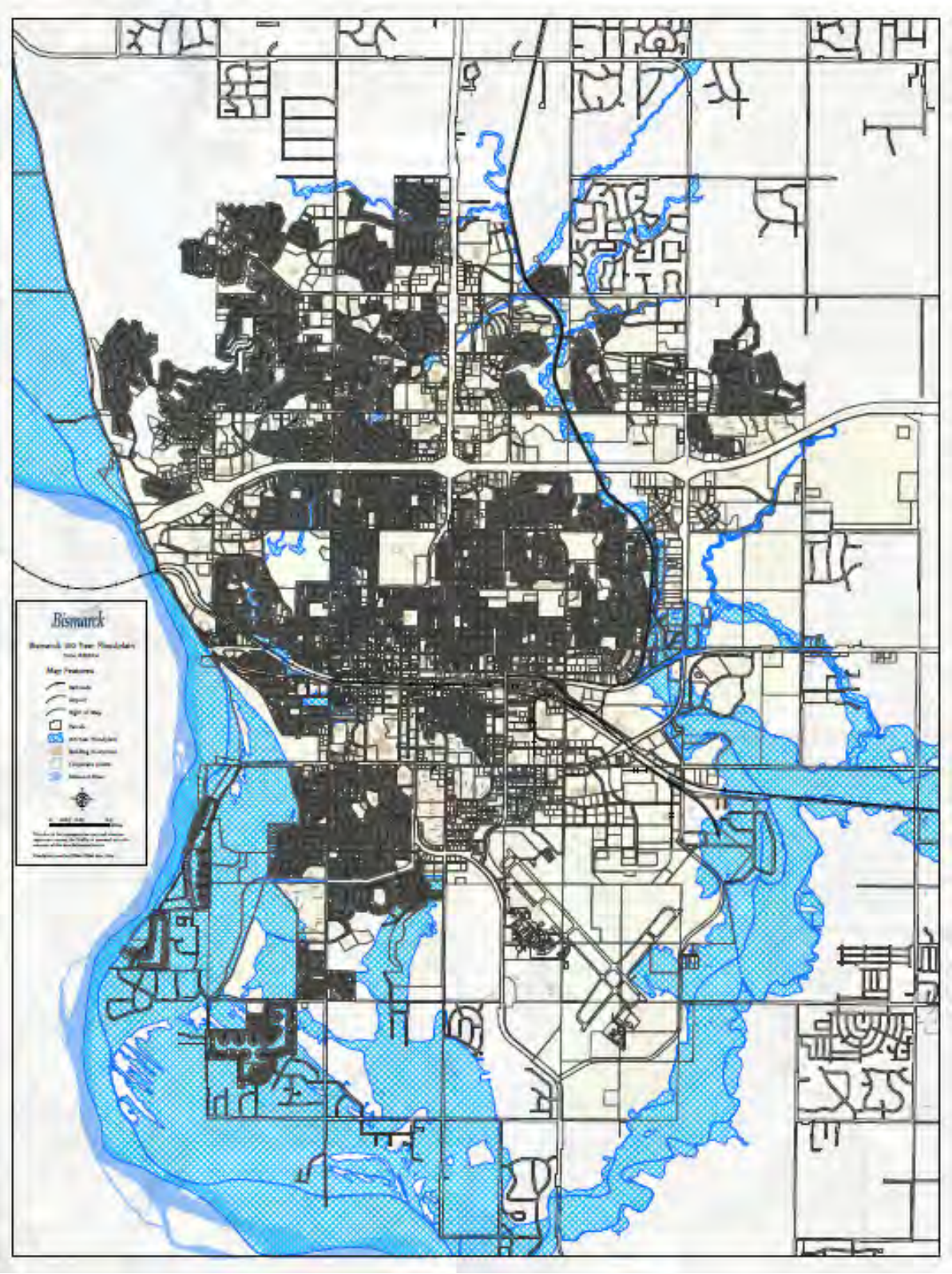
Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Minor	Moderate	Moderate	Moderate

Climate Change Impact:

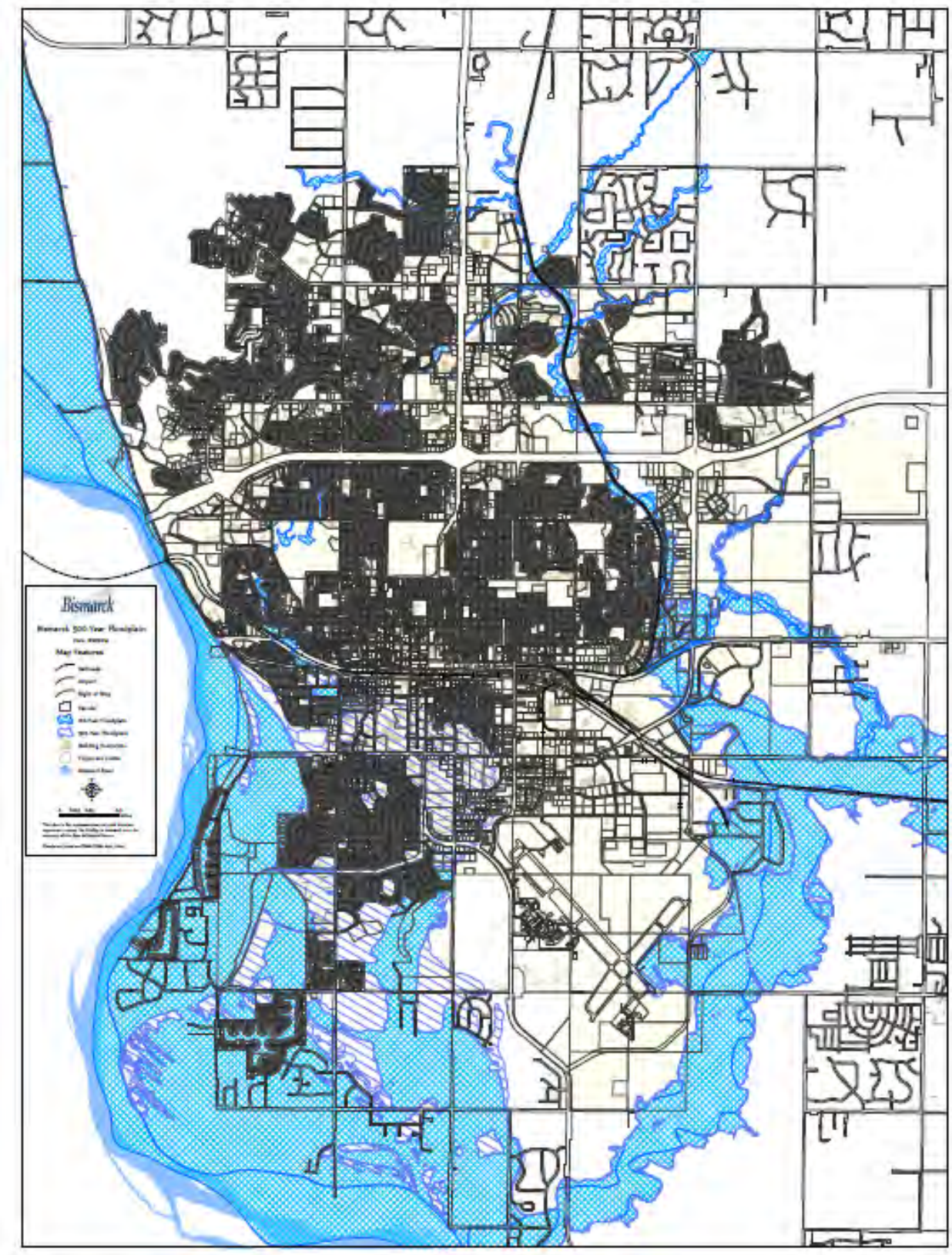
The frequency of heavy rain events has increased. Since 1990, the number of such events has been above average, peaking during the most recent 5-year period (2010–2014). The peak 5-year period for total annual precipitation is the 2007-2011 time period. Heavy precipitation events are also projected to increase. *(note: "heavy" is defined as events with greater than 1 inch per day)* Current observed records do not show a positive trend in cold season precipitation so far, however, projections suggest that winter precipitation will increase even under a lower emissions pathway.	NOAA Climate Summary (ND)
Overall, climate models project an increase in the number of heavy precipitation events (events with greater than 1 inch per day) for much of the region, with the exception of the high-mountain areas in the southwestern portion.	NCA4 Vol II Chapter 22 (Northern Great Plains)
Over the coming century, significant increases *(of precipitation)* are projected in winter and spring over the Northern Great Plains, the Upper Midwest, and the Northeast. Observed increases in the frequency and intensity of heavy precipitation events in most parts of the United States are projected to continue.	NCA4 Vol II Chapter 2

Planning Team Input: Climate change poses additional risk and potential impact to stormwater management infrastructure as a result of more frequent heavy rain events.

100 Year Flood Plain Map



500 Year Flood Plain Map:

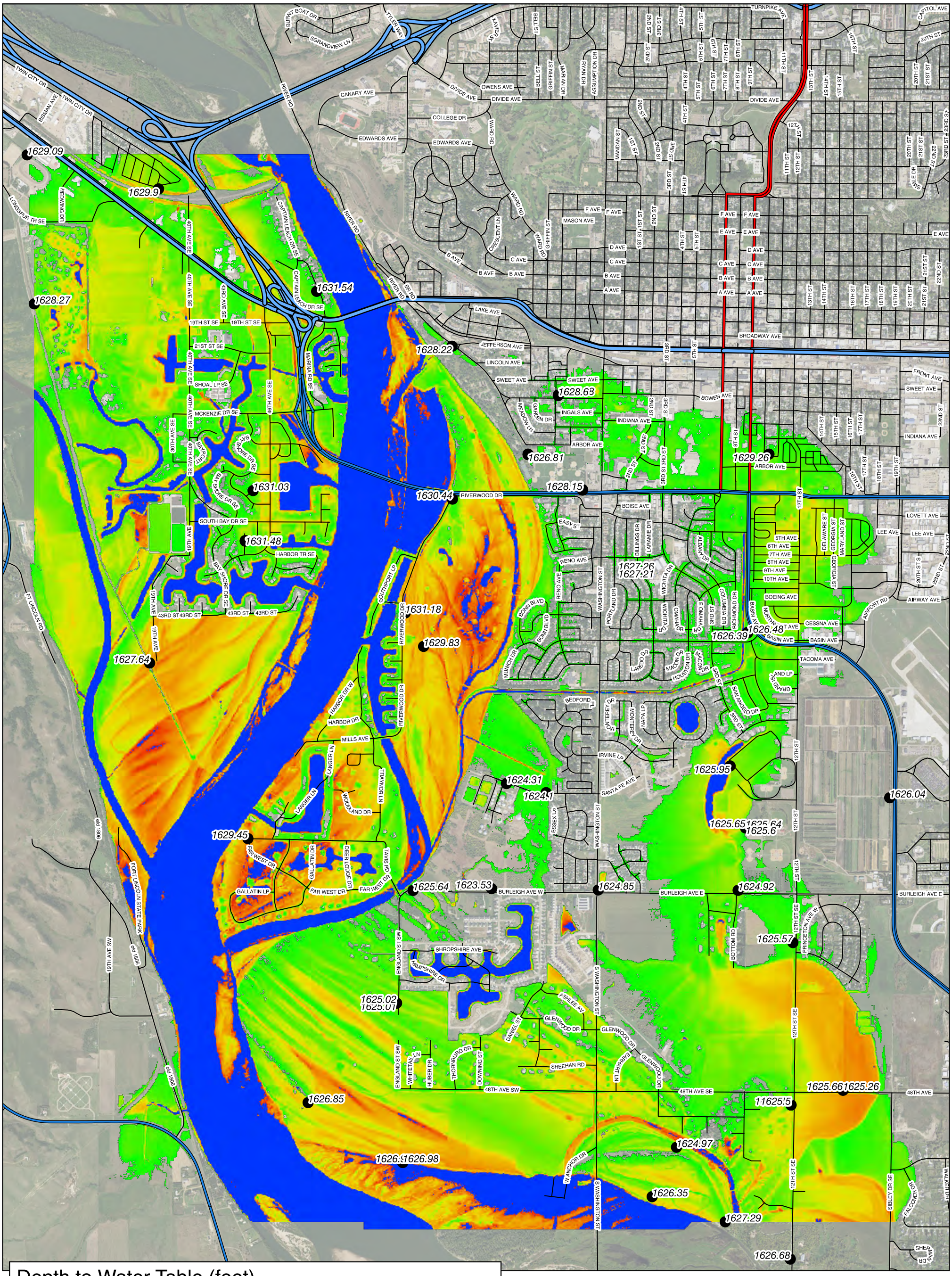


Interactive Flood Map Resources for Bismarck Area:
http://arcg.is/iXW0r
http://gis.burleighco.com/

Groundwater issues, especially in south Bismarck, may arise when higher river levels are maintained for a long period of time during flooding events or simply during higher releases from the Garrison Dam. Extensive and recurring heavy rainfalls would contribute to higher water tables.

The map on the following page illustrates an example of groundwater conditions that promote the use of sump pumps in south Bismarck. The river stage at that time was 13.25 feet. At that point, the flows through Bismarck/Mandan had been about 60,000 cfs for almost a month; and therefore, had the longest amount of time to affect the surrounding groundwater levels. At the end of July that year, the USACE started decreasing flows. It is not fully understood how long it generally takes for the groundwater levels to respond to changes in river flow. See **Depth to Water Table map** on the following page. The map serves as an example of the impact that higher river levels (for an extended period of time) have on the groundwater levels in south Bismarck.

The **Storm Watersheds** map on page 10 illustrates the movement of stormwater through the various watersheds that would occur during significant rain events.



Depth to Water Table (feet)
River Stage at 13.25 feet

- ● *SWC Well Location/July 19-20, 2018 Elevation (ft NAVD88)*

Depth to Water - 7/19/2018 and 7/20/2018

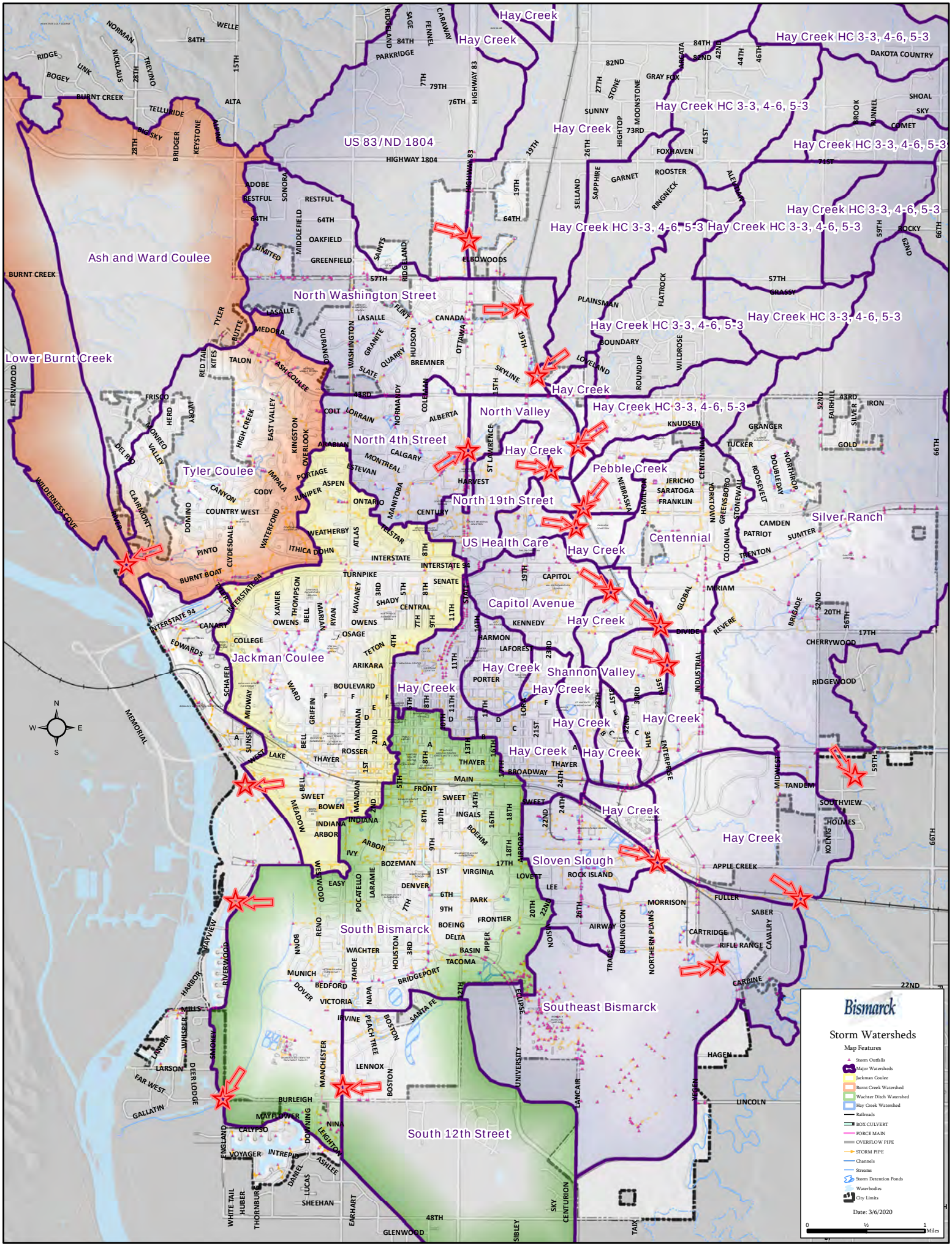
- *0*
- *0.1*
- *0.5*
- *1*
- *2*
- *3*
- *4*
- *5*
- *6*
- *7*
- *8*
- *9*
- *10*

*Legend color scheme revised 7/5/2018

N

North Dakota
State Water Commission

0.5 0 0.5 1 mile


Hay Creek
Hay Creek HC 3-3, 4-6, 5-3
US 83/ND 1804
Ash and Ward Coulee
Lower Burnt Creek
North Washington Street
Tyler Coulee
North 4th Street
North Valley
Pebble Creek
North 19th Street
Silver Ranch
Centennial
US Health Care
Capitol Avenue
Shannon Valley
Jackman Coulee
Sloven Slough
South Bismarck
Southeast Bismarck
South 12th Street
Bismarck
Storm Watersheds
Map Features
Storm Outfalls
Major Watersheds
Jackman Coulee
Burnt Creek Watershed
Wachter Ditch Watershed
Hay Creek Watershed
Railroads
BOX CULVERT
FORCE MAIN
OVERFLOW PIPE
STORM PIPE
Channels
Streams
Storm Detention Ponds
Waterbodies
City Limits
Date: 3/6/2020
0
½
1
Miles

HISTORY

Flood Related Declarations for Burleigh County Since 1989		
Flood Declaration	**Declaration Date**	**Incident Period**
North Dakota Flooding (DR-1981)	Major Disaster Declaration declared on May 10, 2011	Incident period: February 14, 2011 to July 20, 2011 Burleigh County was added Thursday, June 2, to the federal disaster declaration issued by President Obama on May 10 in response to North Dakota flooding beginning Feb. 14 and continuing.
North Dakota Flooding (EM-3318)	Emergency Declaration declared on April 7, 2011	April 5, 2011 to July 1, 2011
North Dakota Flooding (EM-3309)	Emergency Declaration declared on March 14, 2010	Incident period: February 26, 2010 to April 30, 2010
North Dakota Severe Storms and Flooding (DR-1829)	Major Disaster Declaration declared on March 24, 2009	Incident period: March 13, 2009 to August 10, 2009
North Dakota Severe Storms, Flooding, and Ground Saturation (DR-1597)	Major Disaster Declaration declared on July 22, 2005	Incident period: June 1, 2005 to July 7, 2005
North Dakota Floods (DR-1376)	Major Disaster Declaration declared on May 28, 2001	Incident period: March 1, 2001 to August 9, 2001
North Dakota Severe Storms And Flooding (DR-1334)	Major Disaster Declaration declared on June 27, 2000	April 5, 2000 to August 12, 2000
North Dakota Severe Storms, Tornadoes, Snow and Ice, Flooding, Ground Saturation, Landslides and Mudslides (DR-1279)	Major Disaster Declaration declared on June 8, 1999	March 1, 1999 to July 19, 1999
North Dakota Severe Storms/Flooding (DR-1174)	Major Disaster Declaration declared on April 7, 1997	Incident period: February 28, 1997 to May 24, 1997
North Dakota Flooding (DR-1118)	Major Disaster Declaration declared on June 5, 1996	Incident period: March 12, 1996 to June 21, 1996
North Dakota Severe Storms, Flooding, Ground Saturation (DR-1050)	Major Disaster Declaration declared on May 16, 1995	Incident period: March 1, 1995 to July 5, 1995
North Dakota Flooding, Severe Storms (DR-1001)	Major Disaster Declaration declared on July 26, 1993	Incident period: June 22, 1993 to September 24, 1993

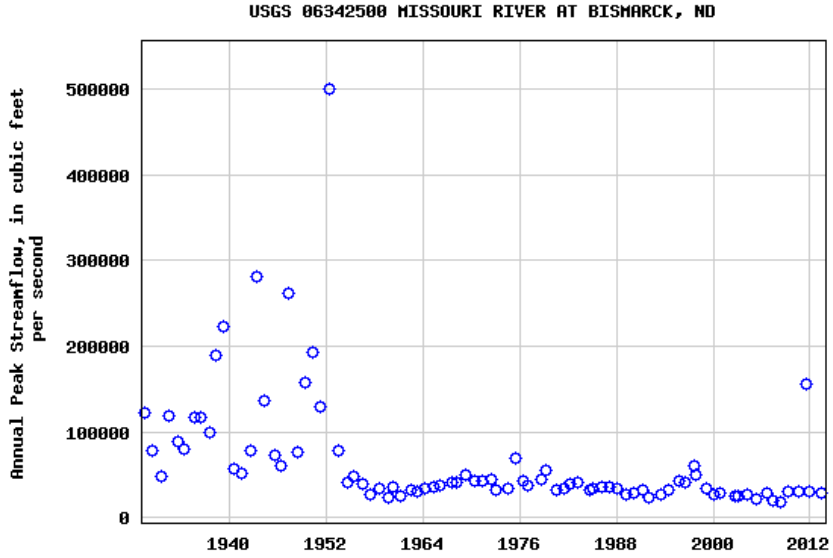
http://www.fema.gov/disasters?field_state_tid=11&field_disaster_type_term_tid=All&field_disaster_declaration_type_value=All&items_per_page=10&page=3

Riverine Flooding

Missouri River at Bismarck - Flood stages and Historical Crests (via Bismarck NWS website)		
Flood Stages		**Historical Crests**
Major Flood Stage	**18**	(1) 31.60 ft on 03/31/1883
Moderate Flood Stage	**16**	(2) 31.10 ft on 01/01/1887
Flood Stage	**14.5**	(3) 30.40 ft on 03/14/1910
Action Stage	**12.5**	(4) 27.90 ft on 04/06/1952
		(5) 27.70 ft on 04/08/1897
Note: As of 2012, "flood stage" is changed to 14.5 feet. Prior to 2012, 16 feet was defined as flood stage.		
In 1939, the Flood Stage was 19 Feet.		

Annual Peak Streamflow – Missouri River at Bismarck

Riverine Flooding (Missouri River at Bismarck) was a common occurrence prior to the construction of the Garrison Dam in 1953 as shown in the graph below.



Source: http://nwis.waterdata.usgs.gov/nd/nwis/peak/?site_no=06342500&agency_cd=USGS

2011 Flood: The 2011 Flood is the most significant Missouri River riverine flooding event impacting Bismarck since the construction of the Garrison Dam. The peak river elevation reached 19.24 feet on July 1, 2011. The peak releases from the Garrison Dam were 151,000 CFS on June 25, 2011. The river exceeded "action stage" (14 feet) from May 23 through August 31, 2011. Temporary protective measures (levee systems) were put in place to protect critical infrastructure (wastewater treatment plant) and south Bismarck in general (homes, streets, access, etc.). The maximum inflow during this period, according to the USACE was 190,000 CFS.

The largest peak discharge recorded at Bismarck following the closure of Garrison Dam in 1953 was 155,000 cfs on June 25, 2011. Source: http://www.swc.nd.gov/pdfs/south_bismarck_sediment_study_2014.pdf

Impact to homes within Bismarck city limits was limited to damage associated with basement seepage as a result of high groundwater due to the higher river levels for an extended period of time and heavy rains throughout the summer. The Missouri River did not overtop or breech the temporary levee systems. Overland river flooding impact was limited to the Meriwether's facility, Meriwether's parking lot, and Pioneer Park in Bismarck. Extensive heavy rains throughout the summer along with the need to close the gate (flood control structure) on South Washington did exacerbate flash flooding impacts (urban street flooding) on a few occasions. However, the pumping operations were successful and worked as planned. The costs of fighting the flood were extensive, but public infrastructure including the wastewater treatment plant and south Bismarck were protected as a result of combined flood fight efforts in Bismarck.

2011 Flood Event – Bismarck Flood Fight Cost *Total Cost: $17,700,838.73 90% Federal Share: $15,930,473.59 *(based on submitted Project Worksheets via the FEMA Public Assistance Program)*	Category A – Emergency Work Debris Removal: $5,941,821.36 Category B – Emergency Protective Measures: $11,323,273.13 Category C – Road and Bridges: $633,709.26 Category D – Water Control Facilities: $0.00 Category E – Buildings and Equipment: $8,273.01 Category F – Utilities: $95,440.35 Category G – Parks, Recreational Facilities, Other: $148,321.62

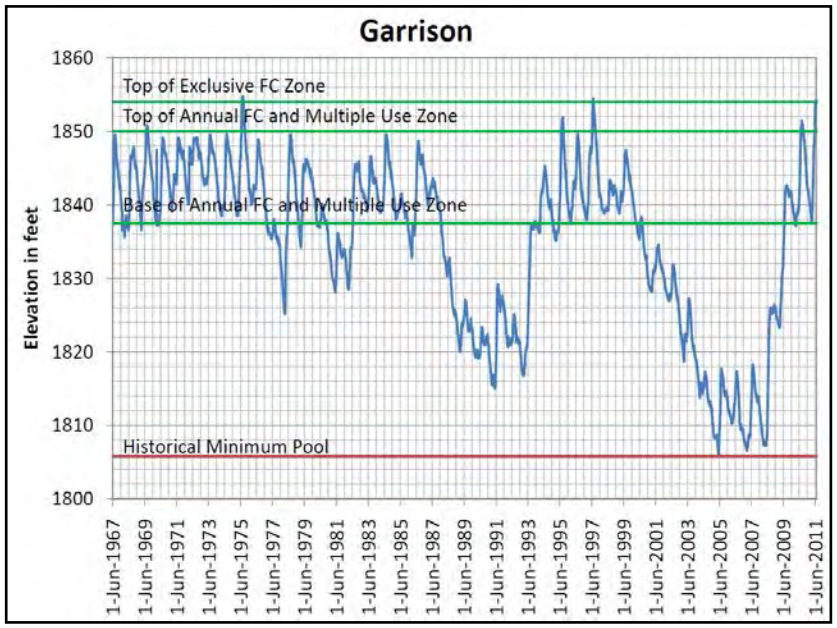
The following description came from the USACE website regarding the 2011 Flood:

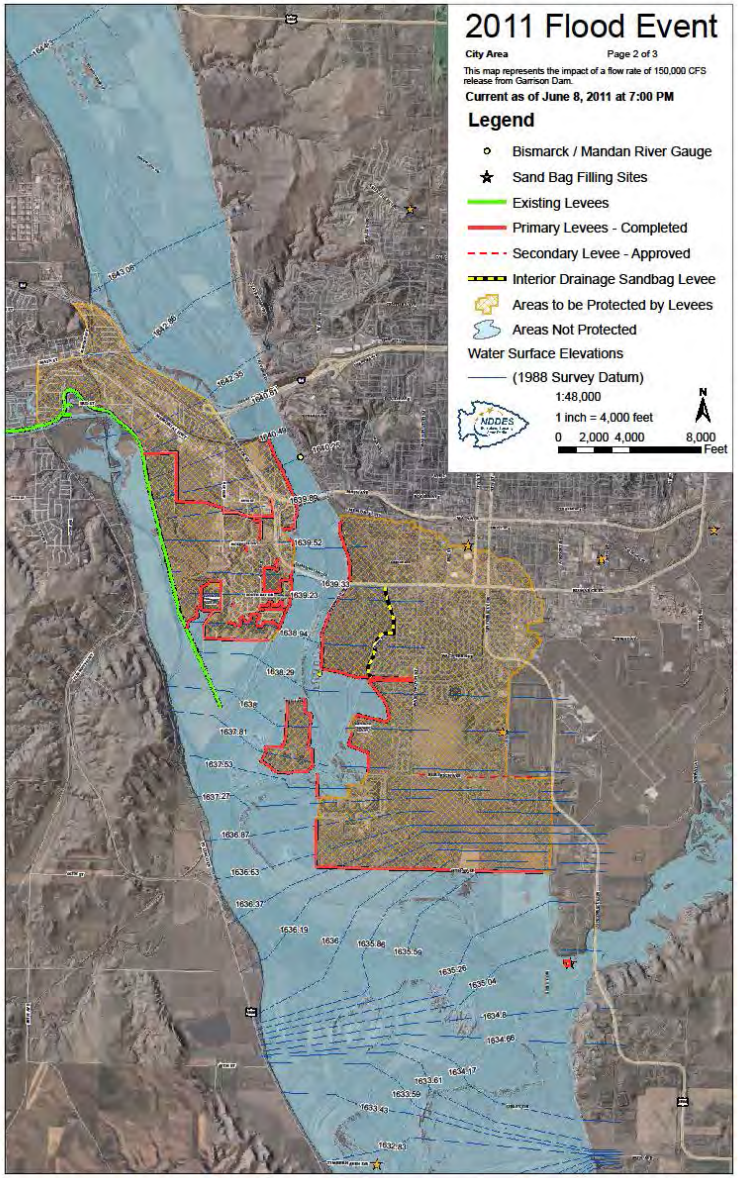
"Where is this flooding occurring?" Flooding is along the entire length of the longest river in the United States: the Missouri River- and many of its tributaries throughout Montana, North and South Dakota, Nebraska, Iowa, Kansas and Missouri. At 2,321 miles, the Missouri River's headwaters begin at Three Forks, MT and join the Mississippi River in St. Louis, MO.

"When did this inundation begin?" May 23, 2011 is recognized as the day that unparalleled flooding would soon commence.

"Why did this come about?" Flooding commenced with unseasonably heavy snows across the Great Plains. This was followed by three to six times the normal rainfall in May in eastern Montana, northern Wyoming and the western Dakotas. Then the snowpack melt came perhaps two weeks later than usual with an accumulation that was around 23 to 40 percent greater than normal. The June 2011 runoff in the Missouri River Basin above Sioux City was 13.8 million acre feet (MAF), the single highest monthly runoff amount since 1898. May 2011 runoff was 10.5 MAF, the third single highest monthly runoff amount since 1898 and more than one and a half times the previous record May inflow of 7.2 MAF in 1995. Combined runoff in May and June, at 24.3 MAF was short of the normal annual runoff of 24.8 MAF. The forecast for total annual runoff into the Missouri River basin during 2011 is 57.7 MAF, more than double the normal.

Garrison Dam levels from 1967 to 2011





What may have happened without the protective measures put in place during the 2011 flood fight response? Missouri River flood inundation mapping prepared by Houston Engineering, Inc., is provided for public use by the Burleigh County Water Resource District. The maps available at this site illustrate estimated inundation based on protective measures NOT being in place. http://gis.burleighco.com/

1997 Flood Five years of high precipitation coupled with record and late season snowfall led to the extreme flood event of 1997. As the record snows began melting and an April blizzard compounded the problem, water levels all across the state began rising to unprecedented levels.

1993 Flood Statewide, excessive rains during the spring destroyed crops and heavy thunderstorms on July 15-16 (4-7 inches of rain), July 22-27 (6-10 inches of rain), and August 21-22 (up to 7 inches of rain) caused flash flooding and damage to public and private property. Minor to moderate flooding occurred in the Missouri, James, Souris, and Devils Lake basins.

1952 Flood Event Article:
http://www.bismarckcafe.com/blogs/252/remembering-the-flood-of-april-1952

Remembering The Flood of April 1952
Source: Bismarck Tribune. May 1, 2009 **Posted in:** 2011 Flood

Recent flooding has caused devastation across the state, and within Bismarck itself. It has left many in southern Bismarck worrying about flood potential of the Missouri River. 2009 marked the first major flooding of the Missouri River in 57 years.

Flooding was a common occurrence in Bismarck prior to the closure of Garrison Dam, which occurred in April 1953. It was not uncommon for springtime floods to cover much of the land south of present-day Main Avenue.

Missouri River Flooding in April 1952 - Liberty Memorial Bridge in background.



One of the worst of such floods occurred in April 1952, when the Missouri River crested at 27.9 feet. On April 6, the river rose 5 feet in just 2 hours, increasing from 20.2 feet at 11:30am to 25 feet at 1:30pm. Nearly everything south of U.S. Hwy 10 (Memorial Hwy/Main Ave) was under water. 200 houses were destroyed and the Wachter Family reported the loss of 300 cattle.

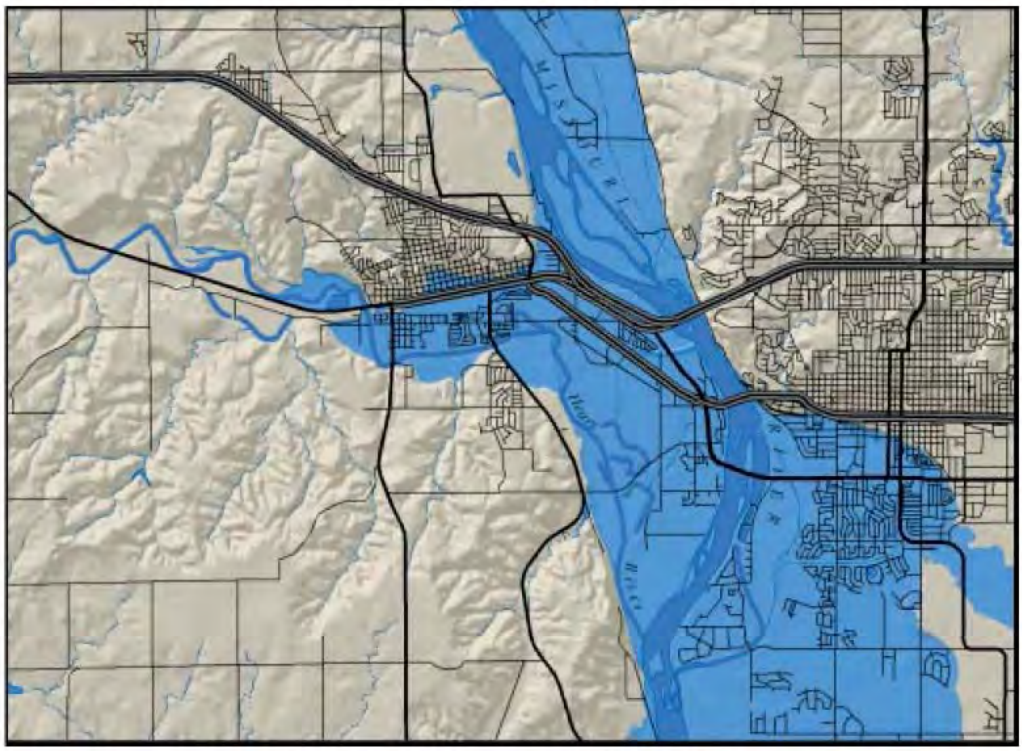
The completion of Garrison Dam allowed, for the first time, major development south of Main Avenue. Prior to this, the Wachter Family and Yegen Family owned most of the land.

Like the flooding seen this year (2009), the 1952 Flood was also primarily caused by ice jams. According to the National Weather Service, the April 1952 river level was the 4th highest recorded. The highest was 31.6 feet on March 31, 1881 *(year corrected).* Flood stage is 16 feet.

Date: 3/26/1939 - Gage Number: 6342500 -Bismarck, ND Missouri River
The gage at Bismarck, North Dakota on the Missouri River recorded water levels of 19.1 feet on March 26, 1939 due to an ice gorge below the gage. Flood stage is 19 feet. The gorge was recorded through 30 March. -- Keywords: Missouri River at Bismarck, ND on Mar 26, 1939 [20020103133602]
https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

Date: 03/31/1881 - Gage Number: 6342500 - Bismarck, ND Missouri River
Maximum annual gage height of 31.6 feet, affected by backwater from ice, reported at USGS gage Missouri River at Bismarck on March 31, 1881. This is the maximum stage for the period 1881, 1929-1963; maximum open-water stage for the same period was 27.9 feet on April 6, 1952 (500,000 cfs). -- Keywords: Missouri River at Bismarck, ND on Mar 31, 1881 [9352]
https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

FLOODING AND SEEPAGE



Area inundated (in blue) by the historic flood of March 31, 1881.

The highest recorded level of the Missouri River (1,649.88 feet) occurred on March 31, 1881. At this elevation, most of the area now occupied by the southern portions of Bismarck and Mandan would have been under 10 feet of water (see adjacent map.)

Overland flooding from unusually large rainfall events is a potential problem for homeowners in the area. Overland flow is focused into ravines and coulees that lead into the Heart and Missouri rivers. These ravines formed over the last 10,000 years, since the last glacier receded from this area. Development, particularly in north Bismarck, has partially or completely filled portions of these drainages with construction fill. Surface water and shallow groundwater still tend to concentrate along these courses. One of these, a four-mile long ravine, runs from Hay Creek to Zonta Park via the Tom O'Leary golf course. Perched groundwater can be concentrated at a number of stratigraphic horizons including: the base of construction fill, the contact between Cannonball sandstone and underling mudstone, as well as the upper surface of thin, well cemented sandstone layers in the Cannonball Formation. Seepage is a potential problem for basement slabs that are in close proximity to any of these settings.

Source: ND Geological Survey, Department of Mineral Resources
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf

National Flood Insurance – Community Statistics as of March 20, 2020

Community Overview

Community:	BISMARCK, CITY OF	**State:**	NORTH DAKOTA
County:	BURLEIGH COUNTY	**CID:**	380149

Program:	Regular	**Emergency Entry:**	02/14/1975	**Regular Entry:**	09/18/1985
Status:	PARTICIPATING			**Status Effective:**	09/18/1985
Current Map:	08/04/2014	**Study Underway:**	YES	**Level of Regs:**	D
FIRM Status:	REVISED			**Initial FIRM:**	09/18/1985
FHBM Status:	SUPERCEDED BY FIRM			**Initial FHBM:**	11/08/1974

Probation Status:			
Probation Effective:		**Probation Ended:**	
Suspension Effective:		**Reinstated Effective:**	
Withdrawal Effective:		**Reinstated Effective:**	

CRS Class / Discount:	08 / 10%			**Policies in Force:**	651
Effective Date:	10/01/2017			**Insurance in Force:**	$192,877,100.00
CAV Date:	05/23/2016	**Workshop Date:**	02/06/2020	**No. of Paid Losses:**	432
CAC Date:	09/25/2019	**GTA Date:**	02/27/2020	**Total Losses Paid:**	$7,352,690.68
Tribal Community		**Community Website:**		**Sub. Damage Claims Since 1978:**	19
Upton Jones Claims			**HMGP Projects**		
ICC Claims			**FMA Projects**		

Insurance Overview

As of 03/02/2020

Community:	BISMARCK, CITY OF	**State:**	NORTH DAKOTA
County:	BURLEIGH COUNTY	**CID:**	380149

Overview | Occupancy | Zone | Pre/Post FIRM

Total by Community

Total Number of Policies:	651
Total Premiums:	$441,971
Insurance in Force:	$192,877,100
Total Number of Closed Paid Losses:	432
$ of Closed Paid Losses:	$7,352,691

Group Flood Insurance

Total Number of Policies:	0
Total Premiums:	$0
Insurance in Force:	$0
Total Number of Closed Paid Losses:	0
$ of Closed Paid Losses:	$0

Post Firm Minus Rated Policies

Total Number of Minus Rated Policies:	31
A Zone Minus Rated Policies:	31
V Zone Minus Rated Policies:	0

Manufactured Homes

Total Number of Policies:	13
Total Number of Closed Paid Losses:	1
$ of Closed Paid Losses:	$0

ICC

Total Number of ICC Closed Paid Losses:	1
$ of ICC CLosed Paid Losses:	$30,000

1316

Number of Properties by Community:	0

Substantial Damage Losses

Number of Substantial Damage Closed Paid Losses:	19

Community Repetitive Loss

COMMUNITY : BISMARCK, CITY OF

Community | State | Regional | National

	AE, A1-30, AO, AH, A	VE, V1-30, V	B, C, X	TOTAL
RL Buildings (Total)	26	0	0	26
RL Buildings (Insured)	23	0	0	23
RL Losses (Total)	53	0	0	53
RL Losses (Insured)	47	0	0	47
RL Payments (Total)	$2,348,596.70	$.00	$.00	$2,348,596.70
Building	$2,189,274.19	$.00	$.00	$2,189,274.19
Contents	$159,322.51	$.00	$.00	$159,322.51
RL Payments (Insured)	$2,153,650.92	$.00	$.00	$2,153,650.92
Building	$1,995,460.35	$.00	$.00	$1,995,460.35
Contents	$158,190.57	$.00	$.00	$158,190.57

Post - FIRM SFHA RL Buildings:	12
Insured Buildings with 4 or More Losses:	0
Insured Buildings with 2-3 Losses > Building Value:	0
Total Target RL Buildings:	0

National Flood Insurance Policy and Loss Statistics, as of April 9, 2014

City of Bismarck

Number of NFIP polices: 741
Number of Polices within the A Zone: 273
Total Claims Since 1978: 410
Total Paid Since 1978: $6,893,228
Total Premium: $499,515
Total Coverage: $206,235,600

Bismarck has been a participating community in the NFIP since 09/18/1985.
Current Effective Map Date: 07/19/2005
CID: 380149

Bismarck	A-Zone
Repetitive Loss (RL) Buildings (Total)	26
RL Buildings (Insured)	25
RL Losses (Total)	53
RL Losses (Insured)	51
RL Payments (Total)	$2,348,596.70
- Building	$2,186,274.19
- Contents	$159,322.51
RL Payments (Insured)	$2,299,312.61
- Building	$2,140,122.04
- Contents	$159,190.57

Repetitive Loss Property (defined):

A repetitive loss property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978. The losses must be within 10 years of each other and be at least 10 days apart.

A severe repetitive loss (SRL) property is a residential property that has had at least four NFIP claim payments over $5,000 each with two such claims occurring within any ten-year period or a residential property that has had at least two separate claim payments within any ten-year period that have cumulatively exceeded the value of the property. Bismarck does not have any SRL properties.

Flood Insurance Study (FIS)

The last Flood Insurance Study (FIS), effective 7-19-05, covered the jurisdiction of Burleigh County, North Dakota and is available at http://www.msc.fema.gov/ Item Number: 38015CV000A. The Study reaffirms the history of the principal flood problems on pages 4-5:

"2.3 Principal Flood Problems Short-duration, high-intensity spring rainstorms, in combination with snowmelt and ice jams, are the principal cause of flooding on the Missouri River and Burnt and Apple Creeks in Burleigh County. High-intensity summer rainstorms also cause minor flooding on Burnt and Apple Creeks.

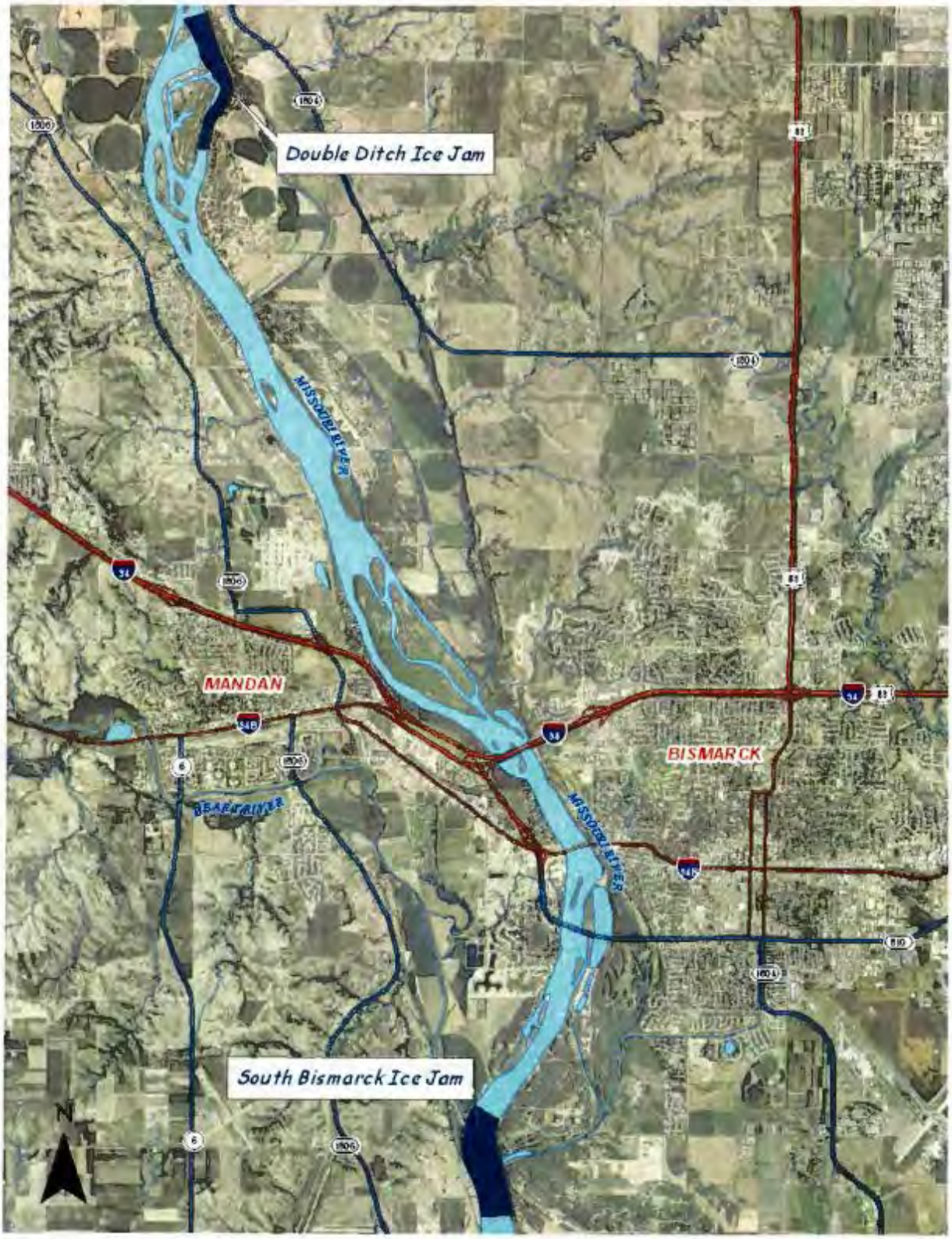
The maximum discharge from Apple Creek during the periods of March 1905 through June 1905 and October 1945 through September 1976 occurred on April 18, 1950, reaching an elevation of 1,657.08 ft at the USGA gage near Menoken, North Dakota (Reference 6). This event had a return frequency of approximately 50 years.

The maximum discharge for Burnt Creek from October 1967 through September 1976 occurred on April 8, 1969 (Reference 6). This event had a return frequency of 15 years.

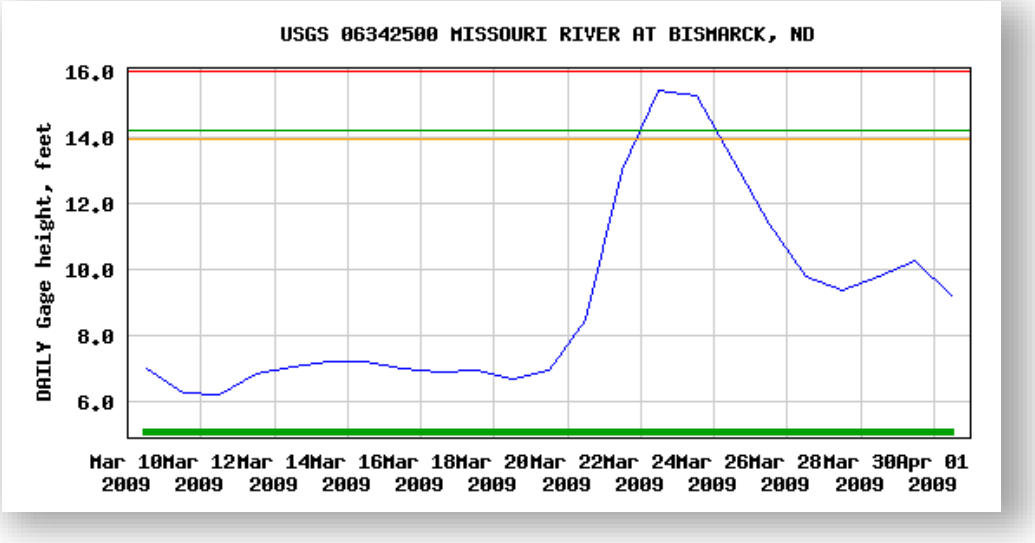
Major flooding from the Missouri River occurred in 1883, 1887, 1910, 1917, 1938, 1939, 1943, 1947, 1950, and 1952. The March 31, 1881, flood reached an elevation of 1,651.26 ft. at the USGS gage at the City of Bismarck. Flooding reached an elevation of 1,647.58 ft. at the same gage on April 6, 1952 (References 6 and 7). Since the completion of Garrison Dam in 1953, floods of this magnitude would have a recurrence interval greater than 500 years."

Ice Jams

March 23-27, 2009 Spring Flood event was caused primarily by ice jams. Extensive amounts of ice floes from the Heart River were discharged into the Missouri and created an ice jam south of Bismarck. An ice jam also formed north of Bismarck near the Double Ditch area. (see ice jam location map) The ice jam (or ice dam) was created by ice and debris. The bends in the river, sediment, sandbars, and potentially the long cold winter of 2008 and 2009 contributed to the formation of the ice jam. Also, an extensive amount of snowfall from the winter season (73.9 inches through March 22), significant snow melt with 54 degrees as the high on March 20th, **a** thunderstorm on March 23rd adding 0.75 inches of rain on frozen ground, and a blizzard over March 23 and 24th dumped an additional 8.1 inches of snow. These events cumulatively exacerbated the flooding situation. High winds and blizzard conditions delayed evaluation (aerial view) of the ice jam by the COE ice jam expert. Prior to the flood event, snowmelt was causing isolated problems throughout the community – primarily relating to landscape and runoff issues. Throughout the flooding event, snow melt, additional moisture, and the ice jam contributed to backing up the storm drain system affecting the Airport Village / Skyway Park Village mobile home park residents and closing 12th Street and a section of Expressway from 9th Street to 12th Street. Bismarck Property impacted by the flooding was primarily in the areas of Fox Island (county), Southport, Munich Drive area, Santa Fe area, and the mobile home parks of Skyway Park Village and Airport Village. Solheim School relocated its students and staff to other area schools. Ultimately, the school was not impacted. Prairie Rose Elementary (just south of Bismarck) was threatened, but not impacted by the flood event.


Double Ditch Ice Jam
MISSOURI RIVER
MANDAN
BISMARCK
HEART RIVER
MISSOURI RIVER
South Bismarck Ice Jam
N

The graph below (2009 Ice Jam) illustrates limited time to react to an Ice Jam.



ICE Jam Flood Characteristics:

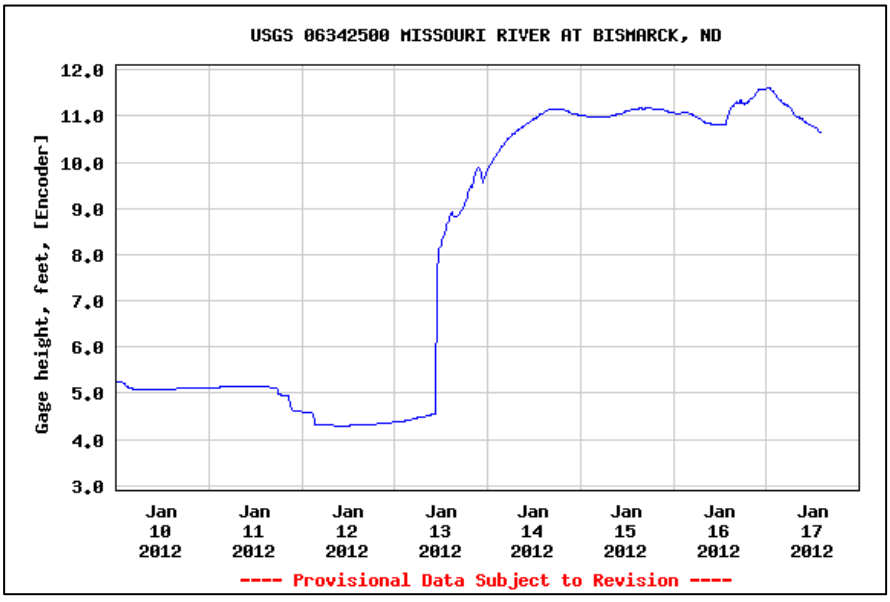
- **River Pool Effect**
- **Unpredictable (Timing and Location)**
- **Very Little Warning**
- **Require Closure of Key Internal Drainage Systems**
- **Protection Must be In Place Before the Event**

Freeze In 10-Year Average Rise at Bismarck

6.09-feet (2010-2019)

Freeze In 10-Year Average Stage at Bismarck

10.86-feet (2010-2019)



2012 Freeze-In

Missouri River – Ice Jam Date: March 23, 2009. Jam Type: Break-Up

Rapid warmup over heavy snowpack led to large increases in discharge on Missouri River tributaries throughout North Dakota, leading to breakup of ice in the headwaters region of Lake Oahe. USACE-Northwest Division Missouri River Region Water Management Office released news release 23 Mar 2009 that Garrison Dam releases were being reduced to near record low levels due to influx of tributary water and ice into Missouri River in Bismarck region. Burleigh County EM issued a Civil Emergency message shortly after noon (CDT) on 23 Mar 2009 asking residents of Fox Island to voluntarily evacuate as the river continues to rise and the unpredictability of stages due to a probable ice jam. Morton County EM issued a Civil Emergency Message at 534 pm Monday 23 March. Residents in the Jetty Beach and Tokach Bottoms area were also asked to voluntarily evacuate the area due to the rising river levels and unpredictable nature of the ice affected river. At 815 am Tuesday 24 March, the stage was 15.04 feet, Flood Stage is 16.0 feet. Burleigh County EM reported the Missouri River continuing to rise due to an ice jam, and advising any area south of Bismarck Expressway, west of South Washington Street, or south of Burleigh Ave, from the Missouri River to Apple Creek, to prepare for potential flooding. Lake Oahe is ice covered and river water will flow north. Monday, 0.75 inches of rain fell in Bismarck, with an additional 0.32 inches by 730 am Tuesday, as well as 3.0 inches of snow. The forecast for Bismarck at 1152 am Tuesday, was for heavy snow, freezing fog and wind, with a temperature of 28 F. At 220 pm Tuesday, NWS reported flooding or the potential for flooding across all of central and most of western ND. The stage was within 0.5 feet of Flood Stage, and rising, as a result of a jam just south of Fox Island. An additional jam was being reported north of Bismarck, near Double Ditch, with the effect uncertain, should the upstream jam release first. NWS reported the stage to be at 16.00 feet at 653 pm CDT Tuesday. By 615 am Wednesday, the stage had receded slightly to 15.77 feet. On Wednesday morning, 903 AM CDT, the ice jam north of Bismarck released and the ice was moving downstream. Officials were concerned about the potential for this ice to cause further increases in water level if it re-jammed at the ice jam at Fox island, south of Bismarck. Roger Kay of the USACE Omaha District was providing ice jam mitigation expertise at the scene. He relayed an update to Steve Daly of CRREL Wednesday morning, 25 March. The jam was reported to be 3 feet thick, having formed by ice released from the Heart River. Permits were in place to use rock salt on the sheet ice, located just downstream of the jam. Upstream of the jam, a 7-8 foot backwater rise was measured by USGS on Tuesday. Cooler temperatures and the river's response to Garrison Dam's water cutback on Monday, are likely causes for the drop in stages today, however, Roger Kay reported interior drainage to be a problem, with flooding ongoing. At 1030 am CDT NWS employees visually confirmed that the jam north of Bismarck, which was reported to have released, still remained in place. This jam is located from the Indian village of Double Ditch to Hogue Island. At 102 pm Weds NWS released a Public Information Statement reporting that the Morton County EM Office and the City of Mandan were downgrading the Mandatory Evacuation of residential areas along the west side of the Missouri River to a Voluntary Evacuation, in response to the fact that the jam north of Bismarck was still in place, but urged residents to be prepared, as a new Mandatory Evacuation Notice would be issued immediately should that jam release. Another Public Information Statement was issued at 127 pm Weds, reporting that the ND Department of Emergency Services needed the Morton County Sheriff's Department and Mandan Police Department to close Highway 1806 from Nineteenth St south to County Road 138 immediately so that experts can blast the ice jam, which was expected to occur between 1pm and 2pm. Water was reported to be flowing around the Double Ditch jam at 5 pm Wednesday. Overloaded storm drains have resulted in localized flooding in south Bismarck. By 915 am CDT Thursday 26 March, the stage at Bismarck had fallen to 13.52 feet, however, the ice jams still remained. Ongoing efforts continue Thursday to weaken the jam to the south of Bismarck. At 115 pm Saturday 28 March, the stage had dropped to 9.66 feet, below Flood Stage of 16.0 feet. In a 2010 review of the jam, it was noted that Gov. John Hoeven has said the cost of temporary levees, cleanup and repairs from last spring's flooding exceeded $78 million

Source: 2015 Weblink https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

Ice Jams in North Dakota 1881-May 2020

The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of historic ice jams. https://icejam.sec.usace.army.mil/ords/f?p=101:17:::NO:RP::

https://icejam.sec.usace.army.mil/ords/f?p=101:2:18949473475967::NO:::

Jam date	Jam type	Damages
1/1/2020	Break-up: no flooding	-
2/15/2016	Break-up	-
1/23/2012	-	-
3/23/2009	Break-up	exceeded $78 million
12/1/2006	Unknown	-
12/10/2005	Unknown	-
12/26/2004	Unknown	-
1/2/2004	Unknown	-
12/9/2002	Freeze-up	-
2/14/2003	Unknown	-
12/27/2001	Unknown	-
12/20/2000	Unknown	-
1/15/2000	Unknown	-
1/16/1999	Unknown	-
1/1/1998	Unknown	-
11/28/1993	Unknown	-
1/1/1989	Unknown	-
2/5/1989	Unknown	-
2/25/1987	Unknown	-
1/13/1983	Unknown	-
12/18/1979	Unknown	-
12/23/1972	Unknown	-
1/29/1971	Unknown	-
1/25/1963	-	?
1/26/1962	-	?
3/27/1960	-	?
12/3/1958	-	?
3/30/1958	-	?
12/10/1956	-	?
4/2/1956	-	?
4/4/1951	-	?
4/3/1949	-	?
4/1/1948	-	?
3/27/1946	-	?
3/18/1945	-	?
4/7/1944	-	?
3/26/1939	-	Unknown
3/20/1936	-	?
3/6/1930	-	?
3/17/1929	-	?
03/31/1881	-	?

Ice Jam/Ice Damming Summary: 1980 – 2020

The table below identifies maximum gage heights due to backwater from ice at the Missouri River USGS gaging station 644250 at Bismarck.

Jam Date	Maxium Gage Height	Estimated Daily Avg Discharge
January 1, 2020	11.13	24,000 CFS
1/23/2012	12.08	22,000 cfs
3/23/2009	16.00	
USACE reduced Garrison Dame release to Zero CFS, first time in history of the dam as a result of the March 2009 ice jam.		
12/1/2006	11.10	14,800 cfs
12/10/2005	11.34	15,200 cfs
12/26/2004	10.63	NA
1/2/2004	12.08	NA
2/14/2003	10.91	NA
12/27/2001	10.25	13,300 cfs
12/20/2000	13.01	18,800 cfs
1/15/2000	13.01	NA
1/16/1999	12.22	25,000 cfs
11/28/1993	13.55	13,800 cfs
2/5/1989	13.12	26,200 cfs
1/1/1989	14.44	19,500 cfs
2/25/1987	13.92	30,400 cfs
1/13/1983	14.8	Not reported

The peak discharge recorded at Bismarck was 500,000 cfs on April 6, 1952; this peak discharge was the result of a combination of rapid snowmelt and the release of an upstream ice jam.
Source: South Bismarck Sediment Management Study (USACE) -
http://www.swc.nd.gov/pdfs/south_bismarck_sediment_study_2014.pdf

The table below illustrates a 10-year average and median the increase in the Missouri River level following the initial freeze-in.

	Ice form date	Pre-ice stage	Max Stage	Increase
2010	12/3/2010	6.5	11.9	5.4
2011	1/13/2012	5.1	12	6.9
2012	12/24/2012	3.7	10.1	6.4
2013	12/5/2013	3	8.9	5.9
2014	12/1/2014	5	11.1	6.1
2015	12/29/2015	3.8	10.2	6.4
2016	12/8/2016	3.8	10	6.2
2017	12/24/2017	4.5	10.95	6.45
2018	12/28/2018	5.8	12	6.2
2019	12/12/2019	6.5	11.4	4.9
Average:		4.77	10.86	6.09
Median		4.75	11.025	6.2

The following are considered reasonable interpretations of information contained within the table above, based on communications with the local NWS hydrologist: The "pre-ice stage" is the initial date of really noticeable start in rise due to ice, and approximate max stage during the initial rise due to ice. *There is no consensus or accepted criteria for selecting the dates or maximum stage.* It is important to remember that the USACE has been lowering the river intentionally to allow the freezing in of the river, so the pre-ice stage is somewhat due to that as it may have been a foot or more higher as little as a week ahead of the pre-ice stage listed. The table above includes only the first freezing over of that winter. Some winters have had multiple events. Typically, the first freeze in has been the most dramatic in terms of increase in river level.

Flash Flooding (Urban Flooding). *Note: When property damage does not occur, these events are technically referred to as "urban ponding."*

Probable Maximum Precipitation (PMP) is defined by the Federal Emergency Management Agency as theoretically, *"the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location during a certain time of year."* The 50% PMP for Bismarck is identified as 10.7" of rain within 6 hours. The 50% PMP is used as a requirement for design standards for dam construction (ex: Jackman Coulee Dam within Bismarck).

July 3, 2018: 1.92 inches of rain fell in a very short time causing street flooding and pooling of water in Bismarck. Due to the higher river levels, the Tavis control gate structure had to be closed, requiring pumping to lower the level of the drainage channel, which requires more time for drainage to occur from streets in lower lying areas (ex: 12th Street, Basin Avenue). The underpasses took more than 8 hours to drain. Left photo below is the drainage channel near the Ascension Church on 3rd Street. Right photo is Basin Avenue.





July 14, 2016: 1.69 inches of rain fell within one hour. Total rainfall for the day was 2.62 inches. The heavy rainfall caused a railroad gate malfunction at 5th street as the ponding water created a connection between the two rails. Bismarck Tribune: *"A 46-year-old daily rainfall record has fallen in Bismarck. The old record of 1.94 inches, set in 1970, was broken by 11 a.m., according to the National Weather Service. The weather service says 1.69 inches fell in just one hour in Bismarck Tuesday morning, and by 2:30 p.m., 2.62 inches had fallen."*

July 10, 2016: 1.42 inches of rain fell within 50 minutes. The underpasses on 7th and 9th streets were filled with water and closed to traffic. One vehicle was stranded in the water after entering the underpass on 7th Street.

July 30, 2011: Multiple reports were received from across Bismarck of water up to 18 inches deep flowing over roads. Mainly the flash flooding was in low lying and poor drainage areas of the city. In some cases water washed up to the foundation of homes and into window wells. Rain amounts were around two inches.

June 15/16, 2009: Rain amounts varied within the Bismarck and surrounding areas - from just over 3 inches to over 7 inches of rain. Bismarck/Burleigh Experienced flash flooding the evening of June 15 into the early am hours of June 16th. Within Bismarck, flash flooding lifted/removed manhole covers and caused street flooding. Dispatch was inundated with calls. Four road closures occurred within Bismarck - Divide Avenue (35th street area impacted by Hay Creek), 12th Street between Expressway and University; Main Ave from 19th to 26th, and 3rd Street from Expressway to Front.

August 23, 2004: Streets and underpasses flooded causing several major arteries to be closed. Water flowed across yards and into several basements of homes.

August 31, 2002: Streets and underpasses filled with water in Bismarck.

July 27, 2001: Rainfall of 3 to 4 inches over Bismarck caused flooding of streets and underpasses. Two mudslides on River Road covered northbound lanes.

July 26, 2001: Around 2 inches of rain fell in a very short time causing street flooding and pooling of water in Bismarck.

June 9, 2001: Widespread street flooding throughout the city of Bismarck where a foot or more covered the roads. Travel not advised. Up to 12 feet of water accumulated in the railroad underpasses.

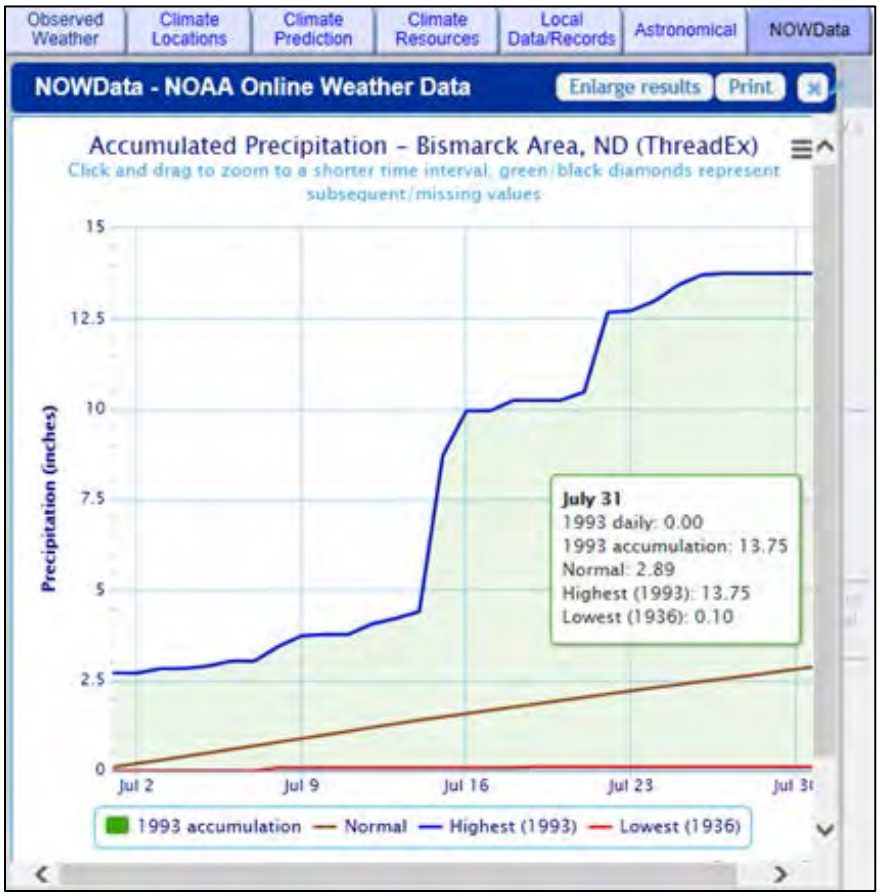
The June 9 storm also produced significant hail (also noted in the "Thunderstorm" section of the mitigation plan:
In June 2001, a hailstorm caused an estimated $230 million in property damage in Burleigh and Morton Counties; an estimated 57,000 insurance claims were filed. (North Dakota Insurance Department, 2007) This hailstorm affected the urban Bismarck and Mandan areas. As the most damaging hailstorm in the state's history, the insurance industry was severely impacted, and insurance availability and premiums were affected statewide; many insurance companies pulled out of the state after the storm. (North Dakota State Water Commission, 2007c) According to the state situation report, officials estimated the North Dakota State Capitol Complex received approximately $100,000 worth of damage. Thirteen windows in the tower were broken; shingles on the State Library were damaged as well as the skylight in the atrium of the Judicial Wing. The exteriors of the State Office Building and the Grounds Maintenance Building were also damaged. Officials estimated that 400 North Dakota State Fleet vehicles suffered hail damage. Approximately 50 required glass replacement (North Dakota Department of Emergency Services, 2007).

August 12, 1999: Heavy rainfall from 4 to 7 inches. Hardest impact in the cities of Bismarck and Mandan. Two hundred twenty-one (221) homes and businesses received water damage. Twelve (12) road sites were damaged and a significant mudslide closed portions of Highway 1804 in north Bismarck.

August 21, 1998: 4.48 inches of rain in two hours

March 21, 1997: Minor overland flooding – wet basements.

July 15, 1993: National Weather Service reported 4.32 inches of rainfall. Cumulative rain for the month of July was 13.75, the record high for the month of July. Normal is 2.89 for the month.



Per Bismarck Tribune archived articles: 7 inches of rain in the Bismarck area causing damages of over $2 million in private property damages. Mayor Sorenson estimated that two-thirds of the flooded basements were on the north side, out of the flood plain, but that the most serious cases of individual damage were on the south side. The American Red Cross provided services (clothes, housing and feeding) to 50 victims in Bismarck-Mandan, many of whom had been displaced from their homes. Norwest Bank set up unsecured low interest loans to help cover uninsured or underinsured flood related costs. Source: archived Bismarck Tribune articles

1993 Flood *Statewide, excessive rains during the spring destroyed crops and heavy thunderstorms on July 15-16 (4-7 inches of rain), July 22-27 (6-10 inches of rain), and August 21-22 (up to 7 inches of rain) caused flash flooding and damage to public and private property. Minor to moderate flooding occurred in the Missouri, James, Souris, and Devils Lake basins.*

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

*Items in last column specific to 500 year flood are noted with an asterisk. 100 Year flood impacts are included in 500 year flood.

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
Probability	Very Likely	Possible	Possible (100 Year) Unlikely (500 Year)
Speed of Onset	Limited warning Minutes to Hours	Some warning, Generally at least 24 hours	Controlled River (Garrison Dam / COE)
Geographic Area	All areas of Bismarck subject to urban flooding	Generally low lying areas along river and in South Bismarck. See 100 Year Flood map.	See 100 Year and 500 Year Flood mapping
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street Most flood deaths result from flash flooding. Source: ND DES Mitigation Plan	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street
Mass Casualty Incident	Limited probability	Limited probability	Limited probability

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
Property Losses	1. Basement flooding – basement contents 2. Airport and Skyway Park Village 3. Basin Avenue Area	1. Basement Flooding – basement contents & utilities 2. Fox Island 3. Washington Street Bridge (concrete damages) 4. Riverwood Golf Course	1. Structures within 100 Year or 500 Year Flood Plain. 2. Main floor and contents (below base flood elevation)
Environmental	1. Basement flooding – basement contents	1. Debris / hazardous materials contaminating flood water 2. Septic systems *Flood waters are typically contaminated*	1. Structures in low lying areas (ie: 100 Year Flood plain) 2. Debris / hazardous materials contaminating water 3. Septic systems *Flood waters are typically contaminated*
COG/COOP	1. Employee/ Family Impact – availability of personnel 2. Bismarck PD	1. Employee/ Family Impact – availability of personnel	1. *Bismarck PD 2. Employee / Family impact – availability of personnel
Critical Facilities	1. South Fire Station	1. Wastewater Treatment Plant 2. South Fire Station access	1. Bismarck Airport 2. *Wastewater Treatment Plan
Critical Infrastructure	*Street Access:* 1. 12th Street – from University to Bismarck Expressway 2. Bismarck Expressway from 7th to 12th Street 3. 7th and 9th Street underpasses 4. S 3rd Street – Arbor Avenue to Bismarck Expressway 5. Broadway – 12th to 14th Street		*Railroad Access:* 1. *DMVW North/South Railroad

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
Schools		1. Prairie Rose Elementary	
High Risk Facilities (chemical)		1. Southport Marina (2009 ice jam) (The "Pier")	1. Southport Marina 2. *Wastewater Treatment Plant 3. Little Dukes 4. Pony Express 5. Holiday Gas 6. Exxon Station (Red Carpet)
Specific Populations: Public Assembly, Vulnerable / Special Populations			1. Dakota Zoo 2. *Diane's Hope House 3. *Crescent Manor
Economy (community wide)	Minor (THIRA rating)	Minor (THIRA rating)	Moderate (THIRA rating)
OTHER:	Mobile HazMat (transportation)	Mobile Hazmat (transportation)	Mobile Hazmat (transportation)

Bismarck Facilities and Infrastructure within 100 Year Floodplain	
Critical Infrastructure	
Bridge: Railroad over Hay Creek	East of 3727 Pebbleview Lp
Bridge: Railroad over Main Av	South of 906 Missouri Av
Bridge: Riverwood Dr	2300 Riverwood Dr
Bridge: Rosser Av Over Hay Creek	North of 3605 E Rosser Av
Bridge: Tavis Rd	3300 Tavis Rd
Clear Channel Radio - KFYR/Y93	3500 E Rosser Av
Fox Island Boat Ramp	North of 2650 Mills Av
Grant Marsh Bridge Boat Ramp	North of 1103 River Rd
Pipeline at Missouri River	West of 4051 Sandy River Rd
Power Line at Missouri River	West of 6948 Burnt Creek Lp
Power Line at Missouri River	West of 5716 Misty Waters Dr
Railroad Crossing at Rosser Av	East of 3422 E Rosser Av
Railroad Over Hay Creek	East of 3120 E Capitol Av
Railroad Over Hay Creek	SE of 2920 E Capitol Av
Sanitary Sewer Pump Station	2516 River Rd
Sanitary Sewer Pump Station	3701 E Bismarck Ex
Hazmat Sites (ie: Tier II sites)	
South Port Marina	1120 Riverwood Dr
Western Area Power Administration	719 N Bismarck
Schools	
Prairie Rose Elementary (Bismarck Public Schools)	2200 Oahe Bend
Vulnerable/Special Populations	
Dakota Zoo	600 Riverside Park Rd

See 100-Year Flooplain map on page 6.

Bismarck Facilities and Infrastructure within 500 Year Floodplain	
Critical Facilities	
Bismarck Police Department	700 S 9th St
Bismarck Public School Facilities & Transportation	705 S 9th St
Cash Wise Foods	1144 E Bismarck
Dan's Supermarket - South	835 S Washington St
Fire Station 2 - South	835 E Bismarck
Salvation Army	601 S Washington St
Sanford Clinic - South	1040 Tacoma Av
Sanford Health Warehouse	1112 S 12th St
Vitalent (Blood Services)	517 S 7th St
Critical Infrastructure	
Bridge: 3rd St over drainage ditch	Southeast Of 1922 S 3rd St
Bridge: Railroad over Hay Creek	East of 3727 Pebbleview Lp
Bridge: Railroad over Main Av	South of 906 Missouri Av
Bridge: Railroad over River Rd and Missouri River	North of 1103 River Rd
Bridge: Riverwood Dr	2300 Riverwood Dr
Bridge: Rosser Av Over Hay Creek	North of 3605 E Rosser Av
Bridge: Southport Lp	1500 Southport Lp
Bridge: Tavis Rd	3300 Tavis Rd
Bridge: Wachter over Drainage Ditch	800 Wachter Av E
Bridge: Washington over Drainage Ditch	2201 Washington St
Clear Channel Radio - KFYR/Y93	3500 E Rosser Av
Fox Island Boat Ramp	North of 2650 Mills Av
Grant Marsh Bridge Boat Ramp	North of 1103 River Rd
Railroad Crossing at Divide Av	SE of 3500 Divide Av E
Railroad Crossing at Rosser Av	East of 3422 E Rosser Av
Railroad Over Hay Creek	East of 3120 E Capitol Av
Railroad Over Hay Creek	SE of 2920 E Capitol Av
Sanitary Sewer Pump Station	100 E Indiana Av
Sanitary Sewer Pump Station	2516 River Rd
Sanitary Sewer Pump Station	850 E Wachter Av
Sanitary Sewer Pump Station	3701 E Bismarck Ex
Wastewater Treatment Plant	601 W London Av

Bismarck Facilities and Infrastructure within 500 Year Floodplain cont'd	
HazMat Sites (Ie: Tier II Sites)	
Alltel	541 S 7th St
AmeriPride Linen & Apparel	1238 Frontier Dr
Bismarck Public School Facilities & Transportation	705 S 9th St
Exxon Station (aka Red Carpet)	919 S Washington St
Holiday Gas	905 E Bismarck
Little Dukes	1140 E Bismarck
Pony Express	1020 S Washington St
South Port Marina	1120 Riverwood Dr
Wastewater Treatment Plant	601 W London Av
Western Area Power Administration	719 N Bismarck
Schools	
Ascension Church School	1911 S 3rd St
Dorothy Moses Elementary	1312 Columbia Dr
ECLC	1901 Oakland Dr
Jeanette Myhre Elementary	919 S 12th St
Noah's Ark Daycare	1550 Wichita Dr
Open Door Community Center	1140 S 12th St
Perfect Start	1001 Basin Ave
Prairie Rose Elementary	2200 Oahe Bend
Preschool Program - House of Prayer	1470 S Washington St
South Central High School	406 S Anderson St
Shepherd of the Valley Preschool	801 E Denver Av
Super Kids Jr. Academy	1227 Park Av
Victor Solheim Elementary	325 Munich Dr
Wachter Middle School	1107 S 7th St
Vulnerable/Special Populations	
Crescent Manor	107 E Bowen Av
Dakota Zoo	600 Riverside Park Rd
Diane's Hope House	315 W Indiana Av

See 500-Year Flooplain map on page 7.

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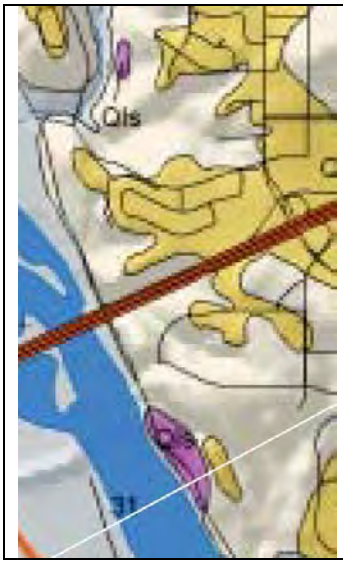
Geologic Hazard – Hazard Profile

Description

SLOPE FAILURE
Seventeen landslides have been identified in the Bismarck – Mandan area. Most of these slides likely predate settlement of the area and are hundreds, if not thousands, of years old. Typically, more recent landslides are reactivations of these older, much larger landslide complexes. Landslides may occur throughout the year but are most prevalent in the spring and early summer due to the availability of moisture from snowmelt and rainfall events. In addition, studies have shown that landslides are most active during a wet period that follows an extended dry period. For these reasons, water is often said to "lubricate a slide." Although this is an oversimplification of the mechanisms and rock properties, such as differential pore pressures, involved in slope failure, it is correct in its emphasis of the importance of water to slope movement. To a degree, landslides are self-perpetuating because more water seeps into the subsurface after a slide occurs due to the ponding of water in the newly formed surface depressions and infiltration of this water through numerous tension cracks.

Rivers and streams erode by undercutting the river banks on the outside of a meander or curve. This erosion creates over-steepened cliff faces that are highly susceptible to slope failure. Such is the case in west Mandan where landslides have occurred in the steep, tall cliffs overlooking the Heart River. A series of landslides in this area has displaced trees, a rock wall, and resulted in the abandonment of at least two lots due to safety concerns.

The mudstone of the Cannonball Formation contains interbedded lenses of sandstone and siltstone (grayish brown) and claystone (dark gray). The sand and clay content of the Cannonball mudstones is also variable, some mudstones are dominated by clay and others by sand and silt. Most of the mudstones in the Bismarck-Mandan area are dominated by claystone. The clays in the mudstone are mixed and contain varying percentages of swelling clays. Differential pore pressures within lenses in the mudstone and the presence of swelling clays may potentially damage building foundations.
All of the landslides identified in the Bismarck-Mandan area involve mudstones in the Cannonball Formation. Not only are these mudstones involved, but most of the slope failures appear to have originated within these rocks. https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf



The areas in pink shading show previous areas of slope failure in Bismarck. The top location is north of Burnt Boat Drive. The bottom location is along River Road just south of the Interstate 94.
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf

The ND Geological Survey (within ND Department of Mineral Resources) has Bismarck area Landslide maps available: https://www.dmr.nd.gov/ndgs/landslides/Bismarck/
as well as a surface geology map:
https://www.dmr.nd.gov/ndgs/surfacegeo/BISMARCK_100K/WebSurfaceGeology/24k/bsmk_sg.pdf

Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. Three major types of mass wasting are classified by the type of downslope movement: falls, slides, and flows. Land subsidence is another type of ground failure covered.

Landslide

A landslide is the movement of rock, soil, artificial fill, or a combination thereof on a slope in a downward or outward direction. The primary causes of landslides are slope saturation by water from intense rainfall, snowmelt, or changes in ground-water levels on primarily steep slopes, earthen dams, and the banks of lakes, reservoirs, canals, and rivers (US Geological Survey). Other causative factors include steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, volcanic eruptions, and the loss of vegetation from construction or wildfires. The saturation or destabilization of a slope allows the material to succumb to the forces of gravity or ground movement.

Many different types of landslides exist: slides, falls, topples, flows, and lateral spreads. Slides involve the mass movement of material from a distinct zone of weakness separating the slide material from the more stable underlying material. The primary types of slides are rotational slides and translational slides. Falls occur when materials, mostly rocks and boulders, fall abruptly from a steep slope or cliff. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water. Topples are similar to falls, yet they pivot around a connection point at the base of the material and are most often caused by gravity or fluids in the cracks of the rocks. Flows typically have a higher percentage of water material embedded in them and behave more like a liquid than other types of landslides. The five primary categories of flows are: debris flows, debris avalanches, earthflows, mudflows, and creeps. Lateral spreads usually occur on gentle slope or flat surfaces when liquefaction occurs and leads to fractures on the surface. Complex landslides involve any combination of these types (US Geological Survey).

Landslides are typically associated with mountainous regions, but they can also occur in areas of low relief. In these areas, the landslides are often the result of cut-and-fill failures (from roadway and building excavations), river bluff failures, lateral spreading, or mine collapse (US Geological Survey).

Landslides occur in natural and anthropogenic settings in North Dakota and are most commonly found within major river valleys and on engineered slopes along major transportation corridors. Landslides are dominantly found in two settings, controlled by the surface geology of the Great Plains in western and southwestern North Dakota and along major river valleys of the Missouri, Sheyenne, James, Souris, and Red Rivers (North Dakota Geological Survey).

Riverbank slumping can be considered a form of landslide and is often found along the rivers in North Dakota. The riverbank soils are inherently weak, and natural forces are always moving river channels.

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.

Earthquake is any sudden shaking of the ground caused by the passage of seismic waves through Earth's rocks. Seismic waves are produced when some form of energy stored in Earth's crust is suddenly released, usually when masses of rock straining against one another suddenly fracture and "slip." Earthquakes occur most often along geologic faults, narrow zones where rock masses move in relation to one another. The major fault lines of the world are located at the fringes of the huge tectonic plates that make up Earth's crust.

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

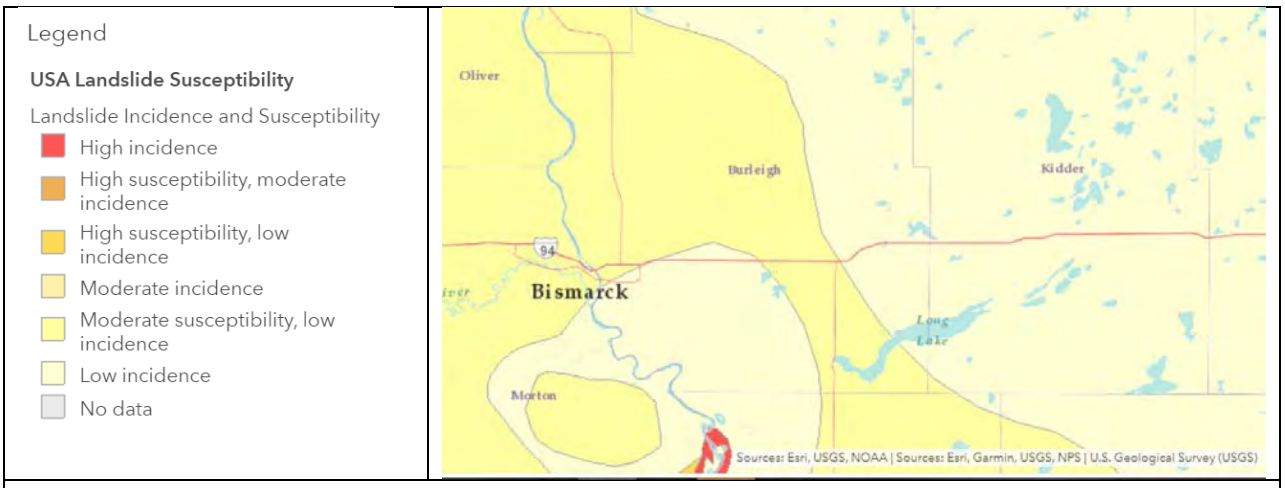
Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Geologic Hazard (Slope Failure along River Road)

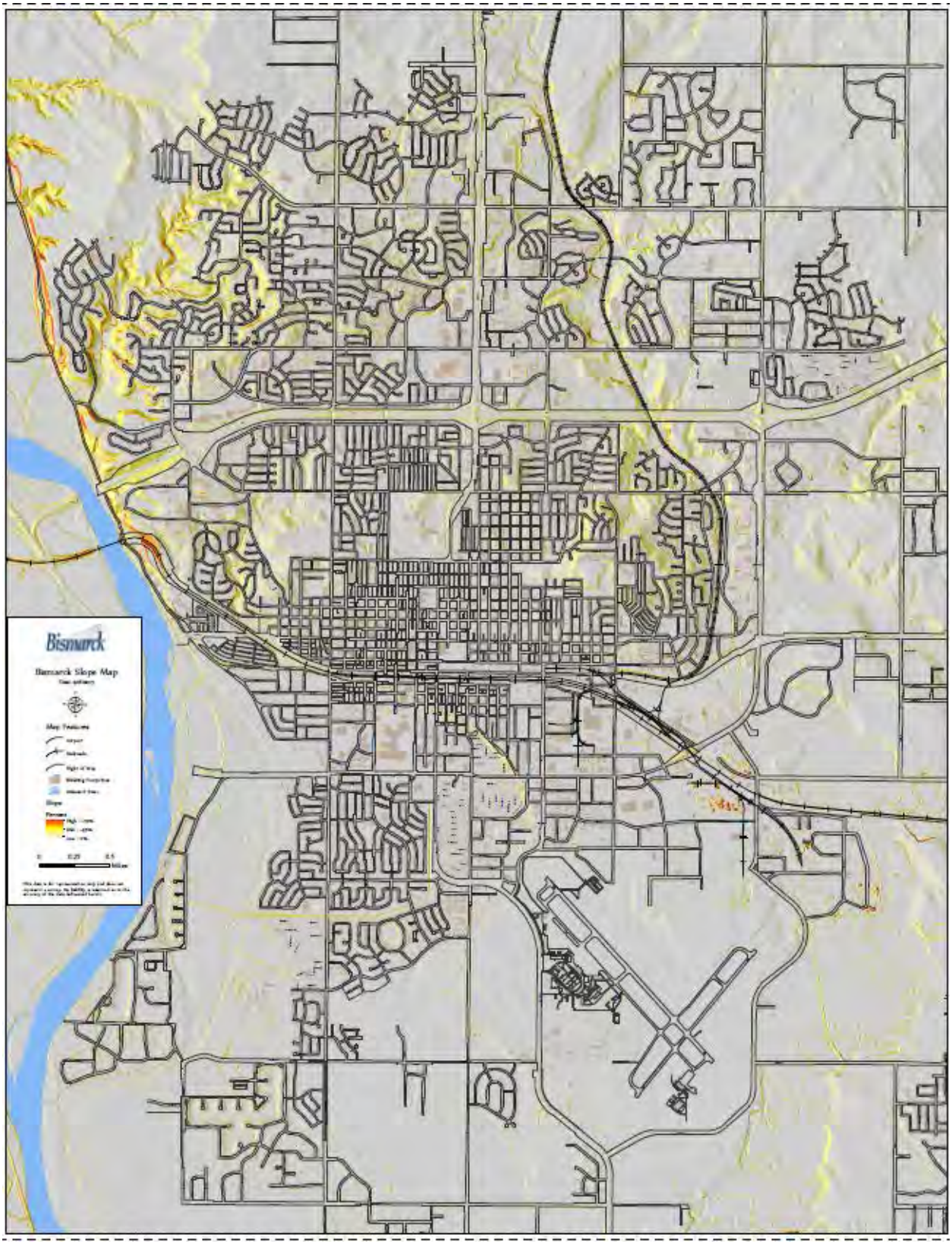
Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	None/Negligible	Minor	Minor	Minor

Climate Change Impact:

Geologic Hazards	A projected increase in the frequency of heavy rain events may impact likelihood of areas already prone to geologic hazards.



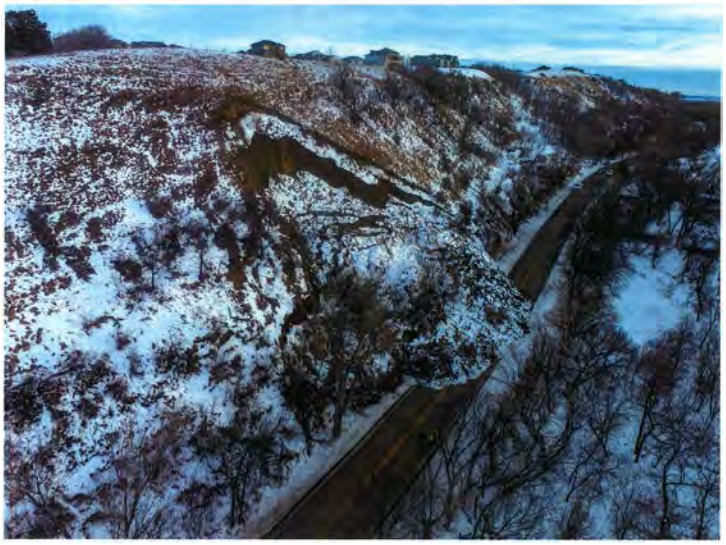
Source: ArcGIS USA Landslide Susceptibility
https://www.arcgis.com/home/webmap/viewer.html?webmap=cc5e9da58860460188705c545e86c871


Bismarck
Bismarck Slope Map

Historical Occurrences:

2019-2020: Active geological slide, see December 22, 2019 below.

December 22, 2019: A large portion of the existing roadway back slope on the east side of River Road (around the 3900 block) let loose and blocked River Road. The material ranged from 10 to 15 feet deep on the east side of the roadway to around 2 to 5 feet deep on the west side. It extended along 200 feet of River Road. As of the following morning material was continuing to fall on the roadway and had not yet stabilized.



June 2016: Two properties along Arizona Drive in Bismarck backyards dropped as much as 7 feet in June, with continued dropping with every rainfall according to resident.



Photo Credit: Bismarck Tribune

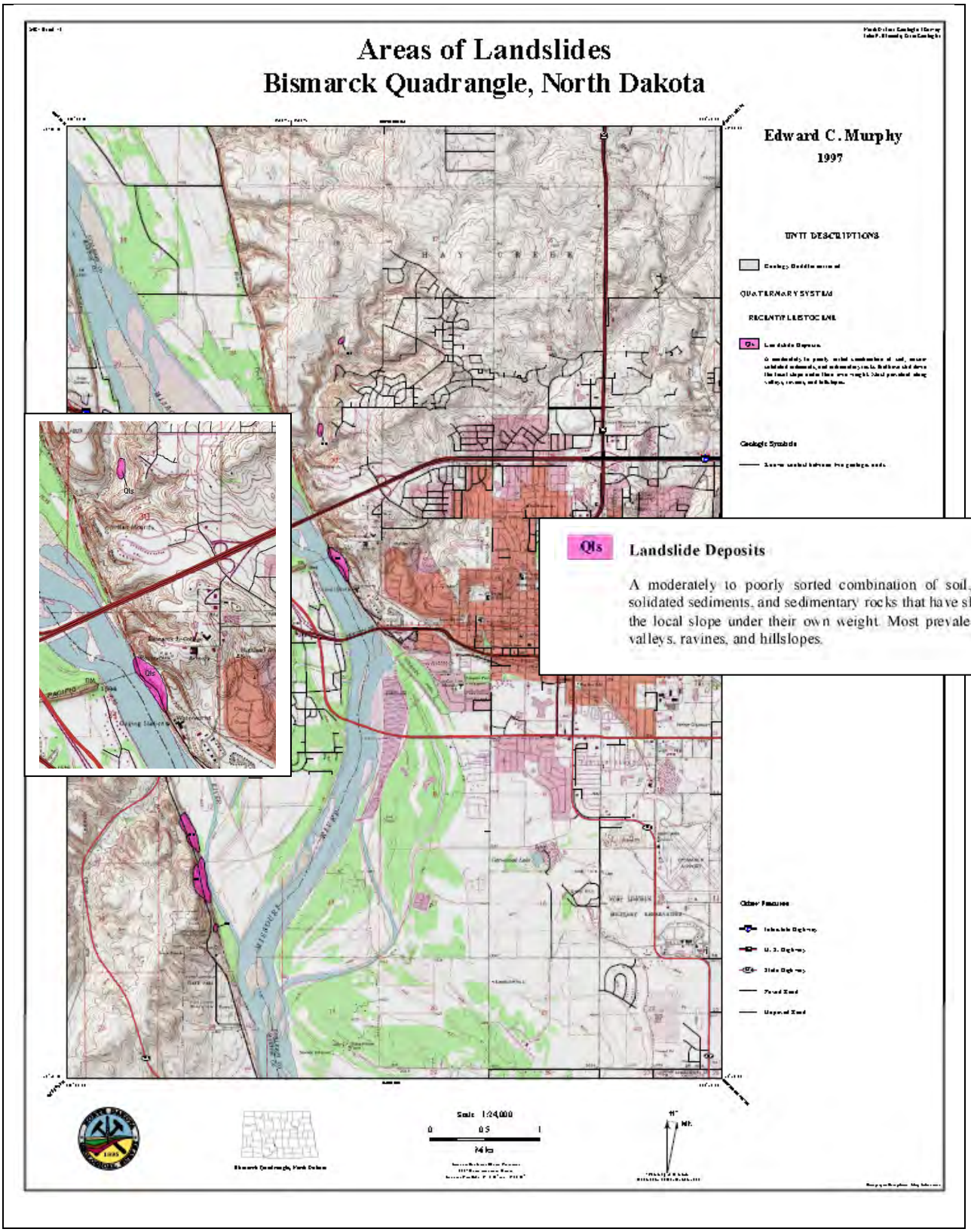
June 2009 thru December 2009: River Road between the Memorial Bridge and the Railroad Bridge was closed as a result of slope failure (land subsidence). Sloping of the half-mile stretch between north of Bismarck's water plant and Keel Boat Park forced the city to close the road in June. Pavement had to be removed and pilings put in place. Permanent surfacing had to be applied in 2010.



Figure 6. Several landslide scarps are visible along the east slopes of the Missouri River Valley above the Bismarck Railroad Bridge. The top of a City of Bismarck water reservoir is visible just below the largest tree at the top of the east slope. Photograph taken by Ralph Peck in 1951.

The ND Department of Mineral Resources (DMR) July 2009 newsletter cites slope instability issue affecting the Northern Pacific Railway Bridge for several decades after it was completed in 1882: "…. Shortly after the railroad bridge was completed, the east pier began sliding towards the river. For the next 68 years, Northern Pacific engineers applied a variety of slope stabilization techniques in an attempt to stop the pier from moving. …. Peck seized the opportunity that was afforded during the straightening of the railroad track to remove a considerable amount of the hillside above the east pier and reduce the remaining slope to within his desired factor of safety. Finally, after all of those years, his efforts resulted in relative stability of the slope above the east bridge pier…"
https://www.dmr.nd.gov/ndgs/documents/newsletter/2009Summer/pdf/IceJamsLandslides.pdf

Historical locations of landslides in the Bismarck area are also noted within the map on page 6.



https://www.dmr.nd.gov/ndgs/landslides/Bismarck/Bsmk_l.pdf

Photos below show slumping north of Burnt Boat Drive
Photo Date: October 9, 2009





NDSU has documented (photos) of slumping in the Double Ditch Area
http://www.ndsu.edu/nd_geology/nd_mass_wasting/index_mass_wasting.htm



This large slump is located north of Bismarck, at the site of the Double Ditch Indian Village. It was initiated by erosion against this slope by the Missouri River (just out of view to the right on this photo).

In the next photo, we see the progress of this slump over just nine months. (Use the telephone pole and highway as reference points between the two photos).
(Photo by J. Kostelecky, 1987).



This is the same slump as in the previous photo, but nine months later. (Use the telephone pole and highway as reference points between the two photos).
(Photo by D.P. Schwert, North Dakota State University, 1988).

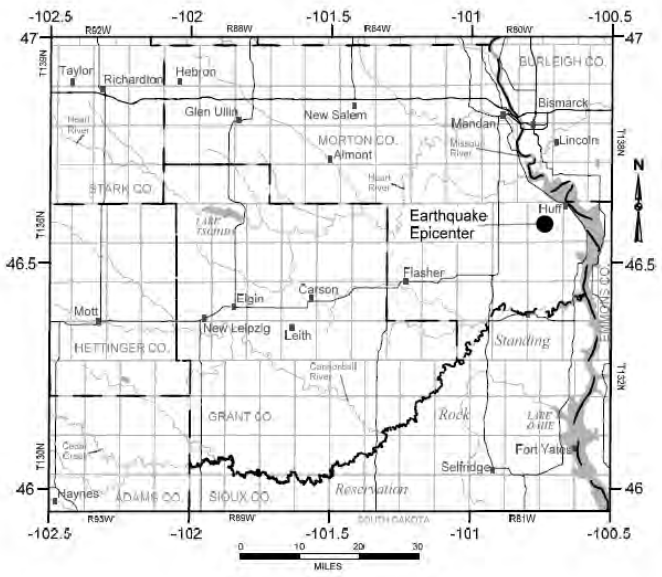
Earthquake History:

Source: North Dakota Geological Survey, North Dakota Earthquake Catalog (1870-2015) by Fred J. Anderson.

July 8, 1968 M 4.4 Earthquake near Huff, North Dakota.

A magnitude M 4.4 earthquake was recorded five miles southwest of Huff in eastern Morton County in south-central North Dakota during the morning of Monday, July 8, 1968 at an estimated depth of 20.5 miles. This earthquake was the first instrumentally verified earthquake recorded in North Dakota and was reported to have been felt over approximately 3,000 square miles of south-central North Dakota. It was reported that "a television set shifted and sounds like thunder were heard." Additionally, Mercalli earthquake Intensity IV effects were noted at Bismarck, Fort Rice, Huff, Linton, Mandan, Menoken, and Moffit; and Mercalli intensity I-III effects at Almont, Flasher, Halliday, and St. Anthondy (Coffman and Cloud, 1970).

Day	Date	Time (local)	Time (UTC)	Magnitude	Depth (miles)	MMI	T & R	Longitude	Latitude
Monday	07/08/1968	10:50:12	16:50:12	4.4	20.5	IV	136-80	-100.74	46.59



Applicable Mercalli Intensity Level Descriptions

III Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration estimated in some cases. Vibration like that due to passing of light, or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.

IV Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experience. Vibration like that due to a passing of heavy or heavily loaded trucks. Sensation like heavy body striking building or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, frame, especially in the upper range of this grade. Hanging objects swung, in numerous instances. Disturbed liquids in open vessels slightly. Rocked standing motor cars noticeably.

V Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few –slight excitement, a few ran out doors. Buildings trembled throughout. Broke dishes, glassware, to some extent. Cracked windows – in some cases, but not generally. Overturn vases, small or unstable objects, in many instances, with occasional fall. Hanging objects, doors, swing generally or considerably. Knocked pictures against walls, or swung them out of place. Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started or ran fast, or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes, shaken slightly.

The North Dakota Earthquake Catalog (1870-2015) provides seismological information on thirteen earthquakes that have been reported to have occurred in the state. Today and historically, the state continues to be in one of the most geologically stable areas of the North American Continent. Earthquakes that have occurred in the state are generally of magnitude (M) 3.0 or less and may occur about once per decade. The largest earthquake to have occurred in the state remains to be the July 8, 1968 M4.4 Huff earthquake which is also the first earthquake in the state to have had an instrumentally located epicenter. There are currently three seismic monitoring stations in operation in North Dakota with the capabilities to detect earthquakes that originate at local, regional, and global distances: one location south of Bismarck near Huff, one in the Red River Valley just northwest of Fargo, and one southeast of Devils Lake near Maddock.

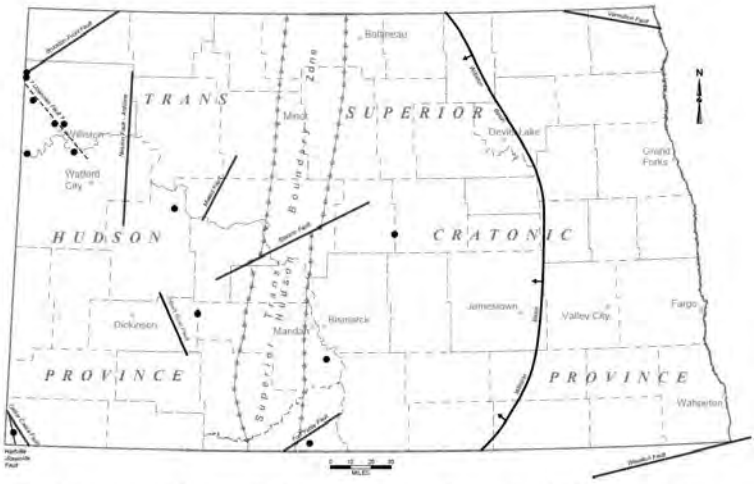


Figure 1. Locations of major faults and tectonic boundaries along with earthquakes that have occurred in North Dakota (as modified from Sims, et.al., 1991, and Nesheim, 2012)

Table 1. Summary of earthquakes that have been reported to have occurred in North Dakota.

Day	Date	Time (local)	Magnitude	Depth (mi.)	Modified Mercalli Intensity	Longitude	Latitude	City or Vicinity of Earthquake
Friday	September 28, 2012	05:53:43	3.3	0.4*	III	-103.48	48.01	SE of Williston
Monday	June 14, 2010	02:58:03	1.4	3.1	I	-103.96	46.03	Boxelder Creek
Sunday	March 21, 2010	11:56:40	2.5	3.1	II	-103.98	47.98	Buford
Sunday	August 30, 2009	20:24:23	1.9	3.1	I	-102.38	47.63	Ft. Berthold SW
Saturday	January 3, 2009	07:53:48	1.5	8.3	I	-103.95	48.36	Grenora
Saturday	November 15, 2008	10:21:27	2.6	11.2	II	-100.04	47.46	Goodrich
Wednesday	November 11, 1998	06:59:37	3.5	3.1	IV	-104.03	48.55	Grenora
Tuesday	March 9, 1982	07:10:50	3.3	11.2	III	-104.03	48.51	Grenora
Monday	July 8, 1968	10:50:12	4.4	20.5	IV	-100.74	46.59	Huff
Tuesday	May 13, 1947	00:02:--	3.7e	U	IV	-100.90	46.00	Selfridge
Sunday	October 26, 1946	15:37:--	3.7e	U	IV	-103.70	48.20	Williston
Friday	April 29, 1927	20:15:--	3.2e	U	III	-102.10	46.90	Hebron
Sunday	August 8, 1915	09:15:--	3.7e	U	IV	-103.60	48.20	Williston

e = magnitude estimated from reported Modified Mercalli Intensity value.
*estimated depth.

Source: North Dakota Geological Survey, North Dakota Earthquake Catalog (1870-2015) by Fred J. Anderson.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Landslide (Slope Failure)
Probability	Possible
Speed of Onset	No Notice event in many cases.
Geographic Area	See applicable maps.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Falling Rock, road washouts. A. Those living or traveling near areas of potential land subsidence.
Mass Casualty Incident	Unlikely
Property Losses (points of vulnerability – high priority)	1. Properties built, potentially on backfill or without adequate setback (prior to current master planning methods). - Tyler Coulee area - Promontory Point – West of Clairmount Road
Environmental (points of vulnerability – high priority)	1. Hay Creek (waterway impacted). 2. Impact to the Missouri River would be minimal.
COG/COOP (points of vulnerability – high priority)	1. No impacts
Critical Facilities (points of vulnerability – high priority)	1. Water Treatment Plant, located off River Road
Critical Infrastructure (points of vulnerability – high priority)	1. River Road – potential loss of access similar to June 2009: closed for 5 months to make repairs. Necessary detour can potentially cause delays in emergency response. 2. DMVW tracks run adjacent to Hay Creek through much of Bismarck. 3. BNSF Railroad Bridge Piers. 4. Private Utility Infrastructure in NW Bismarck – both overhead and underground utilities (ie: near River Road) - gas main near water treatment plant - gas force main – below the Missouri River
Schools (points of vulnerability – high priority)	1. Burnt Boat Drive – bus route.
High Risk Facilities (chemical) (points of vulnerability – high priority)	1. No impacts
Specific Populations: Public Assembly, Vulnerable / Special Populations (points of vulnerability – high priority)	1. Limited to populations affected to by road closure (ie: River Road) or site specific property impacts (ie: slope failure).
Economy (community wide)	
OTHER: (points of vulnerability – high priority)	The failure zone in both the Mary College *(University of Mary*) and the NP Railroad Bridge slides appeared to occur in the Hell Creek – a unit that contains more swelling clays. *E-mail comment: Edward C. Murphy, State Geologist North Dakota Geological Survey, ND Department of Mineral Resources, ND Industrial Commission*

Hazardous Materials Release – Hazard Profile

Description

Hazardous materials are materials that if released, can pose a threat to human health or the environment. Hazardous material releases can cause long/short term health effects, damage to property, expensive cleanup/contractor costs, serious injury, and even death.

A Hazardous material release in Bismarck could result in either evacuation or "shelter-in-place" situations. A hazardous material release may be a rare occurrence, but one major release could have a significant impact.

The hazard profile addresses three primary origins of potential hazmat incidents: Fixed Facilities, Transportation, and Pipeline. Train Derailment (including hazmat) is addressed as its own hazard with a separate hazard profile.

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Hazardous Materials Release

Fixed Facility: Significant Incident requiring full local response resources

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Moderate	Moderate	Minor	Minor

Truck – I-94 (Transportation Accident: Anhydrous Ammonia)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Moderate	Moderate	Minor	Moderate

Pipeline – Natural Gas (HCA)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Significant	Significant	Minor	Minor

Climate Change Impact:

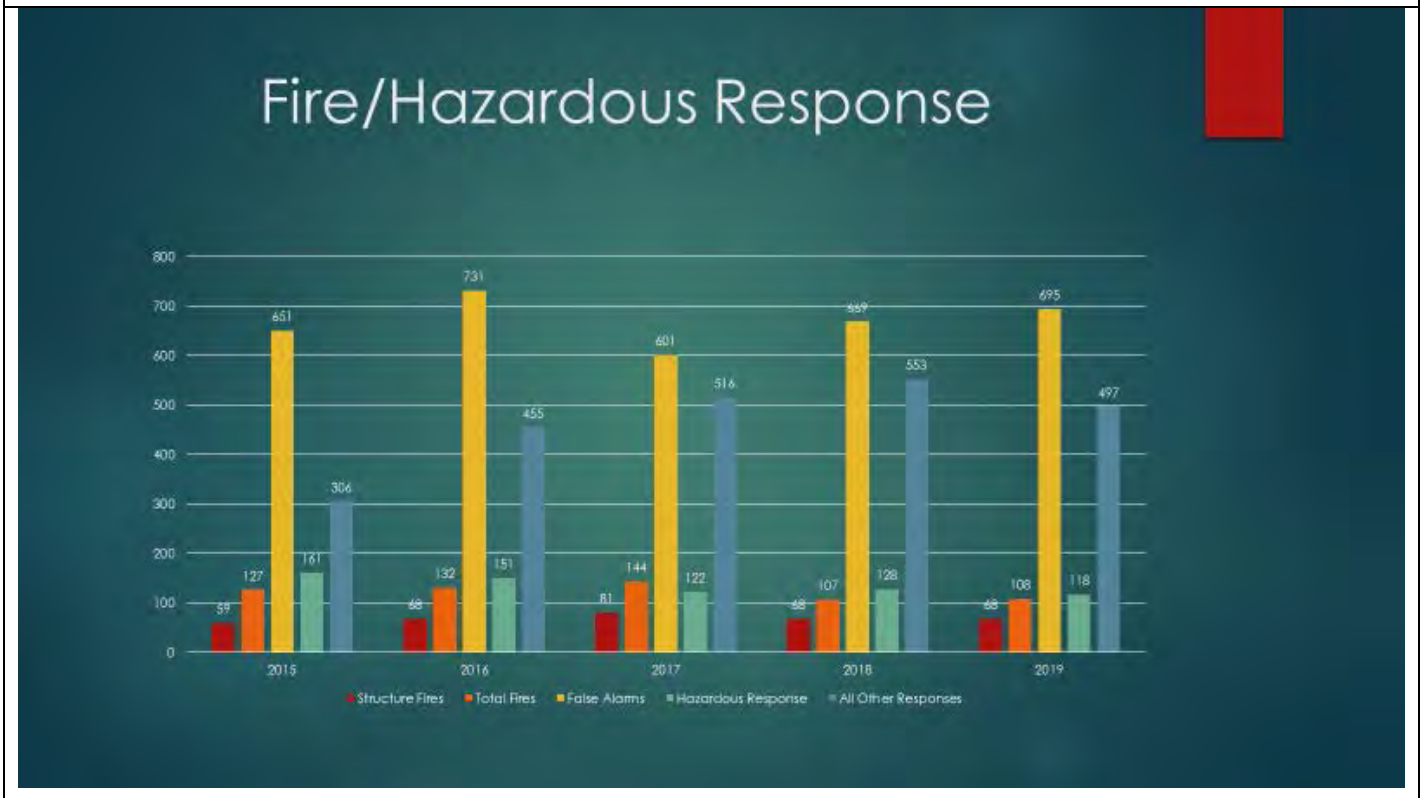
Impact would be indirect. More extremes or higher frequency of significant weather events (ie: heat waves, heavy rain events) can impact risk (enhance likelihood).

History

Within the last 20 years, Bismarck has not experienced many significant hazardous materials incidents. Actual Hazmat incidents of potential significant impact within the last 20 years include:

1. A Gasoline Tanker Leak: An MC 306 tank trailer, containing gasoline was unhooked from the semi-tractor, which was in the shop for engine repairs. It was parked on the street and set on the trailer's landing gear, which are not designed to support the trailer loaded. The excessive weight coupled with the slope of the street caused the landing gear to collapse and puncture the tank, releasing gasoline. The gasoline was running down the gutter towards a storm sewer that drained into the Hay Creek Watershed. The spill was confined and the trailer contents were offloaded successfully.
2. SuperValue Warehouse Ammonia piping system. All personnel evacuated safely and there was not impact outside the facility.

The following graph illustrates the Fire and Hazmat Responses conducted by the Bismarck Fire Department from 2015 thru 2019:



This section of the hazard profile will address three primary origins of potential hazmat incidents: Fixed Facilities, Transportation, and Pipeline. Train Derailment (including hazmat) is addressed in its own hazard profile section. The hazard profile concludes with the vulnerability assessment.

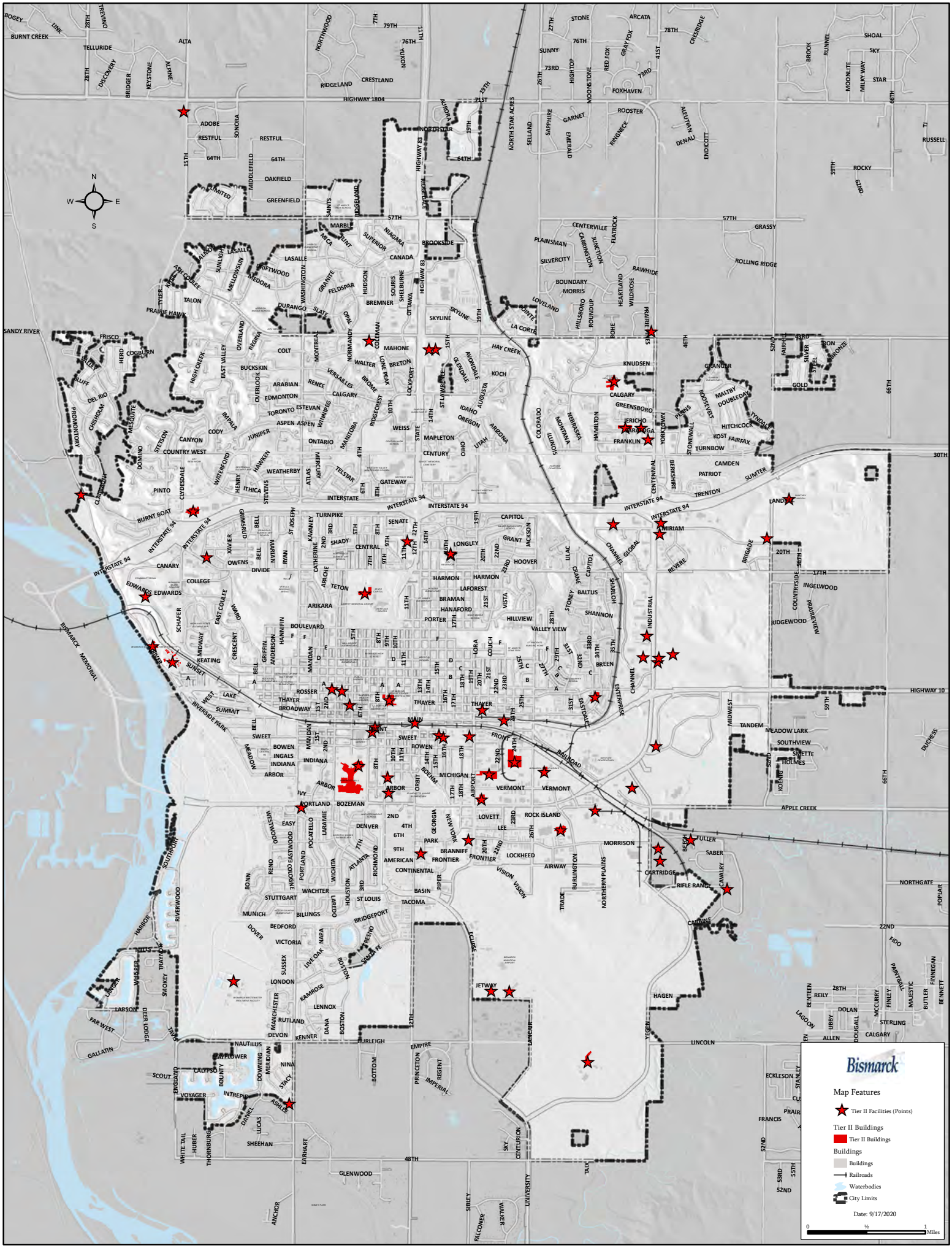
Fixed Facilities

Hazardous materials being used or stored at industrial facilities and in buildings is defined as a *fixed facility* hazardous material release hazard. The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, was enacted in November 1986 to enable state and local governments to adequately prepare and plan for chemical emergencies. Facilities covered by EPCRA must submit an emergency and hazardous chemical inventory form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC) and the local fire department annually.

Bismarck has 81 facilities that are reported as "Tier II" facilities for year 2020 (up from 56 in year 2013). Tier II facilities are determined based on the quantity and/or type of material stored or used on site. Many facilities (ie: gas stations) are not considered "Tier II" facilities and are not required to report. However, the Bismarck Fire Department inspects all commercial and industrial businesses annually and is aware of those additional fixed facilities and materials on site.

The total number of facilities using, storing, or selling hazardous materials, including non-Tier II facilities, will fluctuate on a regular basis. The approximate number of facilities in Bismarck is 242 sites using, storing, or selling materials that are classified as hazardous (including common household products). The vast majority are NOT "Tier II" facilities, and are not required to report per EPCRA.

The Tier II sites (facilities) may be viewed online at https://arcg.is/04KXXn. The Tier II facilities as of 2019 are identified on the map on the next page.


Bismarck
Map Features
Tier II Facilities (Points)
Tier II Buildings
Tier II Buildings
Buildings
Buildings
Railroads
Waterbodies
City Limits
Date: 9/17/2020
0
½
1
Miles

Tier II Facilities in Bismarck - 2020		
Name	**Address**	**Chemical**
Ameripride Services Inc	1238 Frontier Drive	Sodium Hydroxide, Laundry Detergent
AT&T - ND0410	1823 N 16th St	Lead, Diesel Fuel, Sulfuric Acid
BEK Communications - Wilton	112 1st St N	Sulfuric Acid
BEK Communications - Menoken	130 Bismarck St N	Sulfuric Acid
BEK Communications - Wing	115 Mann St	Sulfuric Acid
Bismarck Public Schools Facilities and Transportation	705 S 9th St	Gasoline, Diesel Fuel
Bismarck Public Schools Legacy High School	3400 E Calgary Av	Propane
Bismarck Tribune, The	707 E Front Ave	CentraNews Vintage O/S Ink
Burleigh County Highway Dept Shop	8100 43rd Av NE	Gasoline, Diesel Fuel, Asphalt Cement
Burleigh County Sheriff's Dept - East	2000 N 52nd St	Gasoline
Burlington Northern Santa Fe Railway Company Burleigh East	MP 180.37 East Burleigh	Propane
Burlington Northern Santa Fe Railway Company Burleigh West	MP 181.89 West Burleigh	Propane
Capital Electric Cooperative	4111 State St N	Gasoline
Capital Electric Cooperative - Apple Creek Substation	3307 McCurry Way	Transformer Oil
Capital Electric Cooperative - Bismarck 71st Avenue	7130 Williamson Dr	Battery Acid, Transformer Oil
Capital Electric Cooperative - Bismarck East Substation	701 N Bismarck Expwy	Battery Acid, Transformer Oil
Capital Electric Cooperative - Circle K Substation	7016 Golden Crest Rd	Battery Acid, Transformer Oil
Capital Electric Cooperative - Erickson Substation	9626 370th Ave NE	Transformer Oil
Capital Electric Cooperative - Grandview Pines Substation	3963 Prairie Pines Lp	Battery Acid, Transformer Oil
Capital Electric Cooperative - Horizon Substation	1501 Ash Coulee Dr	Transformer Oil
Capital Electric Cooperative - Lincoln Substation	4800 University Dr	Transformer Oil
Capital Electric Cooperative - South Central Grain Substation	30750 5th Ave NE	Transformer Oil
Capital Electric Cooperative - South Washington Substation	4100 S Washington St	Transformer Oil
Capital Electric Cooperative - Ward Distribution Substation	6950 15th St NW	Transformer Oil
Capital Electric Cooperative - Ward Transmission Substation	1000 71st NW	Battery Acid, Transformer Oil
Capital Electric Cooperative- Bismarck North Substation	2105 E Century Ave	Battery Acid, Transformer Oil

Tier II Facilities in Bismarck - 2020		
Name	**Address**	**Chemical**
Central Dakota Frontier Cooperative Bismarck	1505 Yegen Rd	Cornerstone 5, Class Act, Diesel Fuel, Dry Urea, Amonium Phosphate, Ammonium Sulfate, Muriate Potash, Anyhydrous Ammonia, RT3
CenturyLink (Qwest Corporation)	220 N 5th St	Sulfuric Acid, Lead Acid Batteries, Fuel Oil
CHI St Alexius Health	900 E Broadway Av	Oxygen, Diesel Fuel
CHI St Alexius Health Technology & Education Building	1310 E Main	Diesel Fuel
City of Bismarck Public Works Department	601 S 26th St	Gasoline, Diesel Fuel, Propane, CRS-2, BEET HEET, Salt Water Brine, GEO Mix, Tac Oil
City of Bismarck Public Works Department-Haycreek Lift Station	3701 E Bismarck Expwy	Aqua Hawk HSX
City of Bismarck Public Works- Municipal Landfill	2111 N 52nd St	Diesel Fuel, Cationic Asphalt Emulsion, Asphalt - MC800
City of Bismarck Public Works- Old Airport Lift Station	2301 University Dr #19	Azone
City of Bismarck Public Works- Pioneer Park Lift Station	2516 River Rd	Aqua Hawk HSX
City of Bismarck Public Works- Wastewater Treatment Plant	601 London Ave	Chlorine, Sulfure Dioxide, Ferric Chloride, Sodium Hydroxide, Azone
City of Bismarck Public Works- Water Treatment Plant	615 River Rd	Chlorine, Carbon Dioxide, Diesel Fuel
City of Bismarck Public Works- West End Pump Station	1701 Edwards Av	Ammonium Sulfate
Coca-Cola Bottling Company High Country	3225 E Thayer Av	Lead Acid Batteries, Anhydrous Ammonia, Carbon Dioxide, Sodium Hydroxide, Sulfuric Acid
Cofells Plumbing & Heating Inc	1000 Industrial Dr	Gasoline, Diesel Fuel
Dakota Carrier Network LLC (DCN)	4202 Coleman St	Sulfuric Acid
DAL Global Services	2301 University Dr	Propylene Glycol
Dean Foods North Central (Land O'Lakes)	1207 E Main Ave	Diesel Fuel, Nitric Acid, Sulfuric Acid, Ammonia, Lead
Doosan/Bobcat	521 S 22nd St	Oils, Caustics, Argon, Oxygen, Carbon Dioxide, Powercron CR840P, Propane, CP813B Powercron, Lead Acid Batteries, Diesel Fuel, Ultrax 32
Executive Air Taxi Corp Fuel Farm	2301 University Dr	100LL Aviation Gasoline, Type A Jet Fuel
Farmers Union Oil Co Wilton - Shop/Warehouse	615 Minnie Ave	TMS Diesel Engine Oil
Ferrellgas Bismarck	2300 E Main Ave	Propane
Forterra Pipe & Precast	1101 158th St NE	Sand, Fly Ash, Diesel Fuel, Cement, Rock
GCCD Bismarck Terminal	1316 E Front Ave	Cement
General Services Administration Bismarck FB/CH/PO	220 East Rosser Ave.	Fuel Oil
Gerdau-Bismarck	1320 Airport Rd	Diesel Fuel, Lead/Acid Batteries

Tier II Facilities in Bismarck - 2020		
Name	**Address**	**Chemical**
Hefty Seed Co	143 Hwy 36	Durango DMA, Paraquat Dichloride, Gyphosate Roundup Power max, Widematch, RT3, HelmQuat 3SL, Dicamba Dimethylamine, Buccaneer Plus, Keystone LA NXT, Liberty 280 SL, RangeStar, Caramba, Dicamba DMA, DiFlexx, PerfectMatch
HERC Rentals Bismarck 9452	3101 Morrison Ave	Diesel Fuel, Paraffinic Oil Liquid, Motor Oil, Propane
Holcim (US) Inc-Bismarck Terminal	714 E Front Ave	Fly Ash, Cement
Holcim (US) Inc-NPCC Terminal	2103 Trade St	Cement
Hubbard Feeds	1503 Yegen Road	Urea
Jiffy Lube #519	1017 S Washington St	Methanol, Motor Oil
KFYR Radio	4428 158th St NE	Diesel Fuel
Knife River ND - Bismarck Rock Island Pl	3305 Rock Island Place	Fly Ash, Cement, Diesel Fuel
Long Lake National Wildlife Refuge	12000 353 St SE	Propane, Gasoline
Lowe's of Bismarck, ND Store #2533	1402 Century Ave W	Diesel Fuel
Mariner Construction	1771 W Cavalry Dr	Gasoline, Propane, Diesel Fuel
Missouri Valley Ag - Sterling	30749 5th Ave NE	Ammonium Phosphate, Aromatic Hydrocarbons (Heavy) Liquid, Glyphosate, Monoammonium Phosphate, Monopotassium Phosphate, Paraquat Dichloride, Potassium Chloride, Potassium Hydroxide Liquid, Acetochlor, 2 4-D LV6, Ammonium Nitrate, Petroleum Naphtha, Atrazine, Ethylene Oxide, Propylene Glycol Liquid, Urea, Urea Liquid
Misty Waters Marina	5800 Burnt Creek Lp	Gasoline
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd	Mineral Oil
Montana-Dakota Utilities General Office Generator	400 N 4th St	Diesel Fuel
National Weather Service	2301 University Dr Bldg 27	Diesel Fuel
ND Department of Transportation Bismarck HQ	218 Airport Rd	Tar Oil, Diesel Fuel, Gasoline
ND Department of Transportation-Capitol Ground	600 E Boulevard Av	Gasoline
ND National Guard - Army Aviation Support Facility	3410 Airway Av	Gasoline, Diesel Fuel, Aviation Fuel
ND National Guard - Fraine Barracks	432 Fraine Barracks Rd	Sulfuric Acid, Gasoline, Diesel Fuel
ND National Guard - Raymond J Bohn Armory	4200 E Divide Ave	Diesel Fuel, Gasoline
New Cingular Wireless PCS, LLC (Bismarck - ZX2GBF)	1925 N 11th St	Sulfuric Acid

Tier II Facilities in Bismarck - 2020		
Name	**Address**	**Chemical**
Nutrient Ag Solutions	1240 Hemlock St	Actamaster Solution, Boundary 6.5EC, RT3, Intensity, Halex GT, Rifle, Makaze, Rifle D, Quad 7, Surfate, Makaze Yield Pro, Riser, Fitness, N-Pact, Colt AS, Gramoxone SL 2.0, Huskie Complete, Liberty 280SL, Boradaxe XC, CruiserMaxx Vibrance Cereals, Mad Dog 5.4, Resicore, PerfectMatch, Engenia, Actamaster Soluble Spray, Exract, Mad Dog K6,
Praxair Distribution Inc Plant	2730 Vermont Ave	Carbon Dioxide, Nitrogen Cryogenic Liquid, Argon, Oxygen
Safety-Kleen Systems Inc	3704 Saratoga Ave	Petroleum Naphtha, Motor Oil
Sam's Club #4933	2821 Rock Island Pl	Motor Oil, Lead Acid Batteries
Schwan's Home Service Inc 115300	3500 Miriam Ave	Propane
South Central Grain - Sterling	30750 5th Ave NE	MAP, MESZ, Ammonium Sulfate, Urea, Roundup PowerMax, RT3, N-Edge Nitrogen Stabilizer, Buccaneer 5 Extra
Sprint United Management Company	215 S 15th St	Fuel Oil, Sulfuric Acid
Stamart Travel Center #1224	3936 Miriam Ave	B100 BioDiesel, Diesel Fuel
Supervalu Inc Bismarck	707 Airport Rd	Diesel Fuel, Sulfuric Acid, Anhydrous Ammonia, Lead
Target T2194-Burleigh	600 Kirkwood Mall	Sulfuric Acid
Tri Energy Cooperative Broadway Store	2006 E Broadway Ave	Motor Oil, TMS Diesel Engine Oil, Used Oil
United Parcel Service Inc	3814 Franklin Av	Gasoline, Diesel Fuel
United Rentals	3925 Miriam Ave	Lead Acid Batteries
US Foods	3500 Saratoga Ave	Sulfuric Acid, Lead
Verizon Wireless-Country West 698998	1160 W Divide Ave	Sulfuric Acid
Verizon Wireless-Expressway 4932311	911 S 9th St	Sulfuric Acid
Western Area Power Administration - Bismarck Substation	719 N Bismarck Expressway	Mineral Oil
Western Area Power Administration - Bismarck Warehouse	700 N Bismarck Expressway	Sulfuric Acid
Western Area Power Administration - Hilken Switching Station	680 29th Ave NW	Sulfuric Acid
Williston Basin Interstate - Bismarck Station	850 57th Ave NW	Motor Oil
Wilton Wind Energy	5120 279th Ave NE	Sulfuric Acid
Zayo Group	1520 E Sweet Av	Sulfuric Acid

The following table lists chemicals that are used at various facilities in Bismarck and are identified as EHS, and/or pose an inhalation hazard, and/or have a relatively low IDLH. This list is not all inclusive of chemicals used or stored in Bismarck.

Chemical Name	EHS	Inhalation Hazard	IDLH
Chlorine		x	10 ppm
Anhydrous Ammonia	x	x	300 ppm
Ammonia	x	x	300 ppm
Sulfuric Acid	x	x	15 mg/m
Nitric Acid	x	x	25 ppm
Sulfur Dioxide		x	
Sodium Hydroxide			10mg/m
Oxygen			0.5 ppm
Liquid Nitrogen			20 ppm
Benzene (gasoline)	x		500 ppm
Benzene (diesel fuel)	x		500 ppm
Lead (lead acid batteries)	x		100 mg/m
Paraquat Dichloride	x		1 mg/m
Petroleum Naphtha			1100 ppm
Propane	x		2100 ppm
Actamaster (ammonium sulfate)			1500 mg/m
Carbon Dioxide			40,000 ppm
Petroleum Distillate (liquid asphalt)			1100 ppm
Heptane			750 ppm
Mercury			10mg/m
Toluene			500 ppm
Trichloroethylene			1000 ppm

EHS= Extremely Hazardous Substance (per EPA List of Lists)
Inhalation Hazard – per NIOSH Guide
IDLH: Immediately Danger to Life or Health (parts per million)

The most common hazardous materials within Bismarck at fixed facilities are gasoline and diesel fuel in the sense that they are used, stored, and/or sold at the most locations throughout Bismarck. The number of locations is approximate since they can change frequently. The purpose of the table is to illustrate the common hazardous materials at many of the fixed facilities.

Product	**Number of Locations**
Gasoline	32
Diesel Fuel	28
Propane	16
Sulfuric Acid	12
Oxygen	10
Motor Oil	8
Acetylene	7
Fuel Oil #1	6
Sodium Hydroxide	6
Chlorine	4
Argon	4

Transport (ie: Truck)

Note: Hazardous Materials Release is also addressed in the "Train Derailment" Hazard Profile. Hazmat incidents as a result of train derailment will not be duplicated in this section.

Bismarck has designated truck routes which serve as hazmat routes. However, there are no hazmat routes specifically designated at this time.

Although a Hazmat Flow Study was conducted in 2012 for all of Burleigh County, it's assumed that all materials stored or used at fixed facility locations in Bismarck or anywhere in North Dakota are transported through Bismarck via I-94 and US83 primarily, and also throughout the city (ie: truck routes) if used or stored at a local fixed facility.

The US Department of Transportation (DOT) defines hazardous material as items which pose a risk to health, safety, and property during commerce related transportation. Vehicles transporting hazardous materials are common. These materials could pose a risk should a spill or other release occur. The DOT divided these materials into nine hazard classes, each exhibiting a common threat to health and/or property. These classes offer the general nature of the material being transported when exact identification is not possible. US DOT class identifications are listed below:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable Liquids
- Class 4: Flammable Solids/Spontaneously Combustible/Water Reactive
- Class 5: Oxidizers/Organic Peroxides
- Class 6: Toxic/Infectious
- Class 7: Radioactive
- Class 8: Corrosive
- Class 9: Miscellaneous

https://www.phmsa.dot.gov/about-phmsa/offices/office-hazardous-materials-safety

The harm posed to humans can be characterized by one or more characteristics:

- *Ignitability:* Sustains fire which may cause physical harm.
- *Corrosivity:* May corroding metal or other material, poses a chemical hazard.
- *Reactivity:* Can create explosions or toxic releases, posing a physical harm.
- *Toxicity:* Harmful ingested, breathed, or absorbed, posing a chemical harm.
  Definitions from USEPA at www.epa.gov

The US DOT in the Code of Federal Regulations has standards for marking, labeling, placarding, shipping papers, emergency response information, packaging, handling, and transporting of hazardous materials, but there are no reporting requirements for hazardous material transportation. (49 CFD 100-185)

Northern Plains Commerce Centre - Bismarck

The Northern Plains Commerce Centre (NPCC) is a premier industrial park with immediate access to road and rail transport located in Bismarck, North Dakota. The NPCC allows companies to improve their ability to efficiently distribute products within the Northern Plains region and globally. The facility offers both rail and non-rail served sites.

Located adjacent to the Bismarck Airport, the NPCC is home to a 100,000 square foot Bobcat Company Manufacturing Sequencing Center (MSC) and Tubular Transport and Logistics (TTL). Tubular Transport and Logistics offers rail to truck reloading, trucking and storage services allowing non-rail served businesses to take advantage of long haul cost savings by using rail.

The NPCC has access to both Canadian Pacific and the BNSF via the DMVW Railroad. The truck route between US I-94 and the Northern Plains Commerce Centre is considered a heavy haul corridor.
More information: https://www.bmda.org/northern-plains-commerce-centre/

Hazmat Traffic Flow Overview

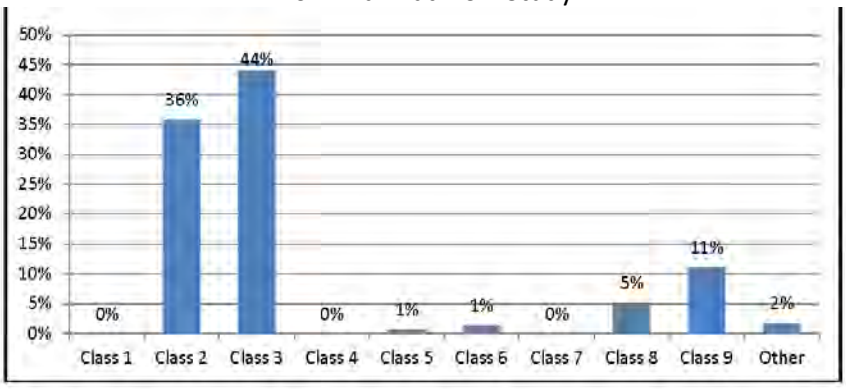
(The following overview is based on the 2012 Hazmat Flow Study for Burleigh County funded by the Local Emergency Planning Committee)

Surface Transportation by Highway: Within Burleigh County, the majority of hazardous materials transported by highway are transported via I-94 (approx. 71%) and US 83 (approx. 26%). Both I-94 and US83 intersect Bismarck. The remaining highways (ND1804, ND14, ND36, and ND41) account for the remaining 3%. The sample included 247 vehicles observed during the 2012 hazmat flow study.

The most common commodities transported by highway were identified as Anhydrous Ammonia, Gasoline, Diesel, Asphalt, and Propane. These top five commodities accounted for 78% of the hazardous materials during the traffic flow study in 2012.

The following graph, from the 2012 Hazmat Flow Study illustrates the hazard classification of the materials transported by highway noted during the study.

DOT Hazard Classification of Materials Transported by Highway
2012 Hazmat Flow Study



Schools and other locations of higher vulnerability based on proximity to I-94 are noted in the table below. Potential icy road conditions along with the higher traffic speed of I-94 enhances the risk of a more significant traffic accident which may involve hazardous materials. Certainly, additional locations are vulnerable, and those listed here would not necessarily be impacted depending on incident location, wind conditions, etc.

Schools and Other Populations in close proximity to I-94 (hazmat traffic)	
Schools	**Other**
Bismarck State College	Dan's Supermarket (near I-94 clover leaf – west Bismarck)
Theo Art School	Hampton Inn (near I-94 clover leaf – west Bismarck)
Montessori Daycare (adjacent to I-94, significant slope)	Residential community Adjacent to 1-94 (properties are approximately 200 feet from I-94)
Grimsrud Elementary (> ¼ mile)	
Centennial Elementary (1/3 mile)	

Air Transportation: The 2012 hazmat flow study included hazardous materials transported in and out of the Bismarck Airport. Air transportation of hazardous materials has the smallest presence by mode as expected due probably to its relative high cost. Hazardous material shipments by air are handled by UPS and FedEx.

In the sample data period of June 1, 2011 through May 31, 2012 there were 960 inbound shipments of hazardous materials at the Bismarck Airport by FedEx (UPS declined to participate in the study citing homeland security concerns). These shipments are significantly smaller than the shipments that are transported by truck or by railway. When inbound hazardous shipments are categorized according to general DOT hazard classifications, hazards falling into class seven are the most reported. Hazard class seven is radioactive material. The majority of these shipments are shipped in Type A Packaging. Material typically shipped in Type A Packages include nuclear medicines (radiopharmaceuticals). Type A packaging are only used to transport non-life-endangering amounts of radioactive material. Type B(U) packaging is also used for shipments into Burleigh County. This packaging includes shipments in 55-gallon drums. Material

typically shipped in Type B(U) packaging includes spent nuclear fuel, high-level radioactive waste, and high concentrations of other radioactive material such as cesium and cobalt.

The sample data period of June 1, 2011 through May 31, 2012 there were 192 outbound shipments of hazardous materials at the Bismarck Airport by FedEx. Hazards falling into class three are the most reported outbound shipments by air.





Top Commodities by Count
Radioactive Material: Type A
Compressed Gas, n.o.s.
Radioactive Material: expected
Sulphuric Acid
Radioactive Material: Type B(U)

Top Commodities by Count
Diesel Fuel
Gasoline
Radioactive Material: Type B(U)
Infectious Substance: Affecting Humans
Petroleum Crude Oil

Rail

The most common commodities transported by rail during the 2012 flow study are Petroleum Crude Oil, Liquefied Petroleum Gas, Alcohols, Anhydrous Ammonia, and Fak-Hazardous Materials with the vast majority being Petroleum Crude (72% in 2012). Since 2012, the percentage of crude oil shipments has increased dramatically. See Train Derailment Hazard Profile for more information.

Pipeline:

Bismarck has a petroleum pipeline running east/west along north Bismarck which also runs under the Missouri River to Tesoro in Mandan. There is a natural gas pipeline (WBI) in northwest Bismarck running north/south.

NuStar

- Product names: Gasoline, Diesel, Jet Fuel
- Quantities: @1800 bbls per hour
- Pressure: 500 PSI

WBI

- Product names Compressed Methane / Natural Gas
- Quantities 12" Diameter Pipeline
- Pressure 204 PSI MAOP (maximum allowable operating pressure)
- Most common Methane / Natural Gas only
- Highest level of concern:

  Per the 2008 Emergency Response Guide Book :

  - Extremely Flammable
  - Easily ignited by heat, sparks or flames
  - Forms explosive mixtures with air
  - Displaces air and can cause asphyxiation without warning
  - High pressure compressed gas

MDU

- Product names: Natural Gas
- Quantities : ~200,000 dkt/yr (dekatherms – heating measure)
- Pressure pressures range from 90 psi to .5 psi.
- Most common: 35 psi
- Highest level of concern: explosive.

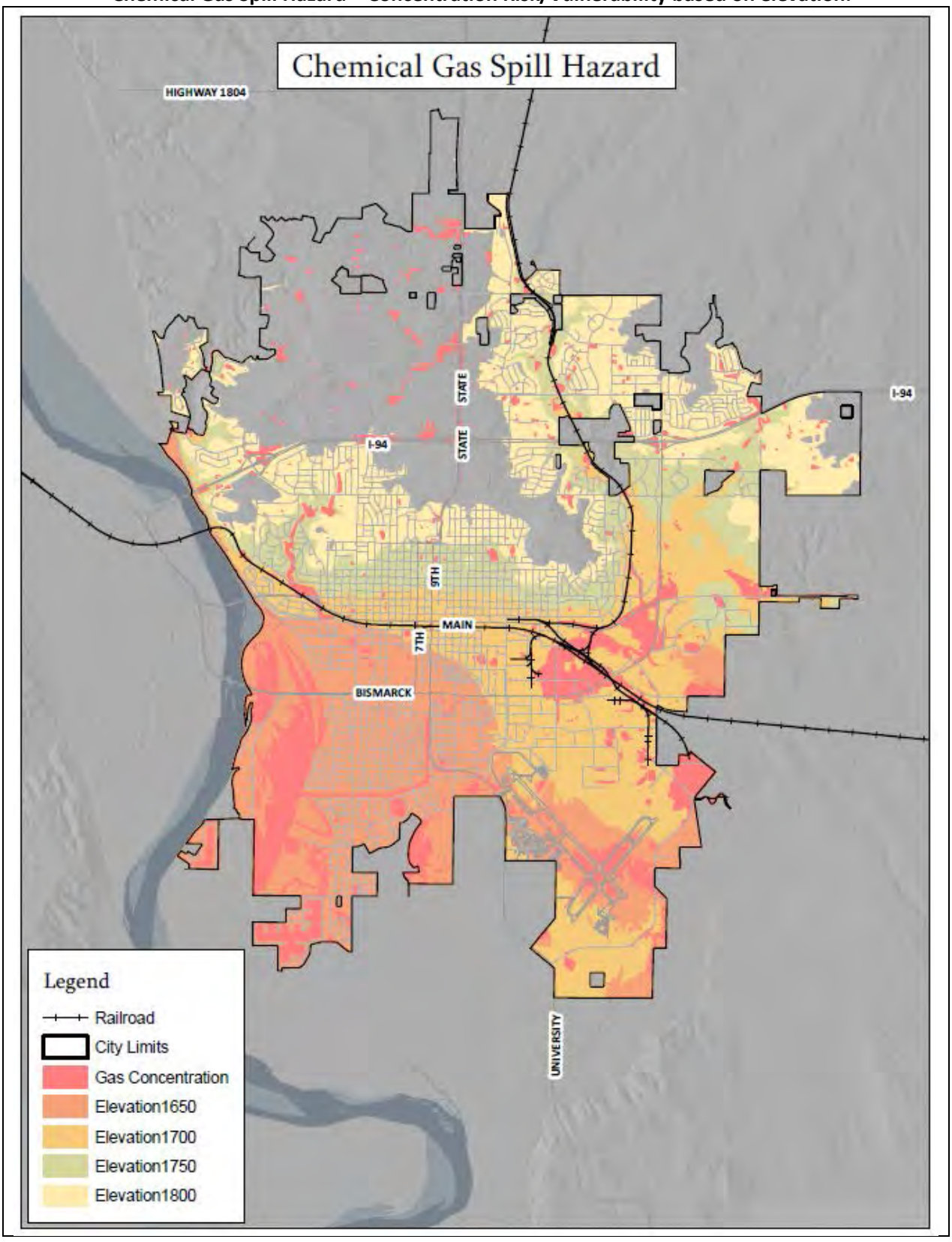
Utility Map showing Natural Gas and Petroleum Pipelines



WBI Pipeline – High Consequence Area



Chemical Gas Spill Hazard – Concentration Risk/Vulnerability based on elevation:



Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

*Note: Train Derailment is addressed separately within the mitigation plan.

Incident Type	**Fixed Facility Incident**	***Transportation (ie: Truck)**	**Pipeline**
Probability	Possible	Likely	Possible
Speed of Onset	No notice event	No notice event	No notice event
Geographic Area	Localized	Localized	Localized
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Fire, explosion, inhalation hazards A. Employees of hazmat facilities	1. Fire, explosion, inhalation hazards A. Involved parties in closer proximity	1. Fire, explosion A. WBI pipeline High Consequence Area as mapped
Mass Casualty Incident	Possible	Possible	Possible
Property Losses (points of vulnerability – high priority)	1. Involved property and properties in close proximity to incident	1. Property in close proximity 2. Properties along Interstate 94	1. Property in close proximity 2. WBI HCA as mapped
Environmental	1. Stormwater drainage system 2. Sanitary Sewer System	1. Stormwater drainage system 2. Sanitary Sewer System	1. Oil Pipeline – east/west pipeline 2. Hay Creek 3. Missouri River
COG/COOP	1. Public Works – proximity to Praxair 2. Water Treatment Plant 3. Wastewater Treatment Plant		

Incident Type	Fixed Facility Incident	*Transportation (ie: Truck)	Pipeline
Critical Facilities	1. Public Works – proximity to Praxair Public Works 2. Fraine Barracks (proximity to Water Treatment Plant)	1. Sanford Health 2. CHI St. Alexius Health 3. Fire Station 2 4. Police Department 5. Water Treatment Plant - organic material overwhelming the sewage treatment process (ex: milk truck) 6. Metro Area Ambulance South 7. Public Health 8. Public Works	1. Water Treatment Plant (near WBI pipeline) 2. Fraine Barracks (WBI pipeline)
Critical Infrastructure	1. Potential impact to water or wastewater treatment plant	1. Temporary blocked streets / Interstate	1. Temporary disruption of petroleum or natural gas distribution.
Schools	1. Emmanuel Christian School (proximity to Ferrelgas) 2. Ehrmantraut Academy (proximity to Ferrelgas)	1. Jeanette Myhre Elementary 2. Bismarck High School 3. Century High School 4. Solheim Elementary 5. Wachter Middle School 6. Centennial Elementary 7. Emmanuel Christian School 8. St. Mary's Elementary 9. ECLC 10. Rasmussen College 11. Exploring Minds 12. Montessori Daycare 13. YMCA Daycare 14. Northridge Elementary 15. Open Door Community Center 16. Super Kids Jr. Academy 17. Bismarck State College 18. Theo Art School	1. Bismarck State College (WBI) 2. Horizon Middle School 3. Grimsrud Elementary School 4. Centennial Elementary School

Incident Type	**Fixed Facility Incident**	***Transportation (ie: Truck)**	**Pipeline**
High Risk Facilities (chemical)	1. Praxair (near Public Works) 2. Ferrell Gas (ie: propane bulk tanks) 3. Waste Water Treatment Plant (ie: chlorine) 4. Water Treatment Plant (ie: chlorine)		
Specific Populations: Public Assembly, Vulnerable / Special Populations		1. Kirkwood Mall 2. Maple View (north) 3. Numerous Churches along truck (hazmat) routes 4. Primrose Assisted Living	1. Waterford Apartment (HCA) 2. Touchmark Nursing Home 3. Horizon Care Home 4. Primrose Assisted Living 5. Women's Health Center (HCA)
Economy (community wide)	Moderate (THIRA rating)	Moderate (THIRA rating)	Significant (THIRA rating)
OTHER:			

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Severe Summer Weather – Hazard Profile

Including Lightning, Wind, Hail, and Extreme Heat.
Note: Tornado is addressed as a separate hazard.

Description: Thunderstorm

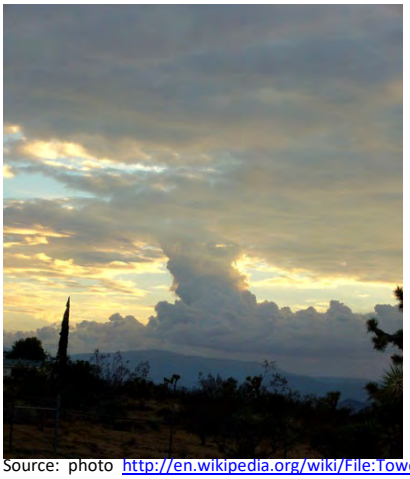
Severe summer storms can result in loss of life, injuries, and damage to property and crops. Although thunderstorms affect relatively small areas when compared to other hazards such as winter storms, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each 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 1" in 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



Source: photo http://en.wikipedia.org/wiki/File:Towering_Vertical_Cloud_1.jpg

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

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.

Source: Photo http://upload.wikimedia.org/wikipedia/commons/0/0c/FoggDam-NT.jpg

The Dissipating Stage

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.

Severe Summer Weather Data Resources:

- US Climate Extremes Data may be found at https://www.ncdc.noaa.gov/extremes/cei/graph/wn/06-08/1
- NOAA Storm Events Database: http://www.ncdc.noaa.gov/stormevents/

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Thunderstorm (ie: Severe Summer WX: High Wind/Hail Event)**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Minor	Minor

Climate Change Impact:

The warming trend in ND has been concentrated in the winter and spring. The winter warming trend is reflected in a below average number of very cold days (days with maximum temperature less than 0 degrees F) since year 2000. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease.	NOAA Climate Summary (ND)
With continued warming, cold-related deaths are projected to decrease and heat-related deaths are projected to increase; in most regions, increases in heat-related deaths are expected to outpace reductions in cold-related deaths.	NCA4 Vol II Summary Findings
The probability for more very hot days (days with maximum temperatures above 90°F) is expected to increase, with potential impacts on agriculture, energy production, human health, streamflows, snowmelt, and fires.	NCA4 Vol II Chapter 22 (Northern Great Plains)

Lightning

Lightning Season Start/End Dates 1995-2019	
March 8, 2000	Earliest seasonal lightning strike
October 19, 2004	Latest seasonal lightning strike

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. The rapid expansion of the heated air causes thunder. (National Weather Service, 2007c)

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.

Lightning History:

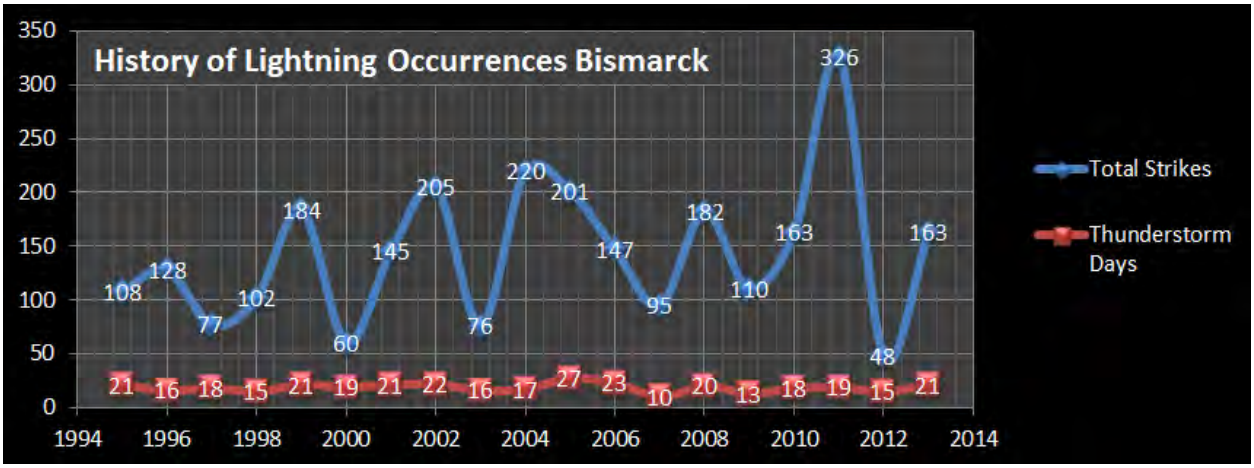
No additional lightning events reported since 2011.

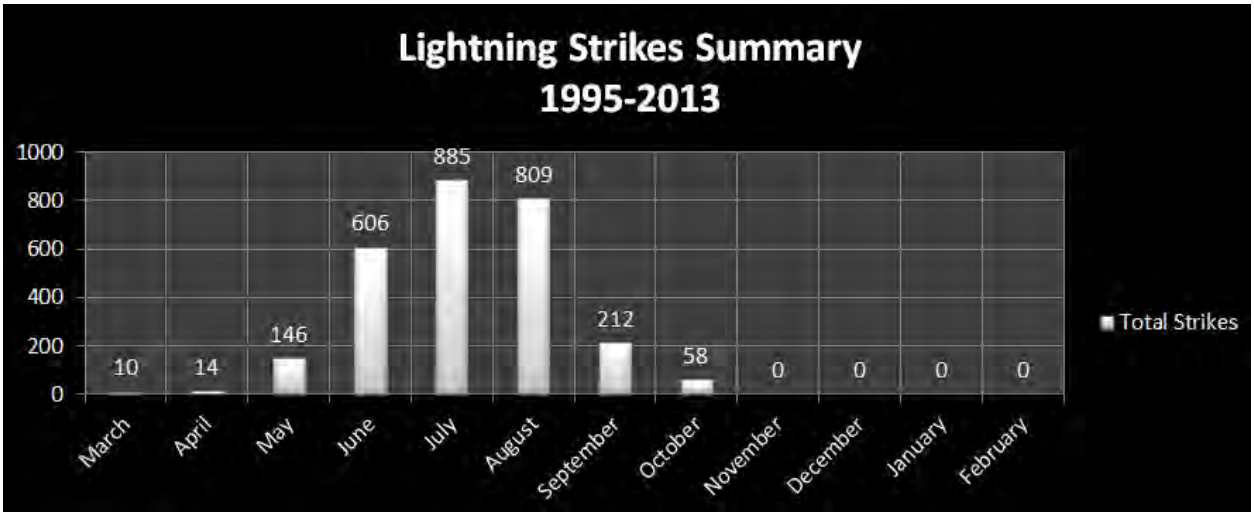
July 30, 2011: A lightning strike to a rural north Bismarck home caused a fire that destroyed the home several hours later.

August 2, 1996: Lightning struck the roof of a garage in Bismarck. Property damage as a result of this storm is estimated at $2,000.

Probability – Lightning

No additional lightning events reported.
http://www.ncdc.noaa.gov/stormevents/





Wind

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.

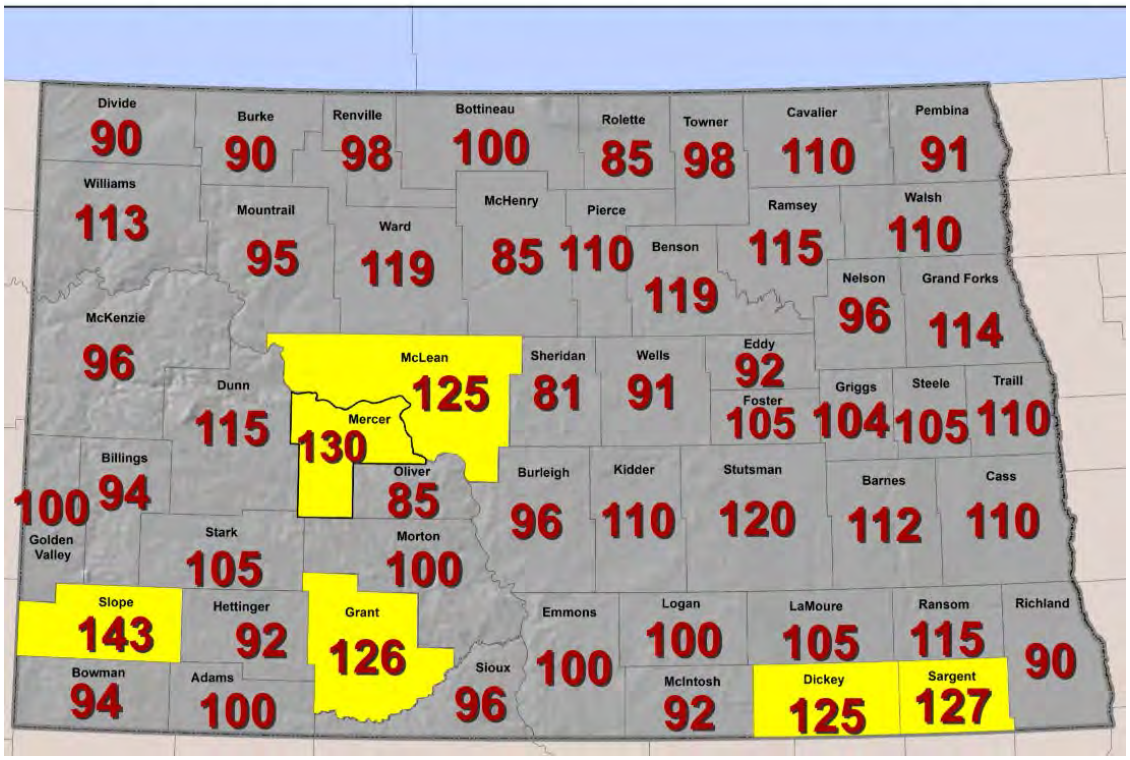
Straight-line winds are responsible for most thunderstorm wind damage. During the summer in the western states, thunderstorms often produce little rain but very strong wind gusts and dust storms. Downbursts can be extremely dangerous to aviation. Damage attributed to tornadoes is frequently caused by 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.

Severe winds associated with thunderstorms are not uncommon during the summer months in North Dakota. Between 1955 and 2018, NCEI recorded 4,648 thunderstorm wind events. The highest wind speed recorded among these events was 124 knots, or 142.6 mph. This event occurred on September 15, 1997, in Slope County (NCEI, 2018). The 4,648 thunderstorm wind events resulted in 3 deaths, and 62 injuries, as well as property damages. The deaths and injuries occurred because of flying debris, collapsed structures, and to those in tractor trailers, vehicles, mobile homes, a camper, an apartment construction site, tents, and an aircraft.

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.

Based on the historical record, North Dakota can expect over 76 high wind events, not related to tornadoes or thunderstorm winds, in any given year. This makes a high wind event highly likely (greater than 90% chance of probability) in a given year. The Federal Emergency Management Agency places the majority of North Dakota, including Bismarck, in Zone II (160mph) for structural wind design. As history demonstrates, these types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly-built or weak structures.

Maximum wind speed reported 1950-2019
Strongest Non-Tornadic Wind Gust (MPH)



Burleigh County High Wind Speed Records Source: NWS Bismarck			
Speed	Date	Location	Damage Estimate
90	June 25, 1999	Bismarck	$2 Million
78 knots. Widespread damage to building, downed power lines, uprooted trees, street flooding and water damage to homes. Property damage from this storm is estimated at $2 million.			
96	July 10, 2011	3.5 miles southwest of Moffit	$250,000
Double poled wood transmission lines were snapped. A ranch sign with three foot long concrete anchors was torn from the ground. A camper was flipped off the highway and tossed over a tree row 25 yards away.			

Wind Events History:

Notable high wind events within Bismarck are noted below. Additional high wind events may be reviewed via the NOAA storm events database: http://www.ncdc.noaa.gov/stormevents/

June 29, 2018: 65 knots. The Broadcast Media estimated thunderstorm wind gusts of 75 mph. (NWS database)

70 mph gusts reported (Bismarck Tribune).



Bismarck Tribune Photo.

June 17, 2016: Hail/Wind Event:
A severe thunderstorm struck northern portions of the city of Bismarck around 4:30 AM. Large hail combined with strong wind gusts to cause substantial damage. The largest hail with a diameter of 3.25 inches fell near Legacy High School. Winds of 75 mph combined with large hail to cause a swath of substantial damage from along Divide Avenue in north Bismarck to approximately 5 miles north of the city of Bismarck. Siding, roofs, and windows were damaged on homes. Multiple car dealerships sustained hail damage, which included the largest dealership in the city. Source: NWS

June 19, 2015: The strongest winds were reported in Burleigh County, where winds blew up to 90 mph. Extensive tree damage and power line damage with some structural damage was reported in the city of Bismarck and surrounding rural areas. Power outages lasted up to 72 hours. Source: NWS

- 82 mph wind gusts from the N-NW. Sustained wind of 60 mph.
  - Event Time (approx): 9 PM to 9:30 PM (higher winds).
- 0.87" rainfall (heavy rain) – short amount of time (approximately 1 hour).
- Two cars submerged in flooded underpass– 7th Street Underpass.
- 11,000 customers impacted by power outages in Bismarck/Mandan area. Many without power overnight.
- Spaedy Office complex on 25th and
- Broadway had roof torn off by the wind.
- New siren installation ended up with a 20 degree tilt or angle.
- City Forestry: The heaviest hit section of town is between Divide Ave and Main Ave from the river east to 26th St. A lot of trees uprooted or completely failed trees in this section of town. The south and north parts of town experienced limb breakage and hangers. Some smaller trees uprooted.





June 22, 2013

Tree debris primarily located from Divide Avenue south to Denver Avenue and from Washington Street to 3rd Street Area. Extensive tree damages in Sertoma Park area as well.

Source: Bismarck Tribune regarding Jun 22, 2013 Storm:

Severe thunderstorms produced high winds, torrential rains and flash floods that blocked thoroughfares and underpasses with water on Saturday night, and left 4,000 homes in Bismarck and Mandan without power overnight.





Bismarck – June 22, 2013 Tree debris primarily located from Divide Avenue south to Denver Avenue and from Washington Street to 3rd Street area. Extensive tree damages in Sertoma Park area as well. Photos: Gary Stockert, Bismarck Emergency Manager

Uprooted and broken off trees crashed onto homes, businesses and vehicles. Winds and hail shattered homeowners' and retail windows. But, for all the calamity, law enforcement agencies reported no injuries as of early Sunday evening.

Bismarck reported 1 inch of rain in 10 minutes. The Bismarck Airport recorded a total of 1.51 inches between the two storm systems. Most of the hail was reported to be nickel and quarter size, but there were reports of up to an inch-diameter hail in Lincoln.

Flash floods

The National Weather Service reported that 5 to 6 inches of water was running over 12th Avenue near the Bismarck Expressway in south Bismarck. Eight inches of water was running over Washington Street near Divide Avenue. The Seventh Street underpass was filled.

No motorists had to be rescued because of flash floods, according to local law enforcement agencies.

"We shut the underpass down at Seventh Street right after it flooded and East Divide right after it flooded," said Bismarck Police Sgt. Nolan Canright. "Officers were checking vehicles where trees had fallen on them to see if anyone was in there. There weren't."

"It looks like southwest Bismarck got hit the worst. It hit Expressway Avenue and Main," he said of structural damage.

Wind gusts up to 75 mph sheared a roof top two miles northeast of Bismarck and blew it into a nearby home and car, totaling the car, reported the National Weather Service.

Power outages Recovery continued into late Sunday afternoon as Montana-Dakota Utilities crews made repairs along Sioux Street, where fallen trees snapped several power lines in the neighborhood.





Bismarck Pioneer Park – July 21, 2005 Photos: Gary Stockert, Bismarck Emergency Manager

July 31, 2011: High winds peaking at 68 mph were measured at the National Weather Service ASOS at the Bismarck Airport during this severe thunderstorm. The wind gusted at or above 60 mph for 20 minutes. This storm also impacted many trees in flood impacted areas including Fox Island and Sibley Park areas. Due to saturated soils as a result of the 2011 flood, many trees were tipped or leaning because the soils could not hold the root systems in place. This caused additional damages to homes already impacted by the Missouri River Flood of 2011.

October 26, 2008: A 59 mph wind gust was reported three miles east of Moffit. High winds were also blamed for a house fire in Bismarck. Local authorities reported the high winds tore down a tree onto power lines, which then started a house basement on fire. No injuries or fatalities were reported.

July 21, 2005: Thunderstorm, High Winds & Hail – Winds estimated between 60 and 70 mph – golf ball-size hail. The storm occurred on July 21 around 8:00 pm. Damage includes destroyed trees, tree damage, broken windows, damaged shingles, and damage to cars. It had been reported by citizens that a few man-hole covers had been displaced. Downed trees reported were primarily in the areas of River Road north of the interstate, North Grandview, Juniper, Ave B near the Cathedral Church, 12th Street, and Pioneer Park.

August 23, 2004: The severe thunderstorm brought strong winds, very heavy rainfall and hail across the Bismarck area. Numerous tree damage was reported. Power lines were downed by the winds causing citywide power outages. Hail sizes up to 2.00 inches were reported in the city. Streets and underpasses flooded causing several roads to become impassible. Water flowed across yards and into several basements of homes.

March 13, 2004: An Alberta Clipper brought very strong winds, sustained at 50 mph and gusting to around 60 mph at times, to western and central North Dakota during the afternoon and early evening hours on March 13, 2004. The winds subsided during the late evening hours on the 13th.

November 29, 2002: After record high temperatures on Thanksgiving Day a strong Canadian cold front moved rapidly south through the state producing strong northwest winds of 40 to 70 mph over western and central North Dakota. The winds diminished during the evening hours. The cold front brought much colder air and a few snow showers to the region Friday night and Saturday.

June 9, 2002: Thunderstorm winds (54 knots) reported at Bismarck Municipal Airport.

February 11, 2002: Strong low pressure system moving across southern Canada produced a tight surface pressure gradient over North Dakota. Wind speeds averaged 50 to 70 miles an hour beginning early in the day and ending late in the evening. Overall, wind damage was minimal, however one semi-truck, which was empty, was blown over on its side along Interstate 94 in Bismarck. In Jamestown, a power outage occurred, but just for a short time period. Other locations reported loose objects were tossed around in the wind. (69 knots)

July 22, 2001: Thunderstorm winds (61 knots) were reported at the Bismarck Airport.

July 21, 2001: Thunderstorm winds (52 knots) were reported in Bismarck.

July 19, 2001: Thunderstorm winds (66 knots) were reported at the Bismarck Airport. Widespread tree damage across the southern half of the city of Bismarck. The property damage figure ($50,000) was for cleanup only. Power outage across much of the city. Several homes and business, including the Bismarck airport terminal building sustained damage.

April 5, 2000: A low-pressure system over Alberta, Canada moved southeast and intensified along the Canadian/North Dakota border. A very tight pressure gradient resulted in very high winds causing injuries and property damages throughout western and central North Dakota. Wind gusts of 55 to 70 mph were common. The injuries were mainly in Burleigh County in the city of Bismarck where 9 people were taken to area hospitals injured from flying debris. One person suffered a broken wrist from falling. Damage was widespread. Widespread power outages occurred. Homes, automobiles, trees, power lines, and businesses were damaged. Several grass fires erupted across the region.

July 18, 1997: Thunderstorm winds (65 knots) were reported in Bismarck. Strong winds blew a 10-inch diameter branch down onto a Jeep. Power was also lost to 500 homes. Property damage from this storm is estimated at $10,000.

September 15, 1997: Thunderstorm winds (57 knots) were reported at the Bismarck Airport.

June 25, 1999: Thunderstorm winds (78 knots) were reported in Bismarck. Widespread damage to buildings, downed power lines, uprooted trees, street flooding and water damage to homes. Property damage from this storm is estimated at $2 million.

June 29, 1997: Thunderstorm winds (52 knots) were reported in Bismarck. Four-inch diameter branches were down in northern Bismarck.

August 2, 1996: Thunderstorm winds (55 knots) were reported in Bismarck.

July 28, 1996: Thunderstorm winds (55 knots) were reported in Bismarck.

July 17, 1996: The Bismarck area received anywhere from 1 to 2 inches of rain in an hour. There were reports of manhole covers being blown out. An 80 yr. old man suffered a heart attack while shoveling water away from his apartment complex.

June 11, 1996: Winds at the National Weather Service Field Office gusted to 52 mph with this storm. Large trees were reported downed near the Capitol building.

May 16, 1996: As the storm moved into the Bismarck area, the National Weather Service at the airport received a gust to 79 mph. A small plane was tipped over at the airport, with part of the airport terminal roof blown off. There was at least 1 mobile home that was destroyed. Significant damage was done to trees, buildings and road signs. An estimated 3,000 people in Bismarck lost power. The Melroe Company had its roof lifted off. Property damage from this storm is estimated at $3.2 million.

February 10, 1996: Bismarck reported a peak gust of 62 mph.

July 12, 1995: Thunderstorm winds (61 knots) were reported in Bismarck.

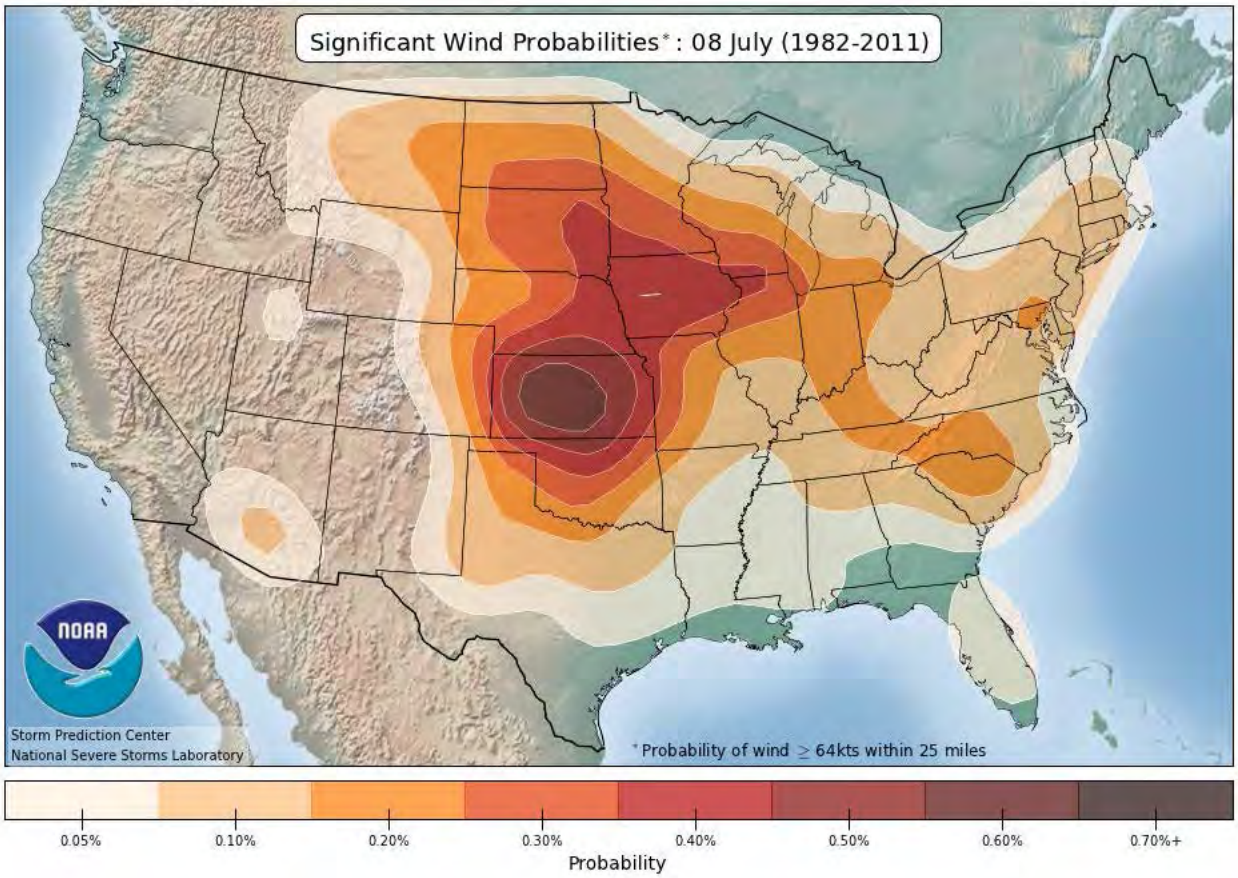
July 11, 1995: Thunderstorm winds (60 knots) were reported in Bismarck.

May 21, 1995: Thunderstorm winds (55 knots) were reported in Bismarck. Two thunderstorms merged north of Mandan causing torrential rain, hail up to golf ball-size for over 20 minutes, and winds to 65 mph, in Bismarck and Mandan. Piles of pea to golf ball-size hail covered the ground. Homes in Mandan had windows broke due to the hail.

September 15, 1994: Heavy rain caused water to run over roads and flood buildings and basements. Two schools in Bismarck were closed due to the water. McLean County west of Washburn.

January 22, 1992: Wind storm with one fatality.

Probability – High Wind



*These probability values were estimated from a 30-year period of severe weather reports from 1982-2011. http://www.spc.noaa.gov/new/SVRclimo/climo.php?parm=sigWind

Hail

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. (National Severe Storms Laboratory, 2007)

Most hail events affect only relatively small areas. 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. (Changnon, 1997)

Hail History:

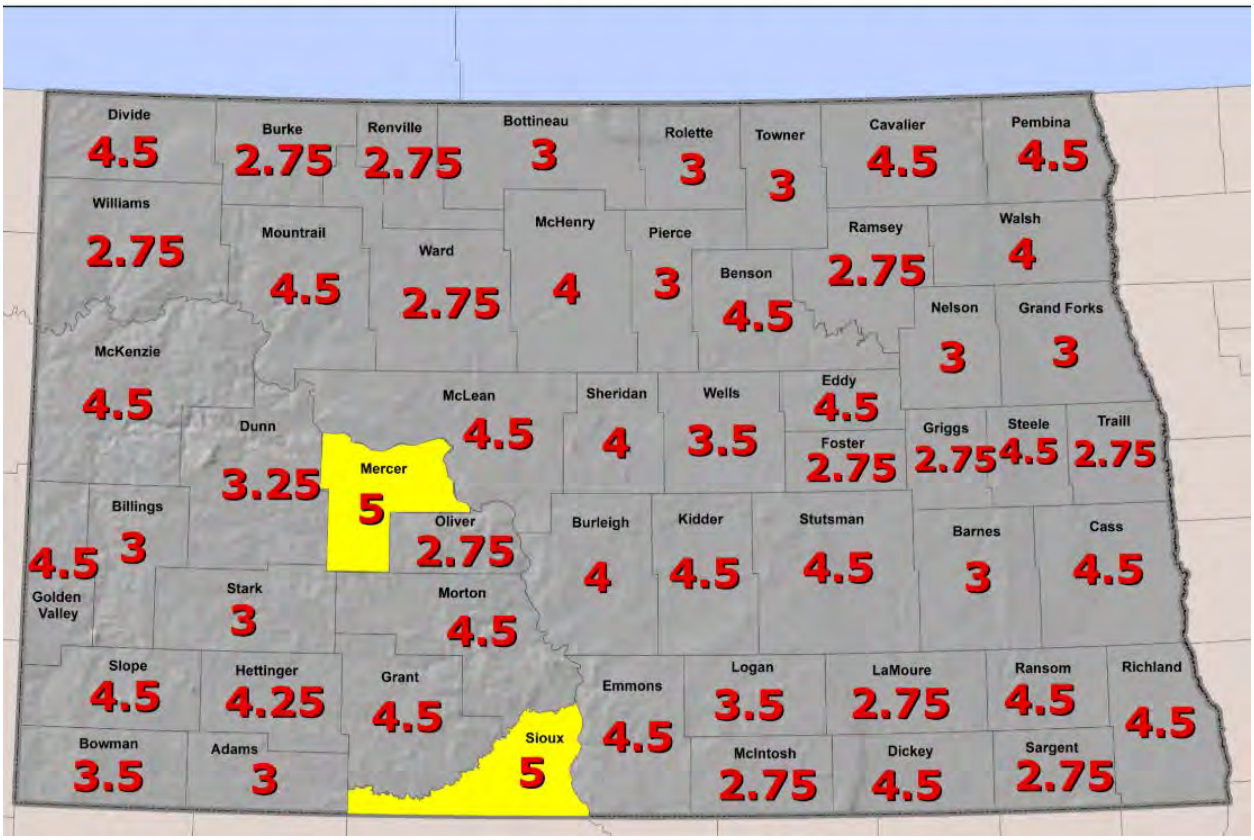
Notable hail events within Bismarck are noted below. Additional events may be reviewed via the NOAA storm events database: http://www.ncdc.noaa.gov/stormevents/

In June 2001, a hailstorm caused an estimated $230 million in property damage in Burleigh and Morton Counties; an estimated 57,000 insurance claims were filed. (North Dakota Insurance Department, 2007)

This hailstorm affected the urban Bismarck and Mandan area. As the most damaging hailstorm in the state's history, the insurance industry was severely impacted and insurance availability and premiums were affected statewide; many insurance companies pulled out of the state after the storm. (North Dakota State Water Commission, 2007c)

In July 2005, nickel size to tennis ball size hail combined with 70 mph winds and caused extensive and widespread damage in Bismarck. The larger hail fell on the north side of the city where most of the damage occurred. Numerous homes and vehicles were damaged. There was damage to siding and roofs, and windows were broken. (National Climatic Data Center, 2007)

Maximum hail size reported 1950-2019
Largest Hail Size (Inches/Diameter)



Burleigh County: Largest hailstone... 4.00 inch diameter -9:10 PM CDT July 29, 1986

Hail – 2 inches and larger
January 1, 2000 thru June 30, 2020

Source: NWS
https://www.ncdc.noaa.gov/stormevents

Storm Events Database

Search Results for Burleigh County, North Dakota

Event Types: Hail

17 events were reported between 01/01/2001 and 06/30/2020 (7121 days)

Summary Info:

Number of County/Zone areas affected:	1
Number of Days with Event:	12
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	5
Number of Days with Event and Crop Damage:	1
Number of Event Types reported:	1

August 25, 2019: A thunderstorm moved through Bismarck producing hail up to two inches in diameter, damaging many roofs and gutters.

June 17, 2016:
A severe thunderstorm struck northern portions of the city of Bismarck around 4:30 AM. Large hail combined with strong wind gusts to cause substantial damage. The largest hail with a diameter of 3.25 inches fell near Legacy High School. Winds of 75 mph combined with large hail to cause a swath of substantial damage from along Divide Avenue in north Bismarck to approximately 5 miles north of the city of Bismarck. Siding, roofs, and windows were damaged on homes. Multiple car dealerships sustained hail damage, which included the largest dealership in the city. Source: NWS

August 11, 2007: 0.75 inches of hail was reported at Bismarck Municipal Airport. Wind gusts of 51 mph were also measured at Bismarck Municipal Airport.

August 11, 2007: 0.75 and 1.00 inches of hail was reported in Bismarck.

June 16, 2007: 0.88 inches of hail was reported in Bismarck.

August 24, 2006: 1.25 inches of hail was reported at Bismarck Municipal Airport.

August 9, 2006: 0.75 inches of hail was reported at Bismarck Municipal Airport.

July 21, 2005: 2.50 inches of hail was reported in Bismarck. Nickel size to tennis ball size hail combined with 70 mph winds caused extensive and widespread damage in Bismarck. The larger hail fell on the north side of the city where most of the damage occurred. Numerous homes and vehicles damaged. There was damage to siding and roofs, and windows were broken. Property damage estimates were provided by the North Dakota Insurance Commissioner.

June 26, 2005: 0.75 inches of hail was reported in Bismarck. Penny size hail in north Bismarck.

June 6, 2005: 0.75 inches of hail was reported in the northeast part of the city of Bismarck.

July 3, 2003: 1.00 inches of hail was reported at the Bismarck Municipal Airport. Wind gust to 52 knots (60 mph) accompanied the storm.

August 31, 2002: 1.00, 2.00, and 2.50 inch hail reported in Bismarck. 1.50 inch hail reported 3 miles north of Bismarck. .75 inch hail reported 11 miles east of Bismarck and 4 miles north east of Menoken.

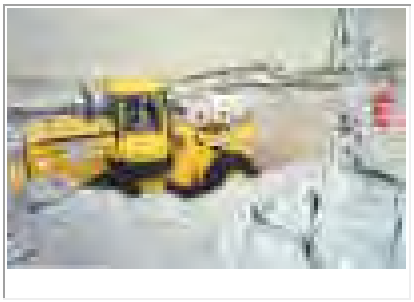
August 30, 2002: 1.00 inch hail reported at the Bismarck Municipal Airport. 1.75 inch hail reported south west of Bismarck Municipal Airport. 2.50 inch hail reported in Bismarck.

June 9, 2001: 1.00 inch hail reported at the Bismarck Airport. An approaching upper level system provided lift to produce severe thunderstorms over central North Dakota Saturday afternoon and evening. Abundant low-level moisture combined with relatively cool air aloft lead to the formation of an incredible amount of hail with many of these storms. The hail caused a tremendous amount of damage to homes and vehicles in the Bismarck and Mandan areas. An estimated damage from the hail in the two cities amounted around $260 million. The wind speed associated with the storm ranged between 50 to 60 mph.

June 9, 2001: 1.75 inch hail reported 3 miles north of Bismarck Airport causing an estimated $113,000,000 in property damages.

June 9, 2001
Severe Storms Pummel Southern North Dakota

An approaching upper level system provided lift to produce thunderstorms across western North Dakota Saturday afternoon. The storms intensified as they traveled east southeast along an instability axis extending into South Dakota. Abundant low level moisture combined with relatively cool air aloft lead to the formation of an incredible amount of hail with many of these storms. The hail caused a tremendous amount of damage to homes and vehicles in Bismarck and Mandan. One tornado was reported just north of Hazelton, which is about 30 miles southeast of Bismarck. No known deaths occurred with these storms but numerous injuries were reported. The pictures below will help put the damage into perspective.



The day after: clearing hail from the railroad underpass on 7th street in Bismarck. Photo taken by NWS employee.

November 1, 2000: 0.75 inch hail reported 8 miles North West of Bismarck.

June 12, 2000: 0.75 inch hail was reported in Bismarck.

July 6, 1998: 1 inch hail was reported in Bismarck.

July 10, 1996: 0.88 inch hail was reported in Bismarck.

July 10, 1996: 1 inch hail was reported in Bismarck.

June 20, 1995: 0.75 inch hail and 60 to 80 mph winds were reported. Extensive damage done to the city of Bismarck. Extensive tree damage. A mobile home northeast of Bismarck had its roof blown off. Reports of a few vehicles totaled due to large trees or tree branches falling on them. Extensive house damage due to falling trees or tree branches.

May 21, 1995: Two thunderstorms merged north of Mandan causing torrential rain, hail up to golf ball size for over 25 minutes, and winds to 65 mph, in Bismarck and Mandan. Piles of pea to golf ball-size hail covered the ground. Homes in Mandan had windows broke due to the hail.



State Historical Society of North Dakota

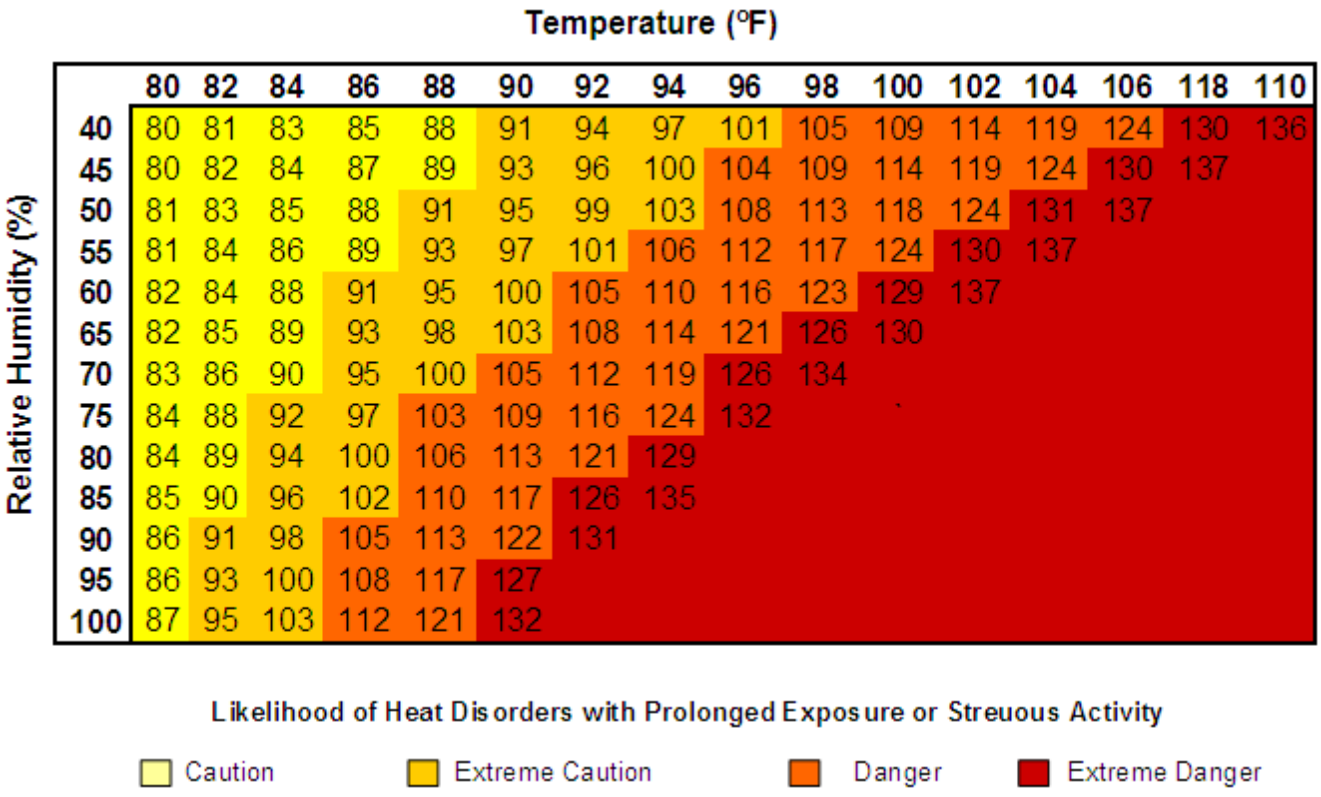
Extreme Heat

According to information provided by FEMA, extreme heat is defined 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.

The following two charts show the Heat Index (HI) as a function of heat and relative humidity. The Heat Index describes how hot the heat-humidity combination makes it feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the HI rises, so do health risks.

- When the HI is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90°-105°F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity.
- When it is 105°-129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130°F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.



Possible Heat Disorders by Heat Index Level

Heat Index	Category	Possible heat disorders for people in high risk groups
130°F or higher	Extreme Danger	Heatstroke risk extremely high with continued exposure.
105° - 129°F	Danger	Sunstroke, Heat Cramps and Heat Exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
90° - 105°F	*Extreme Caution*	*Sunstroke, Heat Cramps and Heat Exhaustion possible with prolonged exposure and or physical activity.*
80° - 90 °F	Caution	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105°F and a nighttime minimum high of 80°F or above is expected for two or more consecutive days. The NWS offices in Bismarck and Grand Forks can issue the following heat-related advisory as conditions warrant.

- **Excessive Heat Outlook**: are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to Heat Index forecast map for the contiguous United States those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- **Excessive Heat Watch**: is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- **Excessive Heat Warning/Advisory:** are issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

<table>
<tr>
<td>Excessive Heat

January 1, 2001 thru June 30, 2020

Source: NWS
https://www.ncdc.noaa.gov/stormevents</td>
<td>
Storm Events Database
Search Results for Burleigh County, North Dakota
Event Types: Excessive Heat
Burleigh county contains the following zones:
'Burleigh'
1 events were reported between 01/01/2001 and 06/30/2020 (7121 days)
Summary Info:
<table>
<tr><td>Number of County/Zone areas affected:</td><td>1</td></tr>
<tr><td>Number of Days with Event:</td><td>1</td></tr>
<tr><td>Number of Days with Event and Death:</td><td>0</td></tr>
<tr><td>Number of Days with Event and Death or Injury:</td><td>0</td></tr>
<tr><td>Number of Days with Event and Property Damage:</td><td>0</td></tr>
<tr><td>Number of Days with Event and Crop Damage:</td><td>0</td></tr>
<tr><td>Number of Event Types reported:</td><td>1</td></tr>
</table>
</td>
</tr>
<tr>
<td>July 19, 2011</td>
<td>Heat index values topped out between 110 and 120 degrees, not a common thing in North Dakota. Although no human life was lost and no injuries were reported, there were livestock losses associated with the heat. It is estimated that up to 700 head of cattle died from the heat wave.</td>
</tr>
</table>

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Lightning	Hail	High Winds or Downbursts
Probability	Very Likely	Very Likely	Very Likely
Speed of Onset	Warning lead time: 30 minutes to several hours	Warning lead time: 30 minutes to several hours	Warning lead time: 30 minutes to several hours
Geographic Area	All of Bismarck Typically 15 miles in diameter	All of Bismarck	All of Bismarck
Duration	Average of 30 minutes Can last much longer	Usually 30 minutes or less.	Usually 30 minutes or less.
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Direct or indirect lightning strike. A. Those outdoors, especially under or near tall trees, or B. On Water, or C. On Hilltops	1. Impact by large hail stones. Hail seldom causes loss of life. A. Those outdoors with no access to shelter.	1. Flying Debris *Non-secure outdoor items* A. Aviation B. Mobile home C. Motor Home D. Camp sites E. Being Caught Outdoors F. In a vehicle G. Insufficient shelter H. Windows
Mass Casualty Incident	No mass casualty incidents reported in ND. Lightning kills – averaging 80 to 93 deaths and 300 injuries in the US each year.	No mass casualty incidents reported in ND.	No mass casualty incidents reported in ND.

	Lightning	Hail	High Winds or Downbursts
Property Losses (points of vulnerability – high priority)	1. Property losses due to Fire (lightning as cause) 2. Computer equipment due to power surges 3. Downed power lines and trees	1. Shingles 2. Windows 3. Siding 4. Auto body damages 5. Trees/plants/crops	1. Mobile home 2. Motor Home 3. Windows/doors 4. Trees 5. Fences 6. Power lines 7. Roofs
Environmental			1. Debris 2. Hazardous Waste debris
COG/COOP	1. Computers and other electronic equipment 2. Loss of power	1. Could delay emergency response time.	1. Employee / family casualties 2. Key personnel – Orders of Succession
Critical Facilities	1. Computers and other electronic equipment 2. Loss of power	1. Windows	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials
Critical Infrastructure	1. Loss of Power	1. Similar to snow event – blocked streets	2. Electricity: Substations & Overhead Power Lines 3. Streets Blocked 4. Communications
Schools	1. Computers and other electronic equipment 2. Loss of power	1. Windows	1. Portable Classrooms 2. Windows 3. Doors 4. Loss of roofing materials

	Lightning	Hail	High Winds or Downbursts
High Risk Facilities (chemical)	1. Computers and other electronic equipment 2. Loss of power		1. Windows 2. Garages/doors 3. Doors 4. Large Span Roofs
Specific Populations: Public Assembly,Vulnerable / Special Populations	1. Outdoor Activities – sporting events, water sports, etc.	1. Outdoor Activities – sporting events, water sports, etc.	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor events
Economy (community wide)	Minor (THIRA rating)	Moderate (THIRA rating)	Moderate (THIRA rating)
OTHER:			Mobile HazMat (truck)

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Shortage or Outage of Critical Materials or Infrastructure – Hazard Profile

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, communications infrastructure, medical products, food, and water.

The disruption of the critical material supply system may be caused by weather conditions (severe low temperatures, ice/winter storm high winds, space weather such as solar flares), other natural disasters such as drought, flooding, and tornadoes, lack of infrastructure maintenance, human error, global conflict, oil embargo, major work stoppage, cyber security or a national security emergency. Any disruption, regardless of the cause could have immediate adverse impacts as well as severely diminish existing supplies, thereby threatening the long-term health, safety, and well-being of 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. Communities/citizens throughout North Dakota depend on the typical utility and communication infrastructure such as water, sewer, electricity, propane, natural gas, communications, internet, and gasoline. Homes and businesses are heated with fuels such as natural gas, propane, oil, and electricity. Buildings heated by various fuels still rely on electricity to power their 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 in North Dakota during the cold winter months. Phone services are important for day-to-day business, but are most important for 911 communications in an emergency. Without phone 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.

The ability to restore services depends on the ability of repair crews (including mutual aid from other jurisdictions) to access the affected areas. Communities including Bismarck, also depend on the private utility industry capabilities regarding their business continuity of operations plans and mitigation plans on a local, regional, and national level. In the case of a quarantine or pandemic, repair crews may not be available to quickly restore services. The most common hazards that interrupt electric services are heavy snow, ice, and wind.

Space Weather

According to the NOAA Space Weather Prediction Center, Space Weather is the condition in space that affects Earth and its technological systems. Space Weather is a consequence of the behavior of the Sun, the nature of Earth's magnetic field and atmosphere, and our location in the solar system. The active elements of space weather are particles, electromagnetic energy, and magnetic field, rather than the weather contributors on earth of water, temperature, and air.

The Space Weather Prediction Center forecasts space weather to assist users in avoiding or mitigating severe space weather. These are storms that originate from the sun and occur in space near Earth or in the Earth's atmosphere. Most of the disruptions can be categorized into three types of events that can have environmental effects on Earth. They are: geomagnetic storms, solar radiation storms, and radio blackouts.

Source: 2014 NDDES Mitigation Plan

A "Worst Case" Scenario - Electromagnetic Pulse (EMP):

The use of a high-altitude nuclear detonation with the intention of causing an Electromagnetic Pulse to shut down critical infrastructure (electric utility) over a wide geographic area is potentially the worst case scenario in creating a shortage of critical materials. A highly effective EMP event could potentially cause a shortage of all critical materials previously discussed.

Below are excerpts from the May 8, 2014 Opening Statement remarks prepared for the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies Committee on Homeland Security.

"… EMP is simply a burst of electromagnetic radiation that results from certain types of high energy explosions or from a suddenly fluctuating magnetic field. A frightening point is that EMP can be generated by nuclear weapons, from naturally-occurring sources such as solar storms, or specialized non-nuclear EMP weapons. Nuclear weapon EMPs are most catastrophic when a nuclear weapon is detonated at high altitude, at approximately 30 kilometers (20 miles), above the intended target. The consequences of such an attack could be catastrophic; all electronics, power systems, and information systems could be shut down. This could then cascade into interdependent infrastructures such as water, gas, and telecommunications. While we understand this is an extreme case, we must always be prepared in case a rouge state decides to utilize this technology…"

Source: https://www.govinfo.gov/content/pkg/CHRG-113hhrg89763/pdf/CHRG-113hhrg89763.pdf

EMP Commission and Commission and Commission Report:
http://www.empcommission.org/
http://www.empcommission.org/docs/A2473-EMP_Commission-7MB.pdf

Risk Assessment – Shortage of Critical Materials or Infrastructure

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings (Threat and Hazard Identification and Risk Assessment)

3 Day Power Outage Due to Winter Storm including high winds and record snowfall on top of freezing rain.

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Minor	None/Negligible	None/Negligible	Minor

One Week Power Loss and Loss of Interstate/Hwy Transportation - Due to Winter Storm - High Wind and excessive snowfall on top of freezing rain.

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	Minor	Minor	Moderate

EMP (worst case scenario)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely or "Unknown"	Catastrophic	Catastrophic	Catastrophic	Catastrophic

Climate Change Impact:

… "Finally, higher maximum temperatures, longer and more severe heat waves, and higher overnight lows are expected to increase electricity demand for cooling in the summer, further stressing the power grid." …	NCA4 Vol II Chapter 22 (Northern Great Plains)

Previous Occurrences

Power outages of some magnitude are an annual event. The probability of a prolonged event is less certain but is more likely during other hazard events. The probability can also be broken down by service type. Electric power outages are the most common, but significant water, sewer, communications, heat, propane, internet, or fuel outages can also occur, with somewhat lower probability. Since 1970, three major material shortages and several extended power outages have occurred in the state.

North Dakota has experienced three separate major statewide incidents involving shortages of critical materials:
1970s Oil Embargo – International events caused the price of gasoline to rise significantly, and many Americans experienced long lines at gas stations and were rationed in the amount of gasoline they were able to buy. During the oil embargo, a ―state of disaster emergency‖ was declared to meet the dangers inherent from a critical fuel shortage to the citizens of North Dakota. As a result, the following steps were immediately implemented by all state agencies to conserve energy resources:
Provisions to eliminate duplication of travel were implemented.

- Fuel-efficient policies regarding the use of and purchase of state vehicles were implemented.
- Temperature control limits and regulations were set for all state buildings.
- Lighting controls and regulations were set for all state buildings.
- Energy conservation public information was coordinated among state agencies and targeted to all residents of North Dakota.

A fuel allocation program was established under federal authority whereby 3 percent of motor gasoline and 4 percent of middle distillate fuels brought into the state were ―set aside to be reallocated to retailers who were experiencing temporary shortages.

- 1970s Anti-Freeze Shortage – The anti-freeze shortage occurred prior to and during the winter months when it is critical to protect cooling system liquids from freezing in automobile engines. Distributors were able to receive ample stocks, but state officials monitored the situation. Because of this situation, state officials monitor distribution of this product annually to ensure proper supply.
- 1980s Farm Fertilizer Shortage – During the fertilizer shortage, phosphate, one of three primary ingredients used in farm fertilizers, was in short supply. Fertilizer has become an absolute necessity to maintain agricultural production levels, which aid in stabilizing the state‘s economy. Agriculture officials monitor fertilizer supplies on a yearly basis to ensure that timely actions are implemented to avert a shortage.
- Yearly power outages – occur that the utility companies classify as major events. These events will vary in magnitude and duration, most of them have been weather related, ice, wind, tornado are the common causes, most occur between October 1 and June 1 however summer wind storms and tornados are also relatively common. Other causes for these events include accidents, vandalism, and terrorism.

Space Weather
There are no recorded space weather effects in North Dakota. The nearest storm affected Montreal, Canada on March 13, 1989 when a geomagnetic storm took out their commercial electric power for 9 hours.

According to the NERC's Geomagnetic Disturbance Reference Document, there are 200 days during the 11-year solar cycle with strong-severe geomagnetic storms, and approximately four days of extreme conditions.

It is important to know that these solar storms typically occur during solar maximum. The sun undergoes an 11-year cycle where the polarities of the North and South Poles reverse. Most solar storms occur during a four- to six-year period referred to as a solar maximum. Solar cycle 24 reached its maximum in April 2014, and peaked at an average sunspot number of 82, with no significant space weather events. Geomagnetic storms, solar radiation storms, and radio blackouts have the capability to all happen simultaneously, causing a "solar super storm."

The last major solar super storm was the Carrington super storm (described in previous occurrences) in September 1859. Solar super storms are likely to occur once every 500 years. Therefore, solar storm events severe enough to potentially impact the energy infrastructure are relatively rare. The chance of occurrence is also inconsistent from year to year, depending on where the sun is at in its solar cycle. In general, though, space weather is considered to be high impact, low frequency events, meaning that they occur relatively rarely but can have serious impacts when they do happen.

Source: 2018 ND Department of Emergency Services Enhanced Mitigation Plan

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: Losses, Impact and Vulnerabilities are assumed to be cumulative from previous columns to the left using winter season as timeframe of occurrence.

Scenario	**3-Day Power Outage (ex: winter storm)**	**1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)**	**EMP (a worst case scenario)**
Probability	Likely	Possible	Unlikely, yet "unknown"
Speed of Onset	No warning for power outage. Adequate warning for storm is assumed.	No warning for power outage. Adequate warning for storm is assumed.	Warning time would depend on detection or recognition of event. A "no notice" event is possible.
Geographic Area	Regional & City-Wide Impact	Regional & City-Wide Impact	Regional / National Event
Duration	3 days	7 days	Months to Years for Recovery
Death / Injury 1. Primary Causes	1. Improper use of alternative heating sources. 2. Carbon Monoxide poisoning. 3. Injury due to cold temperatures and heavy snow. 4. Lack of back-up power for personal life personal supportive equipment.	1. Same as column to the left.	2. Starvation, disease, societal collapse.

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
A. Highest vulnerability	A. Those more affected by colder temperatures and those with poorly insulated homes. B. Those with medical conditions residing at home.		A. Those who are not self-reliant for all necessities (food, water, heat, etc.) and those who require medicines or medical attention
	Some residents will have stand-by generators but the majority of residents do not.		
Mass Casualty Incident	1. No. Some injury and loss of life is possible, but avoidable through sheltering and other response efforts.	1. Possible, but avoidable through sheltering and other response efforts.	1. Yes, potentially a majority of the population. 2. Food, potable water, and medical supplies likely to be depleted.
	Families and individuals may need to rely on their own emergency supplies.		
Property Losses (points of vulnerability – high priority)	1. Frozen and burst water pipes. 2. Personal property sensitive to colder temperatures damaged.	1. Frozen and burst water pipes (extensive) 2. Personal property sensitive to colder temperatures damaged.	1. Power Grid and other Electric Utility property and equipment losses. 2. Equipment having electronic components being disabled or destroyed.
	Structures may be affected by sewer back-up if back-up generators would fail (lift stations)		
Environmental	1. Food spoilage.	1. Food spoilage.	1. Loss of Power would impact water and sewer services. 2. Waste management. 3. Availability of potable water for drinking, food processing, etc.

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
	Personal and commercial food supplies may spoil during extended power outages.		
COG/COOP	1. Non-essential services discontinued. 2. Staffing challenges due to personal impacts.	1. Critical and essential functions maintained. 2. Other functions discontinued. 3. Staffing challenges due to personal impacts.	1. Community Safety and Security. 2. Limited or no communications with the public. 3. Most, if not all government services would be very difficult to sustain. 4. Emergency Services impacted by loss of utility and loss of phone and radio communications 5. Lack of fuel *(depleted based on impact to transportation and utilities)*
Critical Facilities	1. Grocery Stores closed. 2. Gas Stations – not able to pump gas.	1. Grocery Stores closed. 2. Gas Stations – not able to pump gas. 3. Hospitals, Nursing Homes, Assisted Living Centers 4. Prisons, Jails	1. Water and Wastewater. 2. All critical facilities due to lack of electricity, water, as well as impacts to communications and transportation infrastructure. 3. Grocery Stores – food supplies depleted. 4. Hospitals, Nursing Homes, Assisted Living Centers 5. Prisons, Jails
	See Appendices for existing generator capabilities within city-owned critical facilities.		
Critical Infrastructure	1. Heating/Cooling Systems down. Back-up power required. 2. Communications (phone / cell) impacted.	1. Transportation – deliveries delayed for one week. 2. Reduced inventory of food and medicines due to Interstate and Hwy road closures.	1. Power Grids may take months to years to repair. *2.* All critical infrastructure requiring electricity would be impacted including transportation, communications, water, wastewater, heating/cooling)
	According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).		

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
Schools	1. School Closures – some may be used as shelters.	1. School Closures – some may be used as shelters.	1. Schools closed, potentially used for alternative emergency response purposes.
High Risk Facilities (chemical)	1. Facilities without back-up power may be impacted. Safety/security may be impacted without power. 2. Closed for business – economic impact.	1. Same as left column with higher level of impact.	2. All businesses would be closed or severely impacted. High risk facilities may pose additional risk due to limited (if any) emergency services. 3. Safety/Security may be compromised at high risk facilities when fuel for back-up power is depleted.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Evacuation and sheltering would be necessary for those without back-up power at place of residence.	1. Evacuation and Sheltering would be necessary for those without back-up power at place of residence.	2. Life threatening risk in the very short term for those requiring medical attention, medicines, or use of electricity for life support. 3. Evacuation and relocation capabilities seriously compromised.
Economy (community wide)	None/Negligible (THIRA Rating)	Minor (THIRA Rating)	1. Catastrophic (THIRA Rating) 2. Potential for societal collapse.
	The economy depends heavily on utility and communication services. Electricity alone powers many systems used in day-to-day business. Businesses, such as restaurants, require electricity and water to operate. Without these services, many businesses could be shut down. Closed businesses and government offices essentially put the economy at a standstill until services are restored. Fuel shortages due to a power outage, low supplies, high prices, or transportation closures, could have lasting effects on everyone from the individual commuter to any business that ships inventory. Ultimately, the economy has a high dependence on utility or communications services. Source: 2014 DES Mitigation Plan		
OTHER:			1. It may take hours or days to confirm and then communicate the cause of the power outage to the public.
	Depending on the season of initial impact, the challenges would vary. For example, during the cold winter season, existing food supplies may perhaps be maintained longer (avoid spoilage) despite lack of power.		

According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).

A Transportation fuel shortage could occur from a disruption in the supply system due to any number of the following reasons:

- Electric power outage
- Labor strikes
- Embargo
- Natural Disaster
- National Security
- Planned refinery maintenance
- Supply disruptions

Coal Supply
Most of the power plants that rely on coal are mine-mouth facilities, and therefore not dependent on rail or other third-party transportation. However, the coal supply is vulnerable to labor reductions/strikes.

Natural Gas Supply
Natural gas is used in electric generation.

Two fifths of North Dakota households use natural gas for heating, a complete interruption in the supply of natural gas could result in a significantly higher demand for electricity as a substitute heating source.

While North Dakota has significant supply and natural gas processing within the state, it is still vulnerable to disruptions due to the following factors:

- Pipeline disruption either intra or interstate.
- Labor shortages.
- Supply/Demand imbalance.
- Supply reduction for economic or political reasons.

Development in Identified Hazard Areas
New and future development may have significant impacts on the shortage or outage of critical materials or infrastructure hazard. Increased populations add to the challenges of managing a utility outage and a shortage or outage of critical materials.

Loss Estimates

Since infrastructure outage is generally a secondary or cascading impact of other hazards, it is not possible to quantify estimated potential losses specific to this hazard due to the variables associated with affected population, duration of outages, etc.

Although the limitless variables make it difficult to estimate future losses, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis methodologies to estimate the cost of lost utilities on a per-person, per-use basis.

FEMA Standard Values for Loss of Service for Utilities and Roads/Bridges

Loss of Electric Power	Cost of Complete Loss of Service
Economic Impact	$126 per person per day
Loss of Potable Water Service	Cost of Complete Loss of Service
Economic Impact	$93 per person per day
Loss of Wastewater Service	Cost of Complete Loss of Service
Economic Impact	$41 per person per day
Loss of Road/Bridge Service	Cost of Complete Loss of Service
Vehicle Delay Detour Time	$38.15 per vehicle per hour
Vehicle Delay Mileage	$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

Vulnerability Assessment – Electric Utility

Risk, Vulnerability, and Restoration Timeline – Electric Utility

The more "typical" minor power outage affecting isolated areas of Bismarck is most likely to be restored within an estimated two to ~~three~~ four hours (usually less) based on local utility company capabilities.

Based on risk/vulnerability *(excluding the "electromagnetic pulse" hazard),* the City of Bismarck and its residents should prepare to be without power for between 24 hours and one week. Being without power for one week is not a likely scenario, however, there is potential for that to occur as a result of a catastrophic "perfect storm" impacting all input sources (ie: incoming transmission lines from the Garrison, Heskett, and WAPA). Power is estimated to be restored within two to three days short of "perfect storm" catastrophic events. Natural hazards having this potential impact include Ice Storms, Extreme High Wind event, or even multiple tornados.

Another natural hazard of potential significance is a "geomagnetic disturbance" (GMD) which is one type of solar storm. A GMD event could cause a power outage, again requiring an estimated 24 hours to one week to restore all power. A GMD incident created a power outage for all of Quebec in March 1989 for a period of nine hours. Today, because of the more sophisticated circuitry (less mechanical), the impact would likely be more significant and more time required for restoration by any affected utility company. There is some potential for a GMD to compromise back-up generators as well because of the generator's connection to the ground. A GMD event in ND may have a lower probability compared to Canada due to the lower level of iron in North Dakota's soil.

A local and national worst case scenario is the Electromagnetic Pulse (EMP) event, which is primarily a nuclear/terrorist hazard (high altitude detonation) that could create a widespread power outage within "line of sight" impacting multiple states, even a majority of the United States. Although deterrence and prevention are primarily addressed at the federal level, the utility industry and the scientific community are key in researching, identifying, and pursuing feasible opportunities for electric utility hardening. In terms of worst case scenario, an EMP event could leave our community without power for months to year(s). Although the utility companies take the lead in restoring power, an EMP event would require significant response and recovery efforts since this type of event shuts down electricity and all infrastructures depending on electricity including communications, transportation, etc.

Vulnerability Assessment - Space Weather

Space weather storms mainly disrupt technology. As our society becomes more dependent and sophisticated with our technologies, our vulnerability to space weather storms increases. The NOAA Space Weather Prediction Center has created Space Weather Scales as a way to communicate to the general public about the possible effects on people and technologies. The scales describe the environmental disturbances for three event types: geomagnetic storms, solar radiation storms, and radio blackouts. The scales have numbered levels (1-5) similar to hurricane, tornado, and earthquake severity ratings and they list the possible effects at each numeric level.

The table (next page) describes the G1-G5 severity scale disturbances in the geomagnetic field caused by gusts in the solar wind that blows to earth. The possible effects are on power systems, spacecraft operations (including satellites), and other operation systems.

NOAA Space Weather Scale for Geomagnetic Storms

Source: https://www.swpc.noaa.gov/noaa-scales-explanation

Category		Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Scale	**Descriptor**	**Duration of event will influence severity of effects**		
Geomagnetic Storms			**Kp values***	**Number of storm events when Kp level was met; (number of storm days)**
G 5	**Extreme**	**Power systems:** widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.)**.	Kp = 9	4 per cycle (4 days per cycle)
G 4	**Severe**	**Power systems:** possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** may experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.)**.	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	**Strong**	**Power systems:** voltage corrections may be required; false alarms triggered on some protection devices. **Spacecraft operations:** surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.)**.	Kp = 7	200 per cycle (130 days per cycle)
G 2	**Moderate**	**Power systems:** high-latitude power systems may experience voltage alarms; long-duration storms may cause transformer damage. **Spacecraft operations:** corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.)**.	Kp = 6	600 per cycle (360 days per cycle)
G 1	**Minor**	**Power systems:** weak power grid fluctuations can occur. **Spacecraft operations:** minor impact on satellite operations possible. **Other systems:** migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine)**.	Kp = 5	1700 per cycle (900 days per cycle)

* The Kp-index used to generate these messages is derived from a real-time network of observatories the report data to SWPC in near real-time. In most cases the real-time estimate of the Kp index will be a good approximation to the official Kp indices that are issued twice per month by the German GeoForschungsZentrum (GFZ) (Research Center for Geosciences).

** For specific locations around the globe, use geomagnetic latitude to determine likely sightings

NOAA Space Weather Scale for Solar Radiation Storms

Category		Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Scale	Descriptor	Duration of event will influence severity of effects		
Solar Radiation Storms			Flux level of >= 10 MeV particles (ions)*	Number of events when flux level was met (number of storm days**)
S 5	Extreme	**Biological:** unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. **Other systems:** complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	**Biological:** unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** may experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	**Biological:** radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	Moderate	**Biological:** passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk.*** **Satellite operations:** infrequent single-event upsets possible. **Other systems:** small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S 1	Minor	**Biological:** none. **Satellite operations:** none. **Other systems:** minor impacts on HF radio in the polar regions.	10	50 per cycle

* Flux levels are 5 minute averages. Flux in particles·s^{-1}·$ster^{-1}$·cm^{-2}. Based on this measure, but other physical measures are also considered.
** These events can last more than one day.
*** High energy particle measurements (>100 MeV) are a better indicator of radiation risk to passenger and crews. Pregnant women are particularly susceptible.

NOAA Space Weather Scale for Radio Blackouts

Category		Effect	Physical measure	Average Frequency (1 cycle=11 years)
Scale	**Descriptor**	**Duration of event will influence severity of effects**		
Radio Blackouts			**GOES X-ray peak brightness by class and by flux***	**Number of events when flux level was met; (number of storm days)**
R 5	**Extreme**	**HF Radio:** Complete HF (high frequency**) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	**Severe**	**HF Radio:** : HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation:** Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	**Strong**	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. **Navigation:** Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	**Moderate**	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	**Minor**	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. **Navigation:** Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

* Flux, measured in the 0.1-0.8 nm range, in $W \cdot m^{-2}$. Based on this measure, but other physical measures are also considered.
** Other frequencies may also be affected by these conditions.

Vulnerability Assessment - Electromagnetic Pulse (EMP)

EMP Vulnerabilities

"….Today's microelectronics are the foundation of our modern civilization, but are over one million times more vulnerable to EMP than the far more primitive and robust electronics of the 1960s, that proved vulnerable during nuclear EMP tests of that era. Tests conducted by the EMP Commission confirmed empirically the theory that, as modern microelectronics become ever smaller and more efficient, and operate ever faster on lower voltages, they also become ever more vulnerable, and can be destroyed or disrupted by much lower EMP field strengths.

Microelectronics and electronic systems are everywhere, and run virtually everything in the modern world. All of the civilian critical infrastructures that sustain the economy of the United States, and the lives of 310 million Americans, depend, directly or indirectly, upon electricity and electronic systems.

Of special concern is the vulnerability to EMP of the Extra High-Voltage (EHV) transformers, that are indispensable to the operation of the electric grid. EHV transformers drive electric current over long distances, from the point of generation to consumers (from the Niagara Falls hydroelectric facility to New York City, for example). The electric grid cannot operate without EHV transformers--which could be destroyed by an EMP event. The United States no longer manufactures EHV transformers. They must be manufactured and imported from overseas, from Germany or South Korea, the only two nations in the world that manufacture such transformers for export. Each EHV transformer must be custom made for its unique role in the grid. A single EHV transformer typically requires 18 months to manufacture. The loss of large numbers of EHV transformers to an EMP event would plunge the United States into a protracted blackout lasting years, with perhaps no hope of eventual recovery, as the society and population probably could not survive for even one year without electricity.

Another key vulnerability to EMP are Supervisory Control And Data Acquisition systems (SCADAs). SCADAs essentially are small computers, numbering in the millions and ubiquitous everywhere in the critical infrastructures, that perform jobs previously performed by hundreds of thousands of human technicians during the 1960s and before, in the era prior to the microelectronics revolution. SCADAs do things like regulating the flow of electricity into a transformer, controlling the flow of gas through a pipeline, or running traffic control lights. SCADAs enable a few dozen people to run the critical infrastructures for an entire city, whereas previously hundreds or even thousands of technicians were necessary. Unfortunately, SCADAs are especially vulnerable to EMP.

EHV transformers and SCADAs are the most important vulnerabilities to EMP, but are by no means the only vulnerabilities. Each of the critical infrastructures has their own unique vulnerabilities to EMP…"
Source: Dr. Peter Vincent Pry, Congressional EMP Commission, Congressional Strategic Posture Commission, Executive Director of the Task Force on National and Homeland Security, Witness Statement [PDF]

Additional statements regarding the EMP Threat:

- Hon. Trent Franks, A Representative in Congress from the State of Arizona, Witness Statement [PDF]
  https://docs.house.gov/meetings/HM/HM08/20140508/102200/HHRG-113-HM08-Wstate-F000448-20140508.pdf
- Dr. Peter Vincent Pry, Congressional EMP Commission, Congressional Strategic Posture Commission, Executive Director of the Task Force on National and Homeland Security, Witness Statement [PDF]
  https://docs.house.gov/meetings/HM/HM08/20140508/102200/HHRG-113-HM08-Wstate-PryP-20140508.pdf
- Dr. Michael J. Frankel, Senior Scientist, Penn State University, Applied Research Laboratory, Witness Statement [PDF]
  https://docs.house.gov/meetings/HM/HM08/20140508/102200/HHRG-113-HM08-Wstate-FrankelM-20140508.pdf
- Dr. Chris Beck, Vice President, Policy and Strategic Initiatives, The Electric Infrastructure Security Council, Witness Statement [PDF]
  https://docs.house.gov/meetings/HM/HM08/20140508/102200/HHRG-113-HM08-Wstate-BeckC-20140508.pdf

EMP Preparedness/Status Update:

In March of 2019 the Electromagnetic Pulse (EMP) Task Force was formed in response to an executive order by the President of the United States. The executive order also directed the federal government to provide incentives as appropriate to "encourage innovation that would strengthen critical infrastructure against the effects of EMPs through the development and implementation of best practices, regulations, and appropriate guidance.

As such, the EMP Task Force is an advisory team that is charged with providing high-level leadership, recommendations, and guidance to the NERC Board of Trustees. Additionally, work has been done by various organizations (EPRI, DTRA, National Labs, etc.), however, there are still many unknowns regarding the successful operations of the Bulk Power System following an EMP event.

The EMP Task Force released Strategic Recommendations in November of 2019. The recommendations acknowledge there are various approaches to EMP mitigation. One approach is to harden individual components while another is to harden an entire facility and install unhardened components within the facility. Historically, the electric industry in general has hardened its individual components, allowing flexibility to install them in virtually any environment. Since the research is ongoing, the EMP Task Force is unable to endorse a particular mitigation strategy at this time for all stakeholders.

Ultimately an EMP event can potentially cause a voltage collapse resulting in separation, islanding, or blackout of the system where all or a significant portion of the bulk transmission and distribution system is de-energized but may still be tied together through closed breakers. As required by the EOP-005 NERC Reliability Standard MDU does maintain a Power System Restoration Plan for non-EMP related restoration. The plan outlines a logical and reliable restoration of the Interconnection and the Montana-Dakota power system in the event

one or more areas of the Bulk Electric System (BES) shuts down and the use of Blackstart Resources is required to restore the shutdown area. Among other requirements the standard also requires System Operators to participate in annual system restoration training which includes coordination with the Reliability Coordinator, restoration priorities, building a cranking path, and synchronizing.

EMP Task Force: https://www.nerc.com/pa/Stand/Pages/EMPTaskForce.aspx

Data Limitations

Brief power outages occur regularly in North Dakota but since long-term critical material or infrastructure outages or shortages are not a normal event, understanding the specific problems and concerns of this hazard is the greatest limitation.

Tornado – Hazard Profile

Description

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The term "tornado" was derived from the Latin word, "tornare" which means "to make round by turning." 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, 88 percent, 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.

Fujita Scales

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 fact, Dr. Fujita's first major case study on tornado damage was the 1957 Fargo tornado. (North Dakota State Water Commission, 2007)

In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds. The Enhanced Fujita (EF) scale was implemented in February 2007.

Both scales are shown in the table below:
Tornado Scales

Fujita Scale (through January 2007)		**Enhanced Fujita Scale** (Feb 2007 - current)	
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

Source: National Climatic Data Center, 2013.

F0



F1



F2



F3



F4



F5



Photos Source: Wikipedia

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Tornado EF0/EF1**

	Consequence			
Frequency	Human	Economic	Psychological	Government
Possible	Minor	Minor	None	Minor

THIRA Ratings – **Tornado EF2/EF3**

	Consequence			
Frequency	Human	Economic	Psychological	Government
Possible	Significant	Moderate	Minor	Moderate

THIRA Ratings – **Tornado EF4/EF5**

	Consequence			
Frequency	Human	Economic	Psychological	Government
Unlikely	Catastrophic	Catastrophic	Significant	Significant

Climate Change Impact:

Tornado activity in the United States has become more variable, particularly over the 2000s, with a decrease in the number of days per year with tornadoes and an increase in the number of tornadoes on these days (*medium confidence*). Confidence in past trends for hail and severe thunderstorm winds, however, is *low*. Climate models consistently project environmental changes that would putatively support an increase in the frequency and intensity of severe thunderstorms (a category that combines tornadoes, hail, and winds), especially over regions that are currently prone to these hazards, but confidence in the details of this projected increase is *low*. … "judicious use of the report database has revealed important information about tornado trends. Since the 1970s, the United States has experienced a decrease in the number of days per year on which tornadoes occur, but an increase in the number of tornadoes that form on such days. One important implication is that the frequency of days with large numbers of tornadoes—tornado outbreaks—appears to be increasing. The extent of the season over which such tornado activity occurs is increasing as well: although tornadoes in the United States are observed in all months of the year, an earlier calendar-day start to the season of high activity is emerging. In general, there is more interannual variability, or volatility, in tornado occurrence."	NCA4 Volume I Chapter 9

Estimated Annual Probability of a tornado of any magnitude Based on Historical Occurrences: *2%
*This estimate is for planning purposes only – and is based on the following limited and short term data and assumptions: There has been an average of one tornado per year in Burleigh County from 1996 to 2013 (not all tornados are reported). The ratio or target size of Bismarck compared to the geographic square miles of Burleigh County is 2%. It's assumed all of Burleigh County has equal chances.

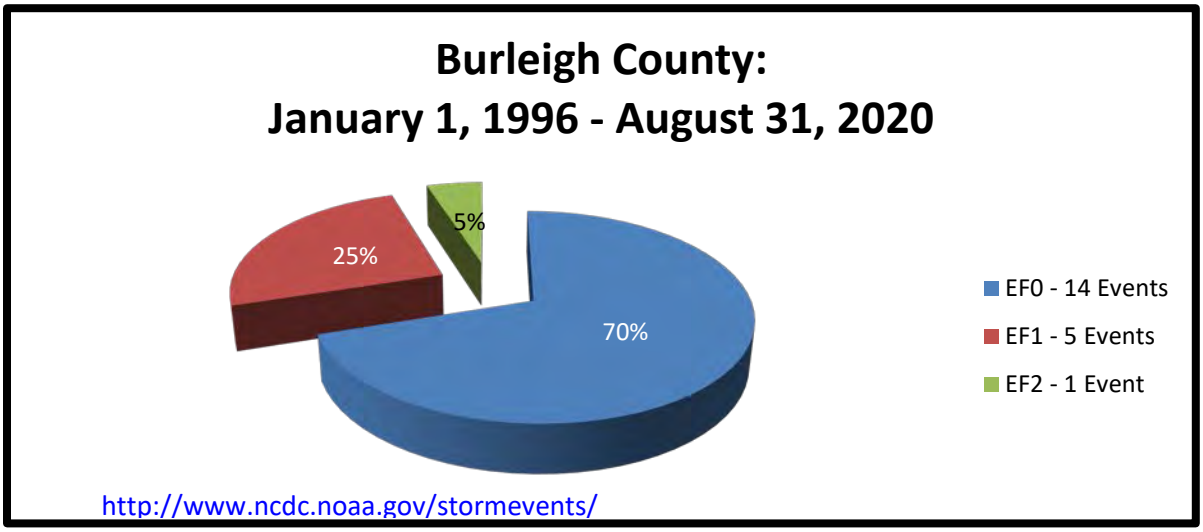
When considering the statewide statistics regarding intensity of tornados since 1950, a majority of the estimated chance is for the weaker tornados (EF0 and EF1). See table below.

Fujita Scale Statistics for North Dakota Tornadoes 1950-2018

Magnitude	Number of Recorded Tornadoes	Average Frequency	Percentage
F0 & EFO	888	13 per year	62%
F1 & EF1	357	5 per year	25%
F2 & EF2	136	2 per year	9%
F3 & EF3	41	1 every 1.5 years	3%
F4 & EF 4	13	1 every 4.5 years	1%
F5 & EF5	3	1 every 21 years	0.2%

Source: NDDES 2018 Mitigation Plan

The peak time of the year for tornadoes in North Dakota is from the end of May through the beginning of August, with most tornadoes in the state occurring between 3:00 p.m. and 11:00 p.m. in the months of June, July, and August; however, tornadoes have been reported as early as March 26 and as late as November 1.



Burleigh County: January 1, 1996 – August 31, 2020

20 Tornado Events

Magnitude	Number of Events	%
EF0	14	70%
EF1	5	25%
EF2	1	5%

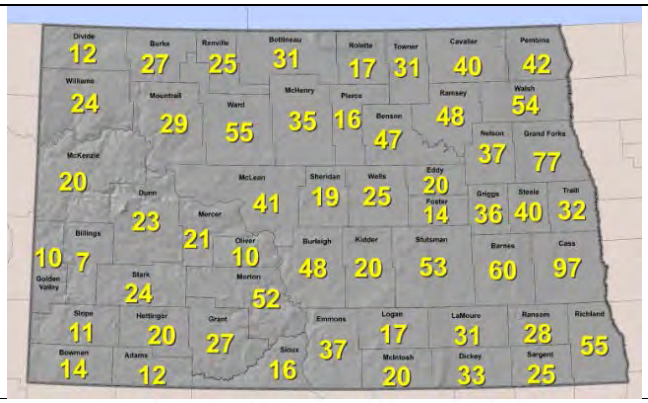
http://www.ncdc.noaa.gov/stormevents/

Burleigh County Statistics - January 1, 1950 through August 31, 2020:

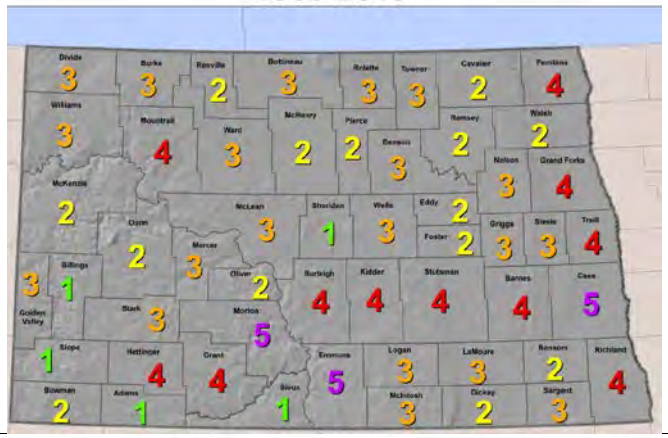
- Total number of tornadoes: 48
- Deaths: 1 (1 on 07-01-1952)
- Injuries: 28 (26 on 07-01-1952, 2 on 11-01-2000)
- Highest rated tornado (EF) 2007-2019: EF1 (86 to 110 mph) on July 16, 2011 5:35 PM CDT to 5:46 PM CDT. Length: 4.05 miles from 8.5 miles north of Regan to 12.5 miles north of Regan. Width: 50 yards. Deaths: 0. Injuries: 0
- Highest rated tornado (F) 1950-2006: F4 (207-260 mph) on July 01, 1952 (data lists two F4 tornadoes on 07-01-1952). Length: 28 miles. Width: 150 yards. Deaths: 1. Injuries: 26.

Risk: Frequency – History

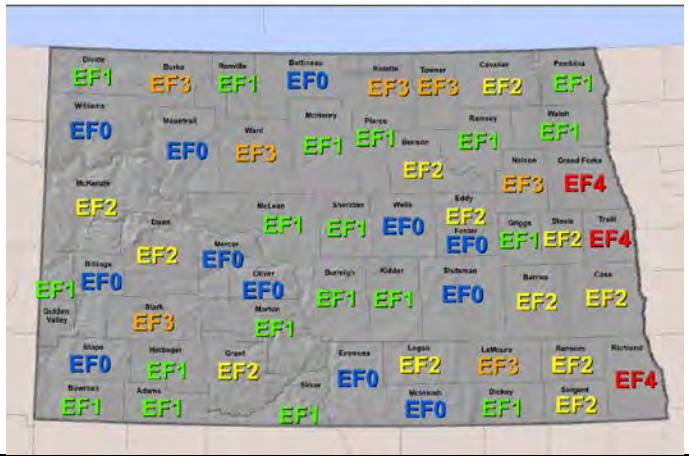
Tornadoes by County 1950-2019



Highest Rated Tornado (F/EF) 1950-2019



Highest Rated Tornado (EF) 2007-2019



Source: https://www.weather.gov/bis/ndtorhistory
http://www.ncdc.noaa.gov/stormevents/

For a tornado to be counted in these statistics, it must be reported, and it is entirely possible for a tornado to occur in the state without anyone knowing it.

Note that these findings may be more indicative of the spotter networks in the state rather than the actual occurrence. The state also conducts cloud seeding operations in the western part of the state for hail suppression.

During the 63-year period from January 1950 to March 2013, 1,477 tornadoes were reported in North Dakota with an estimated $170,126,270 in property damage, $2,700,417 in average annualized property damage, 25 deaths, and 326 injuries. Most of the injuries occurred to people who were inside their homes, outside, or driving a vehicle. (National Climatic Data Center, 2013)

Based on the historical record, the following can be expected on average in North Dakota:
In an average year, 23 reported tornadoes resulting in about $2.7 million in combined property and crop damage and 5 injuries. Fatalities are possible, averaging one every other year over the past 63 years.

Reported tornado and severe thunderstorm events over the past several decades provide an acceptable framework for determining the magnitude of summer storms that can be expected and should be planned for. For tornadoes, even though only a few counties have experienced F5/EF5 tornadoes, all counties could experience tornadoes of this magnitude. The Federal Emergency Management Agency places the majority of North Dakota in Zone II (160 mph) for structural wind design; however, southeastern and south central North Dakota are in Zone III (200 mph). (Federal Emergency Management Agency, 2004)

Deadly Tornadoes in North Dakota 1950-2018

Location	Date	Magnitude	Fatalities	Injuries
Burleigh and Kidder Counties	July 1, 1952	F4	*2 fatalities (1 per county)	*26 injuries (total from both counties)
Morton County	May 29, 1953	F5	2 fatalities	20 injuries
Richland County	July 2, 1955	F4	2 fatalities	19 injuries
Cass County	June 20, 1957	F5	*10 fatalities	103 injuries
Cavalier County	June 24, 1966	F1	1 fatality	1 injury
Hettinger County	June 29, 1975	F4	1 fatality	4 injuries
Elgin, Grant County	July 4, 1978	F4	5 fatalities	35 injuries
12 miles South of Greene Renville County	July 23, 1997	F2	1 fatality	2 injuries
Northwood, Grand Forks County	August 26, 2007	EF4	1 fatality	18 injuries
10 miles north-northeast of Niobe, Ward County	August 12, 2010	EF3	1 fatality	1 injury

Source: 2018 NDDES Mitigation Plan *NWS corrections – local Bismarck Office.

Statewide Statistics (1950 through 2019):

- Tornado deaths 27.
- Tornado injuries 388.
- Earliest tornado (calendar year) March 26, 2003 Stutsman County.
- Latest tornado (calendar year) November 1, 2000 Bismarck/Mandan area.
- Most tornadoes in a year is 61 in 1999.
- Least tornadoes in a year is 2 in 1950, 1951, and 1961.
- Most tornadoes in a calendar day is 24 on June 11, 1976.
- Most tornadoes in any 24-hour period is 29 on June 11-12, 1976.
- There were 30 tornadoes, 24 on June 11 and 6 on June 12. One occurred outside the 24-hour window.
- NCDC web site is missing June 1993 (11 tornadoes in 12 counties) and July 1993 (22 tornadoes in 23 counties) data.
- There were 5 tornadoes in 5 counties in August for a total of 38 in 40 for the year. NCDC web site is missing 3 tornadoes in Kidder County, 07-01-1952, 06-17-1956, and 07-04- 1960. They are listed for Burleigh County and based on LAT/LON most likely crossed into Kidder County.

This data was compiled from several sources and contains the best information available. Due to difficulties inherent in the collection of weather data it may not be all inclusive.
https://www.weather.gov/bis/ndtorhistory

Data Limitations (statewide):

Summer storms can be such isolated events that the vulnerability to a particular area can be hard to determine. Weather data is often limited by the observations taken, and events in the National Climatic Data Center database are only recorded if reported to the National Weather Service. The addition of trained spotters to the area may improve data collection.

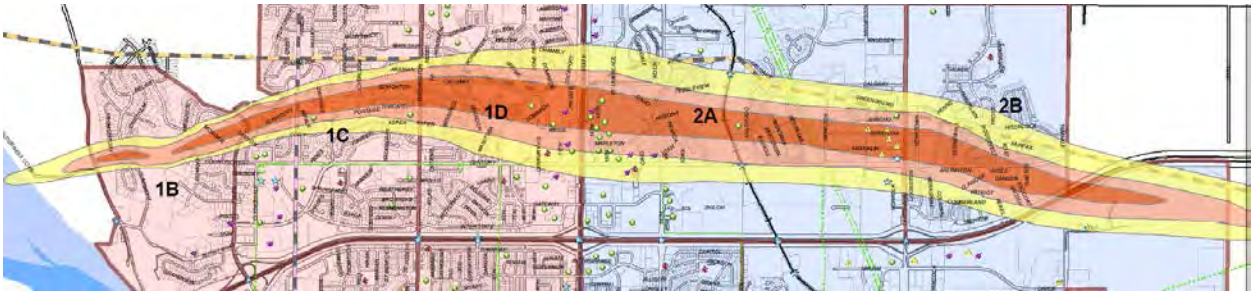
Burleigh County: January 1, 1996 – August 31, 2020 (**20 Tornado Events)**

*Location	Date	Start Time	End Time	Magnitude	Length (miles)	Width (yards)	Deaths	Injuries	Property Damage
REGAN	07/16/2011	16:35	16:46	EF1	4.05	50	0	0	10.00K
MENOKEN	08/11/2008	12:08	12:12	EF0	1.38	35	0	0	0.00K
BALDWIN	07/28/2008	20:25	20:31	EF0	3.72	40	0	0	0.00K
BALDWIN	07/10/2008	17:10	17:13	EF0	0.5	30	0	0	0.00K
STERLING	06/16/2007	23:57	23:59	EF0	1	30	0	0	0.00K
MOFFIT	06/16/2007	23:25	23:30	EF0	1	30	0	0	0.00K
BISMARCK ARPT	06/06/2005	23:02	23:07	F1	1	60	0	0	0.00K
BISMARCK	06/23/2002	18:55	18:55	F0	2	40	0	0	0.00K
DRISCOLL	05/30/2001	13:50	14:00	F0	0	30	0	0	0.00K
WILTON	11/01/2000	15:05	15:05	F0	2	40	0	0	0.00K
BISMARCK	11/01/2000	14:33	15:00	F2	5	100	0	0	55.00K
BISMARCK	11/01/2000	13:55	14:05	F1	3	50	0	2	0.00K
ARENA	06/25/1999	21:24	21:27	F1	2	30	0	0	0.00K
WING	06/06/1999	13:20	13:20	F0	0.5	10	0	0	0.00K
REGAN	06/06/1999	12:30	12:30	F0	0.5	15	0	0	20.00K
DRISCOLL	06/03/1999	16:50	16:50	F1	2	30	0	0	75.00K
DRISCOLL	06/03/1999	16:43	16:43	F0	4	15	0	0	0.00K
BISMARCK	06/18/1998	14:10	14:15	F0	0.2	33	0	0	0.00K
WILTON	05/13/1998	20:10	20:30	F0	6	100	0	0	0.00K
BISMARCK	08/05/1997	17:10	17:13	F0	0.2	10	0	0	0.00K

*Use Ctrl + Click on location name in table for more information.

Exercise Scenario Impact Analysis – NOT a real event

Approximately 7 miles long and ½ to ¾ mile wide at widest point



Estimated Population within impacted area: 8,170

Total Number of Buildings/Structures with a building value greater than zero: 2,815

Estimated Building Value (Bismarck) within tornado path: $761,652,100

Estimated Building Value (Bismarck/Burleigh): $763,114,300

Plus 217 exempt properties, building values not included in estimates above.

Infrastructure, facilities, and population impacted within the exercise scenario tornado path include: 2 nursing home facilities, 1 assisted living facility, 1 high school, 1 private college, 3 day care centers, 6 Tier II facilities (hazmat sites), 1 ambulance station, 7 hotels, 1 clinic, 1 apartment complex, 3 mobile home parks, the landfill, 1 railroad crossing, 1 water tower, 2 state critical facilities, 1 mall, 1 bus service company, 1 home improvement store, 1 supermarket, and 2 churches.

Magnitude of the event can vary greatly depending on the EF Scale applied to the scenario.

Deadly Tornadoes in Burleigh County

Location	Date	Magnitude	Casualties
Burleigh and Kidder Counties	July 1, 1952	F4 28 miles long 150 yards wide	1 fatality 25 injuries

November 1, 2000:
A tornado event on the 1st of November was a rare and unusual weather phenomenon to occur so late in the year in North Dakota. Five tornadoes hit south-central North Dakota, causing property damage and injuries. The majority of the damage and injuries occurred in the Bismarck area. Forty-two homes suffered minor to moderate damage. The tornadoes were rated F0 and F1, packing winds up to 90 mph. Another unusual phenomenon, these tornadoes traveled from east to west. The track was caused by an intense low-pressure system, centered over north-central South Dakota, spinning counterclockwise, allowing the low-level flow over Bismarck to move east to west. At the same time, these tornadoes were occurring, snow began to fall in the far western area of North Dakota. Winter storm watches and warnings were posted across north-west and central North Dakota that afternoon. Before this, the last recorded tornado to occur in the state was October 11th, 1979, in Sargent County in southeast North Dakota. https://www.weather.gov/abr/This_Day_in_Weather_History_Nov_01



The map above of the five tornadoes is from the Midwest Regional Climate Center

June 18, 1965: EF0 Tornado touched down in SW Bismarck at 7:55 PM. One-tenth of a mile and only 10 yards wide near the intersection of Anderson Street and Garden Drive.
Source: NWS Storm Prediction Center http://www.spc.noaa.gov/gis/svrgis/ and on record at the Bismarck NWS office.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: Loss / Impact and Vulnerabilities are assumed to be cumulative from previous columns to the left. Tornado intensity is determined AFTER the incident and is based on level of damage.

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Probability	"Possible" *Highest Probability* *(and frequency)*	"Possible" *Lower Probability* *(and frequency)*	"Unlikely" *Lowest Probability* *(and frequency)*
Speed of Onset	15 minutes approximately	15 minutes approximately	15 minutes approximately
Geographic Area	300 yards wide 1 to 2 miles long is typical	1 mile wide is possible but wide rare (EF3) 1 to 2 miles long Is typical – can be longer	1 mile wide is possible but rare 1 to 2 miles long is typical – can be longer
Duration	5 minutes or less	5 to 15 minutes	In excess of 15 minutes
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Flying Debris *Non-secure outdoor items* A. Mobile home occupancy B. Motor Home C. Camp sites D. Being Caught Outdoors E. In a vehicle F. Insufficient shelter G. Windows H. Smaller detached buildings	1. Flying Debris *Secured items* 2. Structure collapse *Average "stick" construction* A. Homes / buildings of average "stick" construction B. High population density within "average construction" structures	1. Flying Debris 2. Structure collapse *All structures* A. All Structures B. All structures with high population density

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Mass Casualty Incident			Burleigh County July 1, 1952 1 Death 26 Injuries 28 miles long 150 yards wide Also, see Table "Deadly Tornados in ND"
Property Losses (points of vulnerability – high priority)	1. Mobile home 2. Motor Home 3. Windows/doors 4. Trees	1. Homes / buildings of average "stick" construction	1. All Structures
Environmental	1. Debris 2. Hazardous Waste debris	1. HazMat Releases 2. Oil Refinery - Mandan	1. HazMat Releases 2. Oil Refinery - Mandan
COG/COOP	1. Employee / family casualties 2. Key personnel – Orders of Succession	1. Employee / Family casualties 2. Key personnel – Orders of Succession	1. Employee / Family casualties 2. Key personnel – Orders of Succession 3. Property / Building(s) Destroyed 4. Equipment destroyed
Critical Facilities	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials	1. Response agencies (includes 911) 2. City Buildings - Airport 3. Hospitals 4. Ambulance Service

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Critical Infrastructure	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications
Schools	1. Portable Classrooms 2. Windows 3. Doors 4. Large Span roofs 5. Loss of roofing materials	High end EF 3: 1. All Schools structurally damaged 2. Loss of non-bearing walls 3. Loss of load bearing walls 4. Interior walls of 2nd floor or higher collapsed	1. Structures Destroyed Most Elementary Schools (BPS) do NOT have basements for sheltering
High Risk Facilities (chemical)	1. Windows 2. Garages/doors 3. Doors 4. Large Span Roofs	1. Windows 2. Garages/ doors 3. Doors 4. Large Span Roof	1. Water Treatment Plant 2. Waste Water Treatment Plant 3. All Haz Mat storage facilities
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor events	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor Events	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor Events
Economy (community wide)	Minor	Moderate	Catastrophic *Significant recovery challenges*
OTHER:	Mobile HazMat (truck)	Mobile Hazmat	Mobile Hazmat – including railroad

The Federal Emergency Management Agency places the majority of North Dakota in Zone II (160 mph) for structural wind design; however, southeastern and south central North Dakota are in Zone III (200 mph).

Source: Federal Emergency Management Agency, 2004 via 2014 ND DES Mitigation Plan

Generally, during tornado warnings, it's recommend that people move to a pre-designated shelter or a basement. If not available, interior rooms or hallways on the lowest floor away from windows or under a sturdy piece of furniture is recommended. Automobiles and mobile homes, even if tied down, are not safe places. North Dakota has approximately 23,471 mobile homes across the state. Given approximately 2.3 people per housing unit in the state, roughly 53,983 people are at enhanced risk from tornadoes and strong winds. Besides structure failure, wind-driven projectiles and shattered glass can injure or kill occupants. Source: NDDES 2014 Mitigation Plan.

Mobile Home Parks within Bismarck

NAME	PROPERTY ADDRESS	UNITS	POPULATION ESTIMATE
Capitol Park Village	1821 N 11th St	28	49
18th St/Thayer Av	1713 E Rosser Av	28	31
Bismarck Mobile Home Park	2406 E Thayer Av	34	78
Dakota Mobile Home Park	2520 E Broadway Av	51	89
Holiday Park	600 S 9th St	109	197
Airport Village	1437 University Dr	192	404
Century Centennial	2500 Centennial Rd	265	542
Century Park	4191 E Century Av	475	956
Colonial Estates	1501 E Bismarck Ex	282	599
Hay Creek Court	4005 NE 19th St	132	263
Parkview Estates	614 W Sweet Av	87	192
North Valley	4224 N 19th St	151	335
Skyway Park Village	1119 University Dr	397	689
Stardust Terrace	725 S 12th St	254	630
Tatley Meadows	2200 S Washington St	362	769
TOTAL		2,847	5,823

Mobile homes are regulated by HUD. The International Building Code requirements do not apply to mobile homes. Therefore, mobile homes are exempt from this particular International Building Code: Chapter 16 Structural Design - Section 1609 Wind Loads.

International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:
1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm

The table below extracted from the 2012 International Building Code is used to identify the risk category of buildings and other structures.

structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, Section 1610 for lateral soil loads and Section 1613 for earthquake loads.

1604.5 Risk category. Each building and structure shall be assigned a *risk category* in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the *risk category* shall not be taken as lower than the occupancy category specified therein.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same *risk category*, it shall be assigned the classification of the highest *risk category* corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing elementary school, secondary school or day care facilities with an occupa load greater than 250. • Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000[a]. • Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b].
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b]. • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.



Figure 1A – Safe room wind speed map 2015 (courtesy of the ICC).

https://iibec.org/giving-tornadoes-their-due/

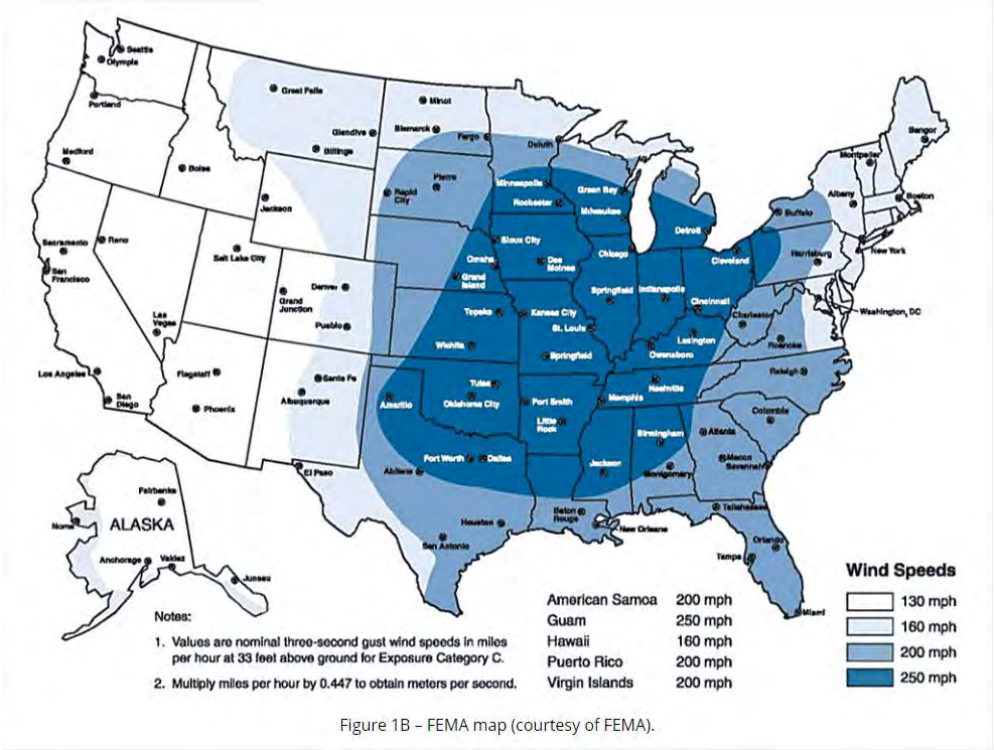
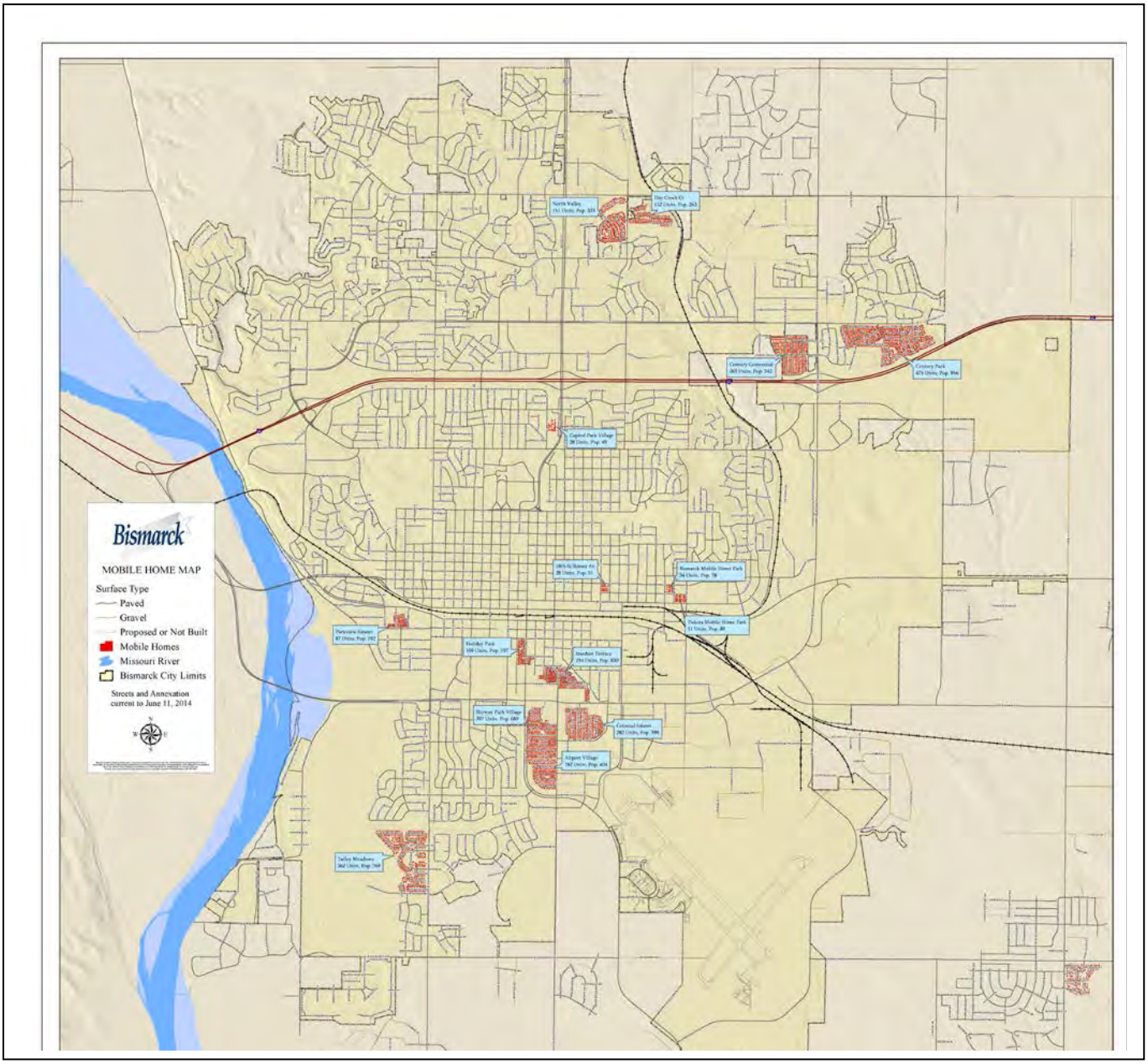


Figure 1B – FEMA map (courtesy of FEMA).

https://iibec.org/giving-tornadoes-their-due/

Bismarck Mobile Home Locations



EF0 – EF2 Vulnerabilities Summary *Based on **Damage Level Indicators** http://www.spc.noaa.gov/efscale/ef-scale.html				
***Type**	**Property Type**	**Expected Wind Speed**	**EF Scale**	**Description**
TS	Trees – Softwood	60	EF0	Small limbs broken (up to 1" diameter)
TH	Trees – Hardwood	60	EF0	Small limbs broken (up to 1" diameter)
TH	Trees – Hardwood	74	EF0	Large branches broken (up to 3" diameter)
MHSW	Single Wide Manufactured Mobile Home	74	EF0	Loss of shingles or partial uplift of one-piece metal roof covering
MHDW	Manufacture Home – Double Wide	78	EF0	Damaged porches or carports
FR12	One and Two-Family Residences	79	EF0	Loss of roof covering material (>20%), gutters and/or awning; loss of vinyl or metal siding
MHDW	Manufacture Home – Double Wide	83	EF0	Broken Windows
TS	Trees – Softwood	87	EF1	Uprooted
MHSW	Single Wide Manufactured Mobile Home	87	EF1	Unit slides off block piers but remains upright
MHDW	Manufacture Home – Double Wide	88	EF1	Uplift of roof deck and loss of significant roof covering material (>20%)
MHSW	Single Wide Manufactured Mobile Home	89	EF1	Complete uplift of roof; most walls remain standing
TH	Trees – Hardwood	91	EF1	Uprooted
MHDW	Manufacture Home – Double Wide	93	EF1	Complete uplift of roof; most walls remain standing
MHDW	Manufacture Home – Double Wide	94	EF1	Unit slides of CMU block piers
FR12	One and Two-Family Residences	96	EF1	Broken glass in doors and windows
MHDW	Manufacture Home – Double Wide	97	EF1	Removal of entire roof structure leaving most walls standing
FR12	One and Two-Family Residences	97	EF1	Uplift of rood deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport.
MHSW	Single Wide Manufactured Mobile Home	98	EF1	Unit rolls on its side or upside down; remains essentially intact
TS	Trees – Softwood	104	EF1	Trunks Snapped
MHSW	**Single Wide Manufactured Mobile Home**	**105**	**EF1**	**Destruction of roof and walls, leaving floor and undercarriage in place**
MHSW	Single Wide Manufactured Mobile Home	109	EF1	Unit rolls or vaults; roof and walls separate from floor and undercarriage
TH	Trees – Hardwood	110	EF1	Trunks Snapped
SBO	Small Barns and Farm Outbuildings (sheds)	112	EF2	Total destruction of building

MHDW	**Manufacture Home – Double Wide**	**113**	**EF2**	**Complete destruction of roof and walls leaving undercarriage in place**
MHDW	Manufacture Home – Double Wide	114	EF2	Unit rolls, displaces or vaults
MHSW	Single Wide Manufactured Mobile Home	118	EF2	Undercarriage separates from unit; rolls, tumbles and is badly bent
FSP	Free Standing Light Poles, Luminary Poles, Flag Poles	118	EF2	Collapsed Pole
ETL	Electrical Transmission Lines	118	EF2	Broken wood poles
MBS	Metal Building Systems	118	EF2	Buckling of roof purlins
SRB	Small Retail Building	119	EF2	Uplift or collapse of entire roof structure
FR12	One and Two-Family Residences	121	EF2	Entire house shifts off foundation
MAM	Masonry Apartments or Motels	121	EF2	Uplift of pre-cast or cast-in-place concrete roof decking
FR12	One and Two-Family Residences	122	EF2	Large sections of roof structure removed; most walls remain standing
SM	Strip Mall	122	EF2	Uplift or collapse of entire roof structure
M	Motels	123	EF2	Uplift or collapse of roof structure leaving most walls standing
WHB	**Warehouse Building**	**124**	**EF2**	**Collapse of pre-cast concrete tilt-up panels**
SPB	Small Professional Building	124	EF2	Uplift or collapse of entire roof structure
ACT	Apartments, Condos, and Townhouses	124	EF2	Uplift of roof decking; significant loss of roof covering (>20%)
ES	**Elementary School**	**125**	**EF2**	**Uplift or collapse of roof structure**
JHSH	**Junior or Senior High School**	**125**	**EF2**	**Uplift or collapse of roof structure**
ASR	**Automobile Showroom**	**126**	**EF2**	**Exterior Walls Collapsed**
MHSW	**Single Wide Manufactured Mobile Home**	**127**	**EF2**	**Complete destruction of unit; debris blown away**
MHSW	Single Wide Manufactured Mobile Home	127	EF2	Undercarriage separates from floor, rolls and tumbles, badly bent
ASB	**Automobile Service Building**	**128**	**EF2**	**Collapse of load-bearing walls**
LSM	Large Shopping Mall	128	EF2	Roof structure uplifted or collapsed
MROB	Mid-Rise Building	129	EF2	Broken curtain wall panel anchors
HROB	High-Rise Building	129	EF2	Broken curtain wall panel anchors
TS	Trees – Softwood	131	EF2	Trees debarked with only stubs of largest branches remaining
IB	Institutional Building	131	EF2	Damaged curtain walls or other wall cladding
FR12	**One and Two-Family Residences**	**132**	**EF2**	**Exterior walls collapsed**
FST	**Free-Standing Towers**	**133**	**EF2**	**Collapsed cell-phone tower**
SSC	Service Station Canopy	133	EF2	Complete destruction of Canopy
LRB	Low-Rise Building	133	EF2	Uplift of lightweight roof structure
MHDW	**Manufacture Home – Double Wide**	**134**	**EF2**	**Complete destruction of unit; debris blows away**
LIRB	Big Box Stores – Large Isolated Retail Building	134	EF2	Uplift and removal of roof structure

Relative Vulnerability of Property and Structure Types
*Based on **Damage Level Indicators**
Expected Wind Speed and associated EF Scale **to cause destruction of property**
http://www.spc.noaa.gov/efscale/ef-scale.html

*Type	Property Type	Expected Wind Speed	EF Scale	Description
TS	Trees – Softwood	87	EF1	Uprooted
TH	Trees – Hardwood	91	EF1	Uprooted
TS	Trees – Softwood	104	EF1	Trunks Snapped
TH	Trees – Hardwood	110	EF1	Trunks Snapped
SBO	Small Barns and Farm Outbuildings (sheds)	112	EF2	Total destruction of building
FSP	Free Standing Light Poles, Luminary Poles, Flag Poles	118	EF2	Collapsed Pole
MHSW	Single Wide Manufactured Mobile Home	127	EF 2	Complete destruction of unit; debris blown away
TS	Trees – Softwood	131	EF2	Trees debarked with only stubs of largest branches remaining
SSC	Service Station Canopy	133	EF2	Complete destruction of canopy
MHDW	Double Wide Manufactured Mobile Home	134	EF2	Complete destruction of unit; debris blown away
FST	Free Standing Tower	136	EF3	Collapsed micro-wave tower
ETL	Electrical Transmission Line	141	EF3	Collapsed metal truss towers
TH	Trees – Hardwood	143	EF3	Trees debarked with only stubs of largest branches remaining
ES	Elementary School (see additional entry below)	153	EF3	Collapse of load bearing walls
MBS	Metal Building System	155	EF3	Total destruction of building
SPB	Small Professional Building (single story, less than 5,000 sf)	157	EF3	Total destruction of entire building
ASB	Automotive Service Building	157	EF3	Complete Destruction of all or a large section of the building
ASR	Automobile Showroom	157	EF3	Complete Destruction of all or a large section of the building
WHB	Warehouse Buildings (non-metal buildings)	158	EF3	Total destruction of large section of building or entire building
SRB	Small retail building (ex: fast food restaurant)	167	EF4	Total destruction of entire building
SM	Strip Mall	171	EF4	Complete destruction of all or a large section of building

LIRB	"Big Box" Store. Large Isolated Retail Building	173	EF4	Complete Destruction of all or a large section of the building
ES	Elementary Schools	176	EF4	Total destruction of a large section of building or entire building
MAM	Masonry Apartments or Motels	180	EF4	Total destruction of large section of building
ACT	Apartments, Condos, and Townhouses (3 stories or less)	180	EF4	Almost total destruction of top two stories
ACT	Apartments, Condos, and Townhouses (3 stories or less)	>180	EF4	Total Destruction of entire building
LRB	Low Rise Building	188	EF4	Complete Destruction of all or a large section of the building
M	Motels (4 or fewer stories)	190	EF4	Total destruction of entire building
JHSH	Junior or Senior High School	192	EF4	Complete Destruction of all or a large section of the building
FR12	One and Two Family Residences	200	EF4	Destruction of engineered and/or well constructed residence; slab swept clean
LSM	Large Shopping Mall	204	EF5	Complete Destruction of all or a large section of the building
IB	Institutional building (ex: hospitals, university buildings)	210	EF5	Significant damage to building envelope
MROB	Mid-Rise building (5-20 stories)	210	EF5	Permanent structural deformation
HROB	High-Rise > 20 stories	228	EF5	Significant structural deformation

Single-Wide Mobile Homes

Damage Description	**Wind Speed Range (expected in parentheses)**
Threshold of visible damage	51-76 mph (61 mph)
Loss of shingles or partial uplift of one-piece metal roof covering	61-92 mph (74 mph)
Unit slides off block piers but remains upright	72-103 mph (87 mph)
Complete uplift of roof; most walls remain standing	73-112 mph (89 mph)
Unit rolls on its side or upside down; remains essentially intact	84-114 mph (98 mph)
Destruction of roof and walls leaving floor and undercarriage in place	87-123 mph (105 mph)
Unit rolls or vaults; roof and walls separate from floor and undercarriage	96-128 mph (109 mph)
Undercarriage separates from unit; rolls, tumbles and is badly bent	101-136 mph (118 mph)
Complete destruction of unit; debris blown away	110-148 mph (127 mph)

One and Two Family Residences

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	53-80 mph (65 mph)
Loss of roof covering material (<20%), gutters, and/or awning; loss of vinyl or metal siding	63-97 mph (79 mph)
Broken glass in doors and windows	79-114 mph (96 mph)
Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport	81-116 mph (97 mph)
Entire house shifts off foundation	103-141 mph (121 mph)
Large sections of roof structure removed, most walls remain standing	104-142 mph (122 mph)
Top floor exterior walls collapsed	113-153 mph (132 mph)
Most interior walls of top story collapsed	128-173 mph (148 mph)
Most walls collapsed in bottom floor, except small interior rooms	127-178 mph (152 mph)
Total destruction of entire building	142-198 mph (170 mph)

School Building (Junior or Senior High School)

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	55-83 mph (68 mph)
Loss of roof covering (<20%)	66-99 mph (79 mph)
Broken windows	71-106 mph (87 mph)
Exterior door failures	83-121 mph (101 mph)
Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC	85-119 mph (101 mph)
Damage to or loss of wall cladding	92-127 mph (108 mph)
Collapse of tall masonry walls at gym, cafeteria, or auditorium	94-136 mph (114 mph)
Uplift or collapse of light steel roof structure	108-148 mph (125 mph)
Collapse of exterior walls in top floor	121-153 mph (139 mph)
Most interior walls of top floor collapsed	133-186 mph (158 mph)
Total destruction of a large section of building envelope	163-224 mph (192 mph)

Source: Storm Prediction Center, 2007

Train Derailment – Hazard Profile

Description

For purposes of this plan, a train derailment is a technological or human caused transportation incident that involves a derailment of one or more engines or train cars. Bismarck has experienced three train derailment incidents since 2002. This hazard profile is intended to illustrate the risk and vulnerabilities relating to both the east/west railroad line (BNSF) as well as the north/south railroad line (DMVW) through Bismarck. The magnitude or impact of a train derailment transportation incident will vary widely depending on the incident location, product involved, and the existence of cascading hazards such as fire, explosion, and/or hazardous materials release. A train derailment transportation incident has potential to be the cause of mass casualties. A mass casualty event can be defined as an incident resulting in a number of deaths and/or injuries that overwhelms local resources and capabilities. Although Bismarck does not have primary responsibility or authority to mitigate or prevent train derailments from occurring, Bismarck has developed this mitigation plan section to better identify vulnerabilities and identify mitigation opportunities or recommendations to share with stakeholders as well as those that might be pursued at the local level.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Train Derailment Involving Hazardous Materials Release or Fire**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Significant	Significant	Significant	Moderate

Climate Change Impact:

Impact would be indirect. More extremes in weather events (ie: heat waves) can impact risk (enhance likelihood). Track failures may occur more frequently as a result of higher frequency or intensity of heat waves (track buckling/warping).

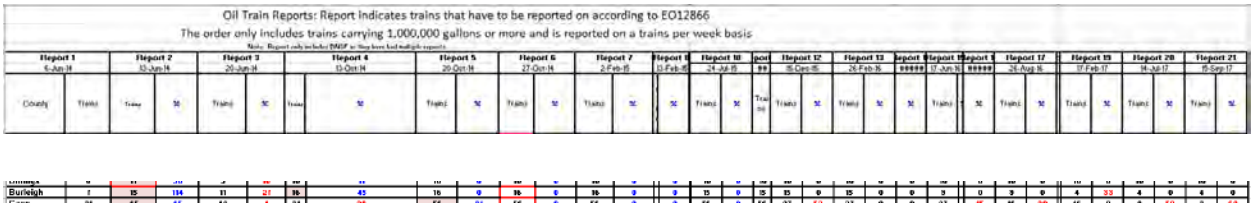
There have been no train incidents (derailment or collision) reported within the City of Bismarck or within Burleigh County since those incidents identified in the previous version of the Bismarck Multi-Hazard Mitigation plan dated 2015.

Information from the previous 2015 City of Bismarck Multi-Hazard Mitigation Plan relating to the extent of hazmat flow and risk as it relates to crude oil transported will be retained within this Train Derailment Hazard Profile to maintain an awareness of the historical data and the potential for transportation of crude oil via railroad.

The current flow of crude oil by railroad through Bismarck/Burleigh has significantly diminished due to oil pipeline recently installed as well as changes in demand (Ex: temporary reduction in demand during COVID-19 for example).

	2013	2020
# of Trains Per Day (24 hours)	18	16
Distribution:		
Coal	*8 – 44%*	*4 – 44%*
Mixed Merchandise (including hazmat)	*4 – 22%*	*4 – 25%*
Grain	*3 – 17%*	*4 – 25%*
Crude Oil	*3 – 17%*	*1 – 5%*
Average Train length (cars)	110 cars	92 cars
Train Length – High		129 cars
Train Length - Low		6 cars (local train)
Averages identified within this table were provided to Bismarck Emergency Management by a BNSF representative in January 2014 and September 2020. These averages are provided for planning purposes only. Actual number of trains will vary.		

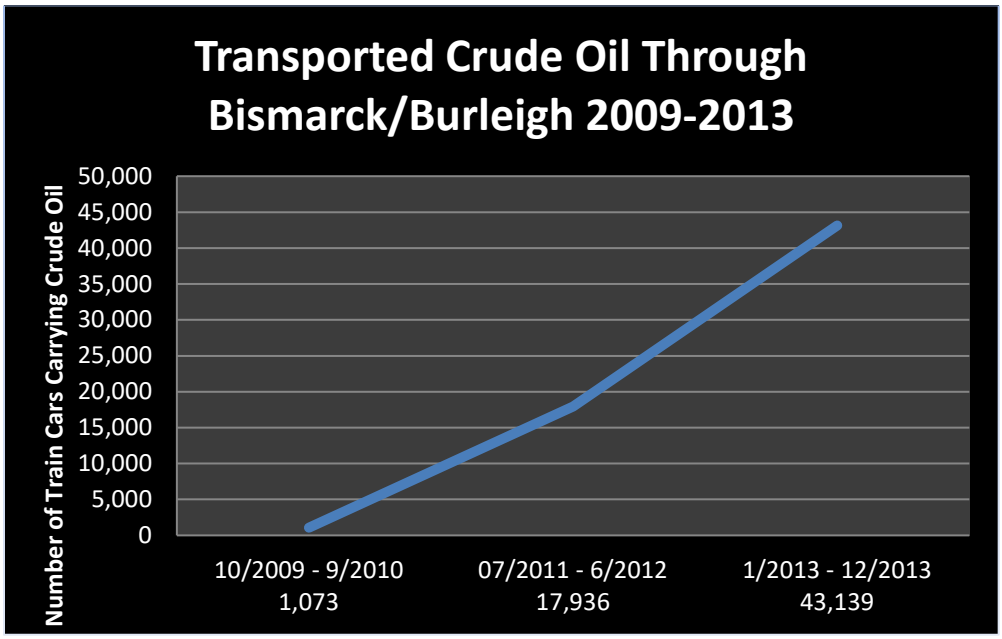
In 2013, the average number of trains carrying crude was 3 per day. During the time period of June 2014 through September 2017, the average number of crude oil trains per week was 11.8 with the number declining to a typical number of 4 oil trains per week in 2017.



Most Common Hazardous Materials in Transport by BNSF (by Loaded Car Count)	
2013	**2019**
• Petroleum Crude Oil – 85% • Liquefied Petroleum Gas – 4% • Anhydrous Ammonia – 2% • Alcohols – NOS – 2% • Diesel Fuel – 1.5% • Environmentally Hazardous Substances, Liquid NOS – 1% • Petroleum Distillates, NOS - <1	• Petroleum Crude Oil – 40% • Liquefied Petroleum Gas – 14% • Anhydrous Ammonia – 0% • Alcohols – NOS – 3% • Diesel Fuel – 5% • Environmentally Hazardous Substances, Liquid NOS – 5% • Petroleum Distillates, NOS - 14% • Butane – 4% • Elevated Temperature Liquid, NOS – 3% • Isobutane – 2% • Hydrocarbons, Liquid, NOS – 2%

Historical Data: Number of Train Cars Carrying Crude Oil

From Oct 2009 thru Sept 2010: 1,073
From July 2011 thru June 2012: 17,936 (this is the number that is contained in the HazMat flow study funded by the LEPC)
Year 2013 (Jan-Dec): 43,139



Source: Hazmat Flow Information provided by BNSF.

Train Accidents (ie: Derailments): Previous Occurrences and Causes

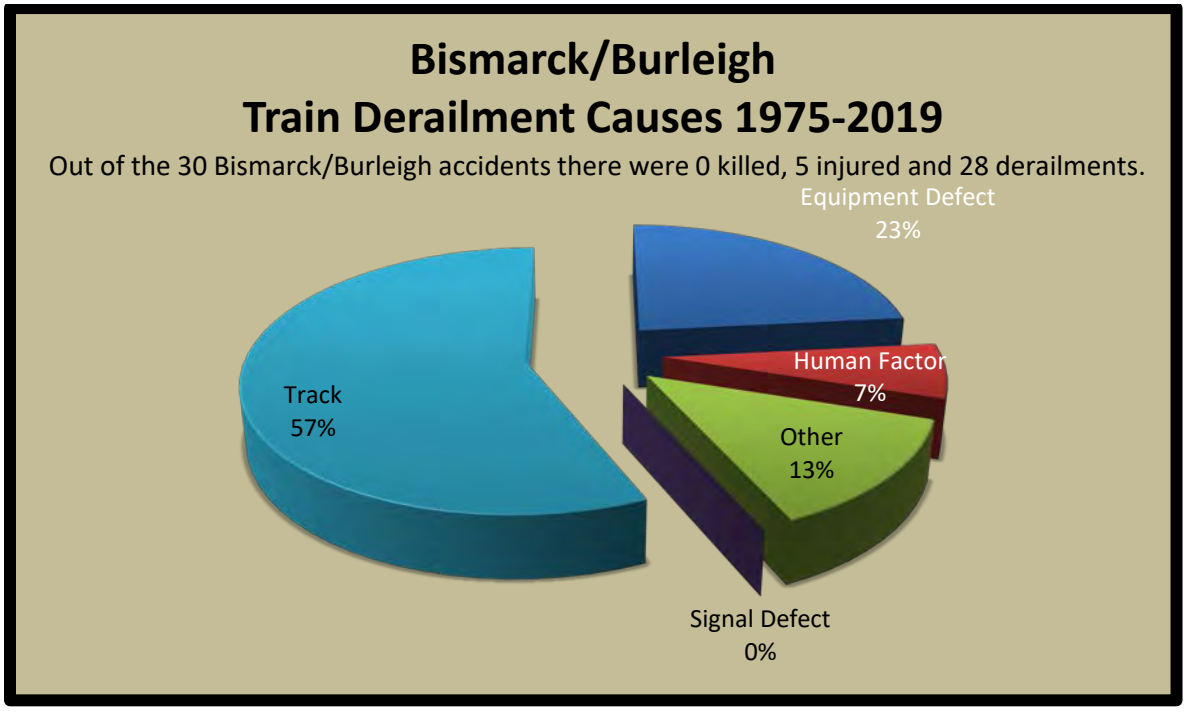
Bismarck/Burleigh Train Derailments
1975-2019 (45 years)

Unless otherwise specified, train derailment statistics within this plan section are derived by Bismarck Emergency Management from the Federal Railroad Administration website:
http://safetydata.fra.dot.gov/OfficeofSafety/Default.aspx

- **Total Number of Train Derailment Incident Reports from 1975-2019 for Burleigh County: 30**
- **Incidents In or Near Bismarck: 10 of 30**
- Incident Average within Burleigh County: 1 per 18 months (includes Bismarck)
- Incident Average with the City of Bismarck: 1 per 4.5 years

Incident Type Description:

Derailment: 28 of 30
Obstruction: 1 of 30
Explosion – Detonation: 1 of 30

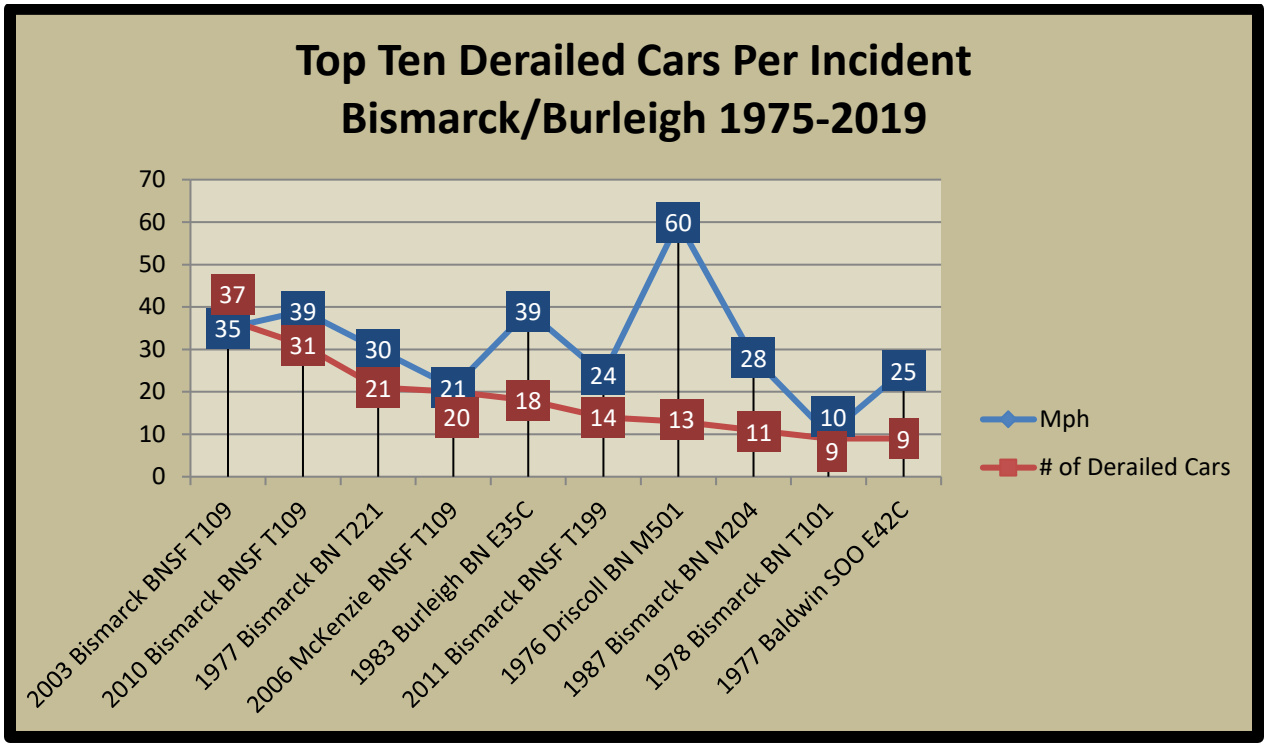


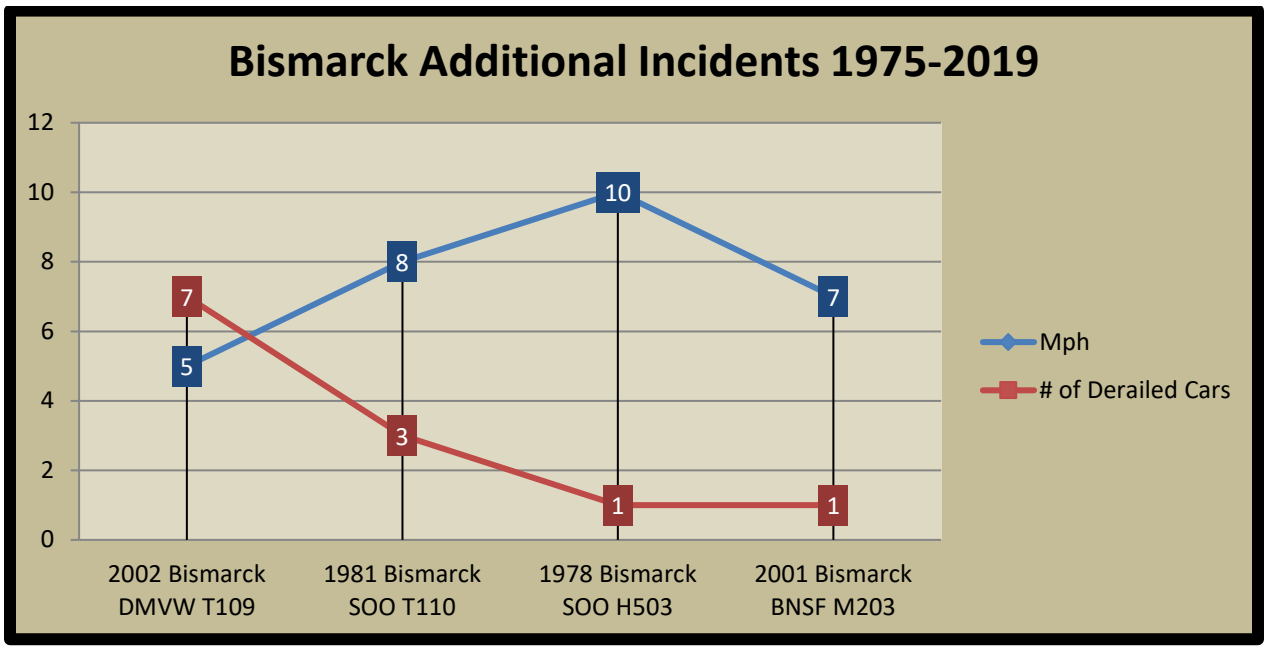
Total Derailed Cars Per Incident Report – Top Ten Bismarck/Burleigh 1975-2019					
Derailed Cars +Derailed Loco	**Year**	**Cause**	**Speed Estimated Recorded**	**Location (In or Near)**	**Rail Line**
37	2003	T109 Track alignment irregular (buckled/sunkink)	35-R	Bismarck	BNSF
31	2010	T109 Track alignment irregular (buckled/sunkink)	39 - R	Bismarck	BNSF
19+2	1977	T221 Broken Rail - Vertical split head	30 – R	Bismarck	BN
20	2006	T109 Track alignment irregular (buckled/sunkink)	21 - R	McKenize	BNSF
18	1983	E35C Coupler carrier broken or defective	39 - E	Burleigh	BN
14	2011	T199 Other track geometry defects (Provide detailed description in narrative)	24-R	Bismarck	BNSF
13	1976	M501 Interference (other than vandalism) with railroad operations by non-railroad employee	60-E	Driscoll	BN
11	1987	M204 Improperly loaded car	28-E	Bismarck	BN
9	1977	E42C Side bearing(s) broken	25-R	Baldwin	SOO
9	1978	T101 Cross level of track irregular (at joints)	10-E	Bismarck	BN
Bismarck (In or Near) Additional Incidents					
7	2002	T109 Track alignment irregular (buckled/sunkink)	5-E	Bismarck	DMVW
3	1981	T110 Wide gage (due to defective or missing crossties)	8-R	Bismarck	SOO
1	1978	H503 Buffing or slack action excessive, train handling	10-E	Bismarck	SOO
1	2001	M203 Overloaded car	7-R	Bismarck	BNSF

Deaths, Injuries, and Evacuations per Train Incident Reports Bismarck/Burleigh 1975-2019					
# of Deaths	**# of Injuries**	**People Evacuated**	**Year**	**Location**	**Railroad**
0	2	0	1995	Sterling	BN
0	1	0	1987	Regan	BN
0	1	0	1977	Bismarck	BN
0	1	0	1976	Driscoll	BN
No deaths or evacuations reported for Bismarck/Burleigh Incidents from 1975-2019.					

Two Incident Reports Involving Hazardous Materials 1975-2019					
# of Hazmat Cars Derailed Or Damaged	**Total # of Hazmat Cars**	**Total # of Cars**	**Incident Year**	**Location**	**Railroad**
0	3	81	1976	Driscoll	BN
0	1	17	1978	Bismarck	SOO

Product Involved – Train Derailments				
Incident Date	**Railroad**	**Location**	**Description**	**Product**
March 18, 2011	BNSF	East Main – near 100 block of South Airport Road. Blocked 26th street crossing	14 coal cars derailed – 13 destroyed. The train blocked several crossings including 26th Street and Airport Road.	Coal Cars - 14
July 10, 2010	BNSF	Near 93rd Street	Rail cars filled with coal derailed and were lying on the bank of the Apple Creek east of Bismarck.	Coal Cars - 30
July 5, 2003	BNSF	Near State Penitentiary in Bismarck	Coal was spilled against the trestle on the Expressway Bridge. No cars hit the bridge.	Coal Cars – 37 100 ton of coal each
September 5, 2002	DMVW	Intersection of Rosser and North 35th Street	Dakota Missouri Valley & Western Railroad authorities said they believe work on the tracks and 90-degree heat caused the rails to shift outward about four feet and the train to derail at 3:30 p.m. (source: Bismarck Tribune)	Fly Ash 7 Cars


Top Ten Derailed Cars Per Incident
Bismarck/Burleigh 1975-2019
70
60
50
40
30
20
10
0
37
35
39
31
30
21
21
20
39
18
24
14
60
13
28
11
10
9
25
9
2003 Bismarck BNSF T109
2010 Bismarck BNSF T109
1977 Bismarck BN T221
2006 McKenzie BNSF T109
1983 Burleigh BN E35C
2011 Bismarck BNSF T199
1976 Driscoll BN M501
1987 Bismarck BN M204
1978 Bismarck BN T101
1977 Baldwin SOO E42C
Mph
# of Derailed Cars


Bismarck Additional Incidents 1975-2019
12
10
8
6
4
2
0
5
7
8
3
10
1
7
1
2002 Bismarck
DMVW T109
1981 Bismarck
SOO T110
1978 Bismarck
SOO H503
2001 Bismarck
BNSF M203
Mph
# of Derailed Cars

Statewide Train Accidents (Derailments) Summary – **January 2015 through August 31, 2020**:

- 71 total derailments
- Total killed: 0
- Total injuries: 0

https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/AccidentByStateRailroadSQL.aspx

Statewide - Top 10 Derailments: Total Train Cars Derailed
January 2015 through August 31, 2020

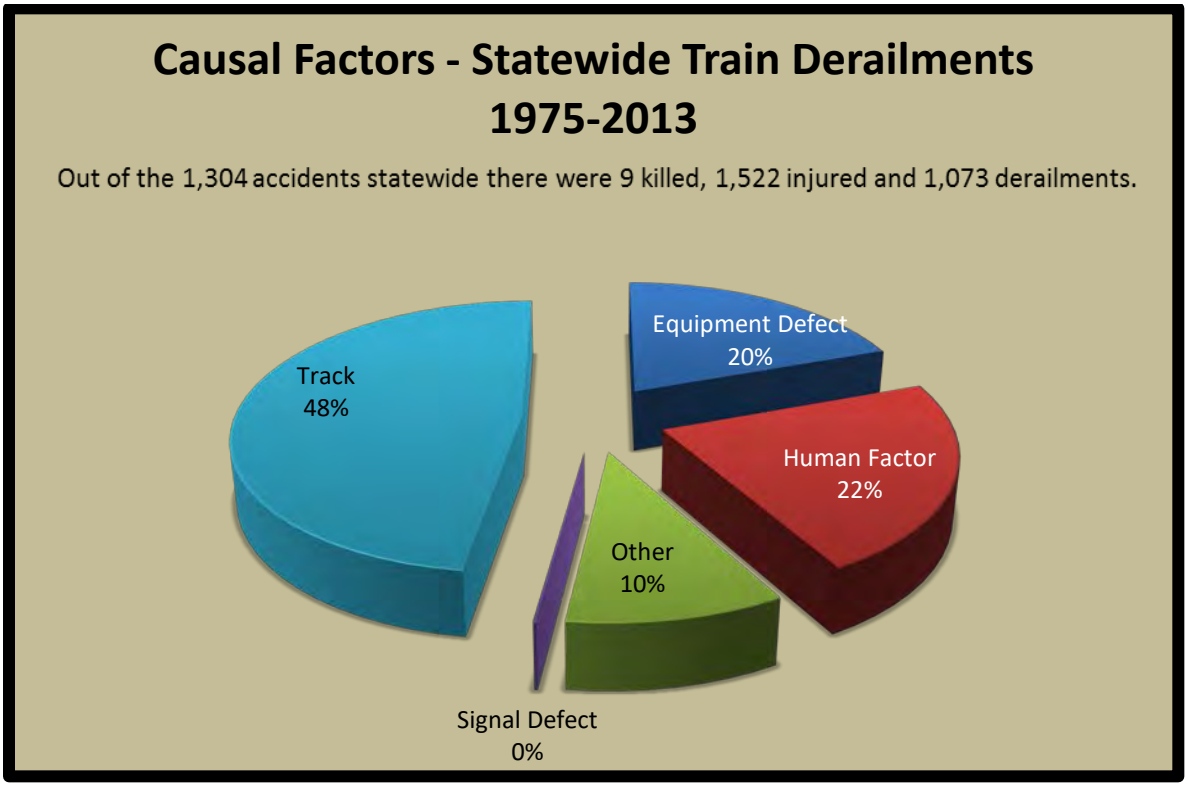
# of Cars Derailed*	County	Date	Primary Cause Code	Cause Description	Cause Category	Speed
35	Foster	March 2, 2019	T201	Broken Rail - Bolt hole crack or break	Rack, Roadbed and Structures	49
20	Foster	April 26, 2020	T001	Roadbed settled or soft	Rack, Roadbed and Structures	50
19	McHenry	February 5, 2018	E61C	Broken rim	Mechanical and Electrical Failures	26
16	Ward	January 29, 2019	T210	Broken Rail - Head and web separation (outside joint bar limits)	Rack, Roadbed and Structures	13
12	Cass	March 7, 2018	H402	Motor car or on-track equipment rules, failure to comply	Train operation - Human Factors	10
12	Foster	April 26, 2020	T001	Roadbed settled or soft	Rack, Roadbed and Structures	0
11	Dickey	March 27, 2018	T110	Wide gage (due to defective or missing crossties)	Rack, Roadbed and Structures	9
9	Mercer	March 23, 2017	T212	Broken Rail - Horizontal split head	Rack, Roadbed and Structures	9
8	Ward	April 6, 2020	E46C	Truck bolster stiff, improper swiveling	Mechanical and Electrical Failures	9
8	Cavalier	June 27, 2015	M102	Extreme environmental condition - TORNADO	Miscellaneous Causes Not Otherwise Listed	0
8	Dickey	April 17, 2019	T001	Roadbed settled or soft	Rack, Roadbed and Structures	8

* None of these derailments included a derailed locomotive.

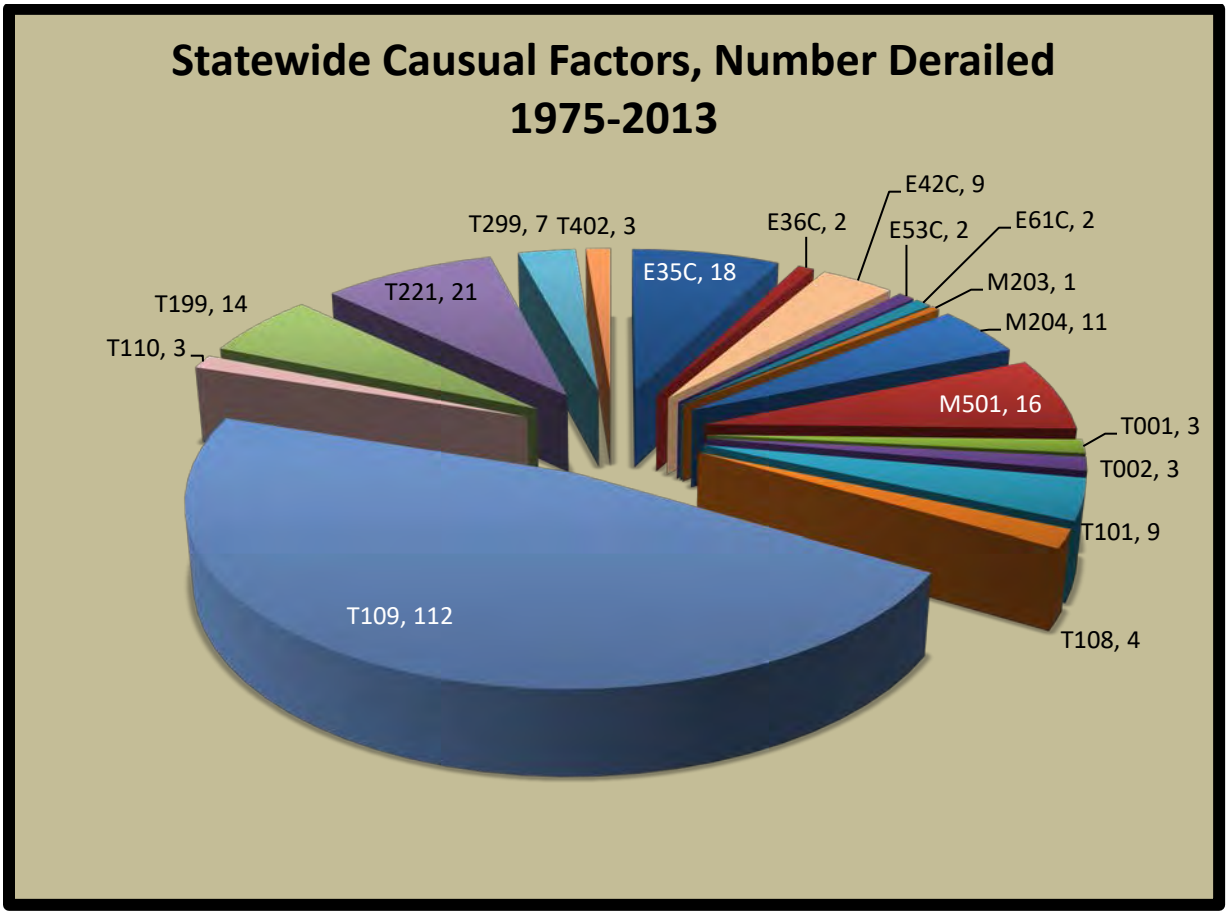
Statewide – Derailments including Derailed Locomotives January 2015 through August 31, 2020						
# of Locomotives Derailed	**County**	**Date**	**Primary Cause Code**	**Cause Description**	**Cause Category**	**Speed**
3	Ransom	October 4, 2019	T111	Wide gage (due to defective or missing spikes or other rail fasteners)	Track Geometry	8
2	Billings	July 12, 2017	H607	Failure to comply with restricted speed or its equivalent not in connection with a block or interlocking signal.	Train operation - Human Factors	4
2	Ward	September 11, 2015	H702	Switch improperly lined	Train operation - Human Factors	7
2	Williams	January 7, 2016	H702	Switch improperly lined	Train operation - Human Factors	7
2	Stark	October 17, 2018	H704	Switch previously run through	Train operation - Human Factors	10
2	Walsh	August 9, 2019	T109	Track alignment irregular (buckled/sunkink)	Track Geometry	25
Eleven additional derailments involved one locomotive each.						

Summary of Derailment Causes – Primary Cause: **January 2015 through August 31, 2020**

# reported	Primary Cause Code	Cause Description	Cause Title	Cause Category
9	T001	Roadbed settled or soft	Rack, Roadbed and Structures	Roadbed
8	H702	Switch improperly lined	Train operation - Human Factors	Switches, Use of
4	H607	Failure to comply with restricted speed or its equivalent not in connection with a block or interlocking signal.	Train operation - Human Factors	Speed
In addition, 12 were identified as “Mechanical and Electrical Failures” (Cause Title), 10 were identifies as “Roadbed” (Cause Category), 5 were identified as “Track Geometry” (Cause Category), and 28 were identified as “Train operation – Human Factors” (Cause Title).				

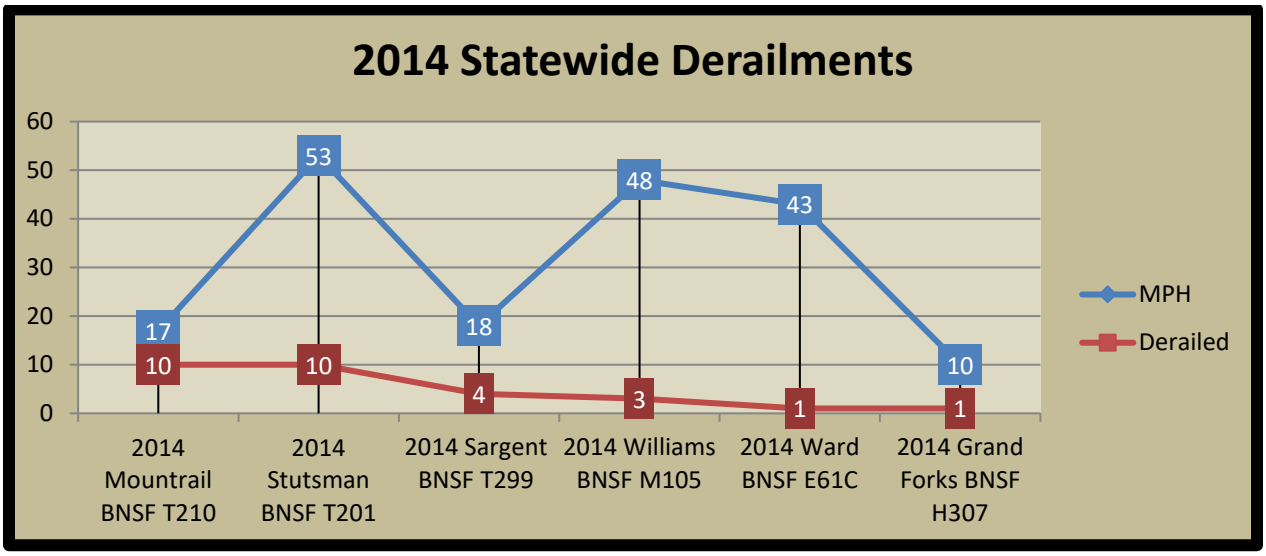


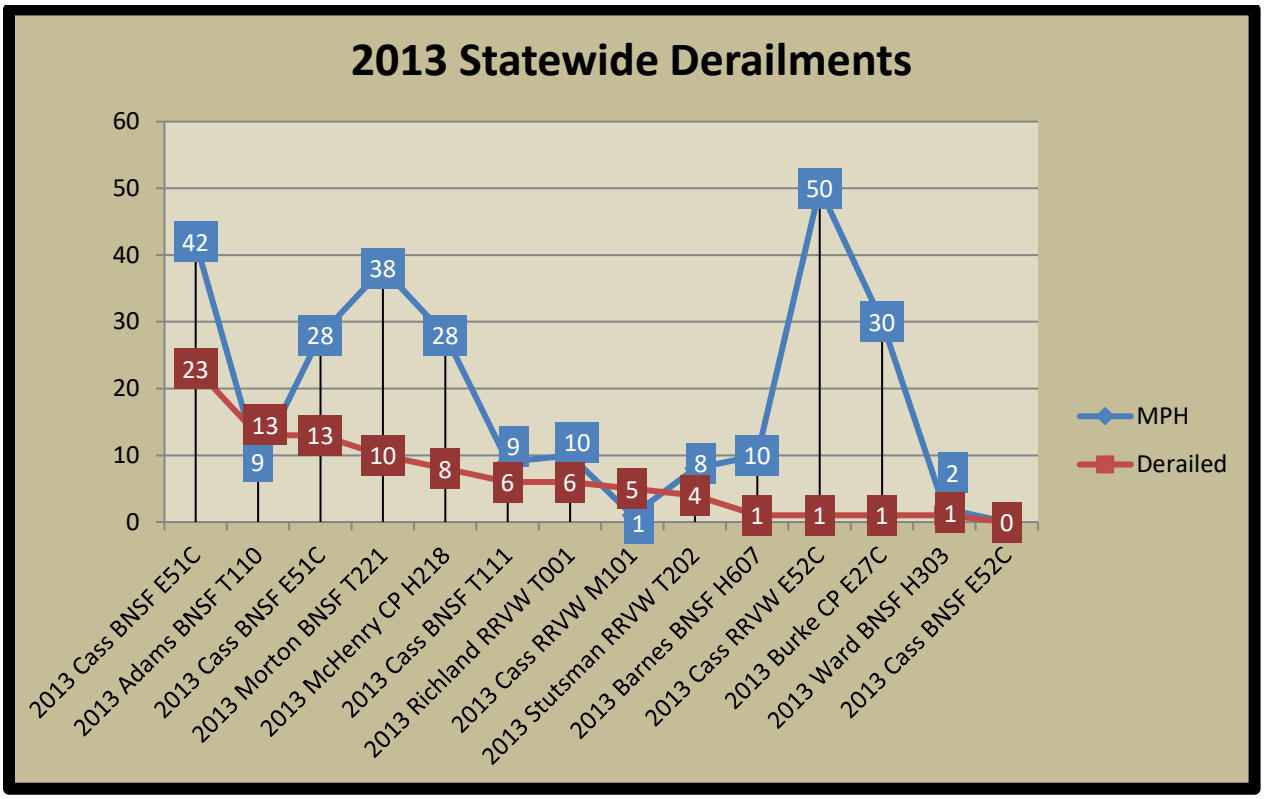
*Traffic accidents at railroad crossings that do not result in a train derailment are not included in the totals.



E35C Coupler carrier broken or defective
E36C Coupler shank broken or defective (includes defective alignment control)
E42C Side bearing(s) broken
E53C Journal (roller bearing) failure from overheating
E61C Broken rim
M203 Overloaded car
M204 Improperly loaded car
M501 Interference (other than vandalism) with railroad operations by no railroad employee
T001 Roadbed settled or soft
T002 Washout/rain/slide/flood/snow/ice damage to track
T101 Cross level of track irregular (at joints)
T108 Track alignment irregular (other than buckled/sunkink)
T109 Track alignment irregular (buckled/sunkink)
T110 Wide gage (due to defective or missing crossties)
T199 Other track geometry defects
T221 Broken Rail - Vertical split head
T299 Other rail and joint bar defects (Provide detailed description in narrative)
T402 Flangeway clogged

The following four charts illustrate the number of train cars derailed in relation to the speed. Although the charts demonstrate that fewer cars derail with lower speeds (in general), it's also demonstrated that lower speeds do not always result in fewer cars derailed, and higher speeds do not always result in more cars derailed.





Potential Magnitude

Actual Incidents may be used to estimate the potential magnitude of a significant train derailment incident involving fire, explosion, and/or hazardous materials.

Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia.	
Minot, North Dakota January 18, 2002	NTSB Number: RAR-04-01 NTIS Number: PB2004-916301. Adopted March 9, 2004

Executive Summary:
At approximately 1:37 a.m. on January 18, 2002, eastbound Canadian Pacific Railway freight train 292-16, traveling about 41 mph, derailed 31 of its 112 cars about 1/2 mile west of the city limits of Minot, North Dakota. Five tank cars carrying anhydrous ammonia, a liquefied compressed gas, catastrophically ruptured, and a vapor plume covered the derailment site and surrounding area. The conductor and engineer were taken to the hospital for observation after they complained of breathing difficulties. About 11,600 people occupied the area affected by the vapor plume. One resident was fatally injured, and 60 to 65 residents of the neighborhood nearest the derailment site were rescued. As a result of the accident, 11 people sustained serious injuries, and 322 people, including the 2 train crewmembers, sustained minor injuries. Damages exceeded $2 million, and more than $8 million has been spent for environmental remediation.

Probable Cause
The National Transportation Safety Board determines that the probable cause of the derailment of Canadian Pacific Railway train 292-16 was an ineffective Canadian Pacific Railway inspection and maintenance program that did not identify and replace cracked joint bars before they completely fractured and led to the breaking of the rail at the joint. Contributing to the severity of the accident was the catastrophic failure of five tank cars and the instantaneous release of about 146,700 gallons of anhydrous ammonia.
The safety issues identified in this accident were as follows:

- Canadian Pacific Railway's programs and practices for the inspection and maintenance of joint bars in its continuous welded rail;
- The Federal Railroad Administration's oversight of continuous welded rail maintenance programs;
- Tank car crashworthiness, specifically the adequacy of non-normalized steels to resist tank fracture propagation.

The analysis also addresses the appropriateness of using shelter-in-place to protect the public from the release of hazardous material.

http://www.ntsb.gov/investigations/summary/RAR0401.html

Casselton Train Derailment – Preliminary Report	
Near Casselton, North Dakota December 30, 2013	**PRELIMINARY REPORT** (January 13, 2014) **RAILROAD DCA14MR004** *The information in this report is preliminary and will be supplemented or corrected during the course of the investigation.*

On December 30, 2013, about 1411 central standard time, a westbound BNSF Railway (BNSF) grain train, G-RYLRGT9-26A, derailed 13 cars at milepost 28.5 near Casselton, North Dakota. The grain train, operating on main track 1, consisted of two head-end locomotives, one rear distributed power locomotive, and 112 cars. One of the derailed cars, the 45th car from the head end, fouled main track 2. An eastbound BNSF petroleum crude oil unit train, U-FYNHAY4-05, operating on main track 2 collided with the derailed car that was fouling main track 2 and derailed the head-end locomotives and the first 21 cars of the train. The petroleum crude oil unit train consisted of two head-end locomotives, one rear distributed power locomotive, and 106 cars.
Local emergency officials coordinated a voluntary evacuation of about 1,400 people from Casselton. No injuries to the public were reported.

The grain train was traveling about 28 mph when it went into an emergency brake application. The petroleum crude oil unit train was traveling about 43 mph when the train crew initiated an emergency brake application. The train was traveling about 42 mph when the collision occurred. Damage was estimated at $6.1 million**.** The accident occurred in daylight with weather conditions of overcast skies, a temperature of -1° F, and wind from the north at 7 mph.
National Transportation Safety Board (NTSB) investigators have completed the on-scene work near Casselton. The investigation will continue at the NTSB headquarters in Washington, D.C. Preliminary results of the investigation include the following:
• Twenty-one cars from the petroleum crude oil unit train derailed along with the two lead locomotives. Twenty of the tank cars were carrying petroleum crude oil; one was a hopper car carrying sand.
• Of the 20 tank cars that derailed, 18 were breached (punctured).
• Initial estimates are that more than 400,000 gallons of crude oil was released.
• From January 1–3, 2014, investigators interviewed the train crews and first responders. Interview transcripts will be included in the public docket upon release.
• A broken axle and two wheels were shipped to the NTSB materials laboratory in Washington, D.C., for further evaluation and analysis.
• Locomotive event and video recorders were also sent to the NTSB materials laboratory in Washington, D.C., for further analysis.

http://www.ntsb.gov/doclib/reports/2014/Casselton_ND_Preliminary.pdf

Lac-Mégantic runaway train and derailment investigation summary

The accident

On the evening of July 5, 2013, at about 10:50 p.m., a Montreal, Maine & Atlantic Railway (MMA) train arrived at Nantes, Quebec, carrying 7.7 million liters of petroleum crude oil in 72 Class 111 tank cars. Originating in New Town, North Dakota, these were bound for Saint John, New Brunswick.

In keeping with the railway's practice, after arriving in Nantes, the locomotive engineer (engineer) parked the train on a descending grade on the main track. A replacement engineer was scheduled to continue the trip east in the morning.

The engineer applied hand brakes on all five locomotives and two other cars, and shut down all but the lead locomotive. Railway rules require hand brakes alone be capable of holding a train, and this must be verified by a test. That night, however, the locomotive air brakes were left on during the test, meaning the train was being held by a combination of hand brakes and air brakes. This gave the false impression that the hand brakes alone would hold the train.

The engineer then contacted the rail traffic controller in Farnham, Quebec, to advise that the train was secure. Next, the engineer contacted the rail traffic controller in Bangor, Maine, who controls movements for the crews east of Lac-Mégantic. During this conversation, the engineer indicated that the lead locomotive had experienced mechanical difficulties throughout the trip, and that excessive black and white smoke was coming from its smoke stack. Because they expected the smoke to settle, it was agreed to leave the train as it was and deal with the situation the next morning.

Shortly after the engineer left, the Nantes Fire Department responded to a 911 call reporting a fire on the train. After shutting off the locomotive's fuel supply, the firefighters moved the electrical breakers inside the cab to the off position, in keeping with railway instructions. They then met with an MMA employee, a track foreman who had been dispatched to the scene but who did not have a locomotive operations background.

Once the fire was extinguished, the firefighters and the track foreman discussed the train's condition with the rail traffic controller in Farnham, and departed soon afterward. With all the locomotives shut down, the air compressor no longer supplied air to the air brake system. As air leaked from the brake system, the main air reservoirs were slowly depleted, gradually reducing the effectiveness of the locomotive air brakes. Just before 1 a.m., the air pressure had dropped to a point at which the combination of locomotive air brakes and hand brakes could no longer hold the train, and it began to roll downhill toward Lac-Mégantic, just over seven miles away.

As it moved down the grade, the train picked up speed, reaching a top speed of 65 mph. It derailed near the center of the town at about 1:15 a.m.

Aftermath and emergency response

Almost all of the 63 derailed tank cars were damaged, and many had large breaches. About six million liters of petroleum crude oil was quickly released. The fire began almost immediately, and the ensuing blaze and explosions left 47 people dead. Another 2000 people were forced from their homes, and much of the downtown core was destroyed.

The pileup of tank cars, combined with the large volume of burning petroleum crude oil, made the firefighters' job extremely difficult. Despite the challenges of a large emergency, the response was well coordinated, and the fire departments effectively protected the site and ensured public safety after the derailment.

http://www.tsb.gc.ca/eng/rapports-reports/rail/2013/r13d0054/r13d0054-r-es.asp

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Vulnerabilities identified within the table are within ½ mile of the railroad. The properties and populations noted in the table are representative of the significant vulnerabilities within ½ mile radius of the railroad lines. Due to the extensive number of properties within a ½ mile, not all are listed.
Maps illustrating the ½ mile radius from the railroad lines follow the vulnerability table.

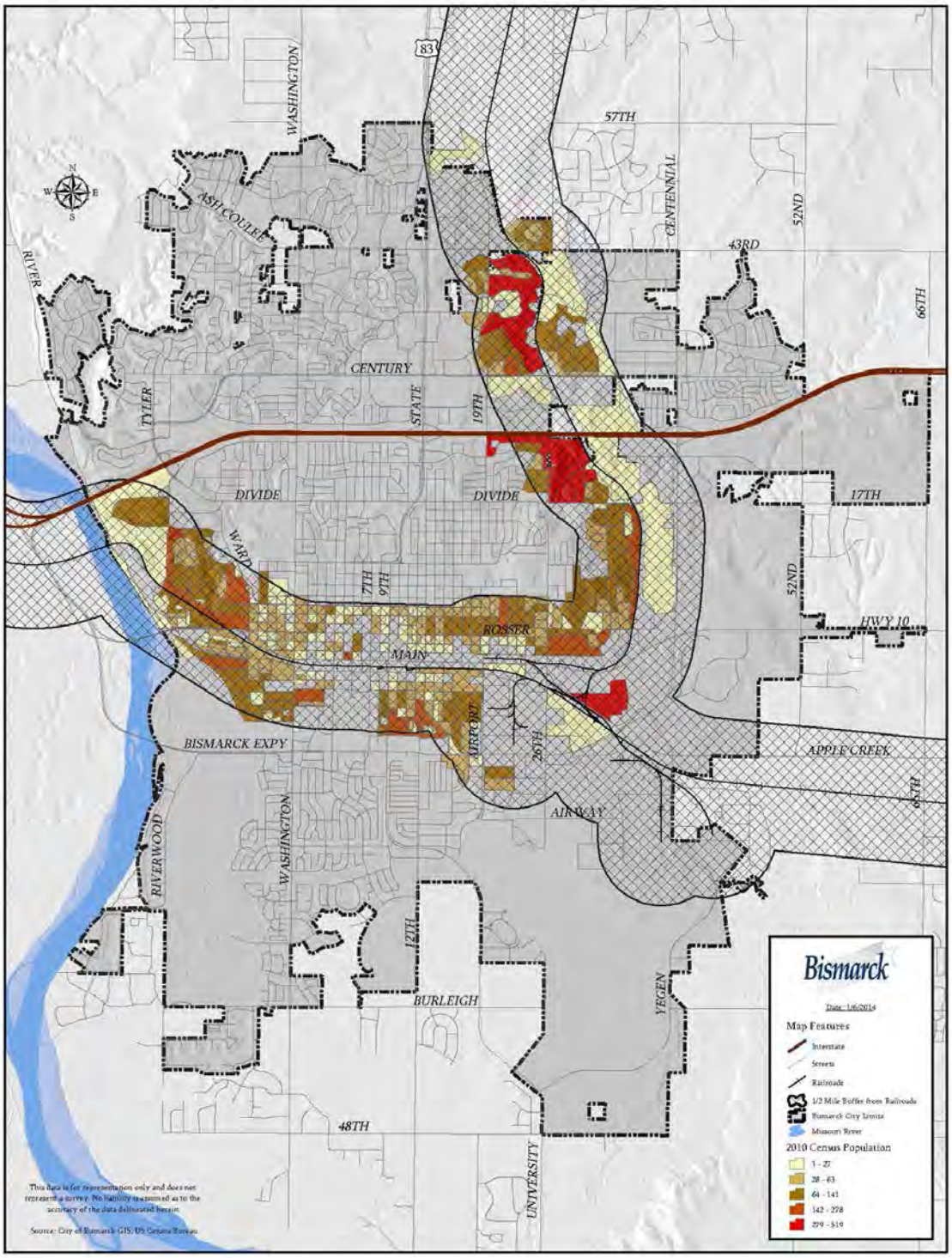
Scenario	Train Derailment Fire/HazMat – Significant Event
Probability	Possible
Speed of Onset	No Notice Event
Geographic Area	See maps included, this section.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Fire 2. Explosion/projectiles 3. Inhalation Hazards A. Those within close proximity to the railroad lines (1/4 mile) B. Those within close proximity to the railroad lines (1/2 mile) C. Those downwind of hazmat release.
Mass Casualty Incident	Yes, potentially significant
Property Losses (points of vulnerability – high priority)	1. All Structures within ¼ to ½ mile radius of incident.
Environmental	1. Storm Water System – Hazardous Materials 2. Air, Water, Soil contamination depending on material involved 3. Missouri River 4. Hay Creek
COG/COOP	1. Public Health – Bismarck/Burleigh 2. City/County Building 3. Water Treatment Plant 4. Public Works and proximity of Praxair

Scenario	Train Derailment Fire/HazMat – Significant Event	
Critical Facilities	1. Public Health 2. City/County Office Building 3. Fraine Barracks – DES, NDNG 4. Water Treatment Plant 5. Waste Water Treatment Plant – via spill, drainage system 6. Metro Area Ambulance – South 7. Sanford Health 8. Sanford Health Powerhouse 9. St. Alexius Medical Center 10. St. Alexius Purchasing / Warehouse 11. Burleigh County Courthouse 12. Burleigh County Social Services 13. Public Works Department	14. ND State Penitentiary 15. US Postal Processing and Distribution 16. Post Office 17. ND State Lab 18. ND Department of Health Warehouse 19. MDU – Airport Road 20. MDU Operations – 4th Street 21. Civic Center 22. Bismarck Police Department 23. Metro Area Ambulance – North 24. Metro Area Ambulance - South 25. Bank of North Dakota
Critical Infrastructure	1. Western Area Power Substation 2. Clear Channel Radio 3. KFYR 4. BisMan Transit 5. Missouri River Train Bridge 6. Railroad Bridge over Main Avenue 7. Railroad Bridge over Washington Street 8. Main Avenue Bridge over Washington Street	9. Railroad Bridge over 7th Street 10. Railroad Bridget over 9th Street 11. Railroad Bridge over Bismarck Expressway 12. Railroad over Hay Creek (3 locations) 13. I-94 Bridge over Railroad
Schools	1. Bismarck State College 2. Roosevelt Elementary 3. Cathedral Elementary 4. Riverside Elementary 5. St. Mary's Elementary 6. Emmanuel Christian School 7. Rita Murphy Elementary 8. Stepping Stones Daycare 9. Shiloh Christian School 10. Child's Hope Learning Center	11. Discovery Daycare 12. Dakota Boys Ranch 13. Kidz First Daycare 14. Angel Academy 15. First Presbyterian Church Daycare 16. Highland Acres Elementary 17. Saxvik Elementary 18. South Central High School 19. Robert Miller Elementary
High Risk Facilities (chemical)	1. Water Treatment Plant 2. LaFarge 3. Ferrell Gas 4. Praxair (9th Street) 5. Praxair (near Public Works)	

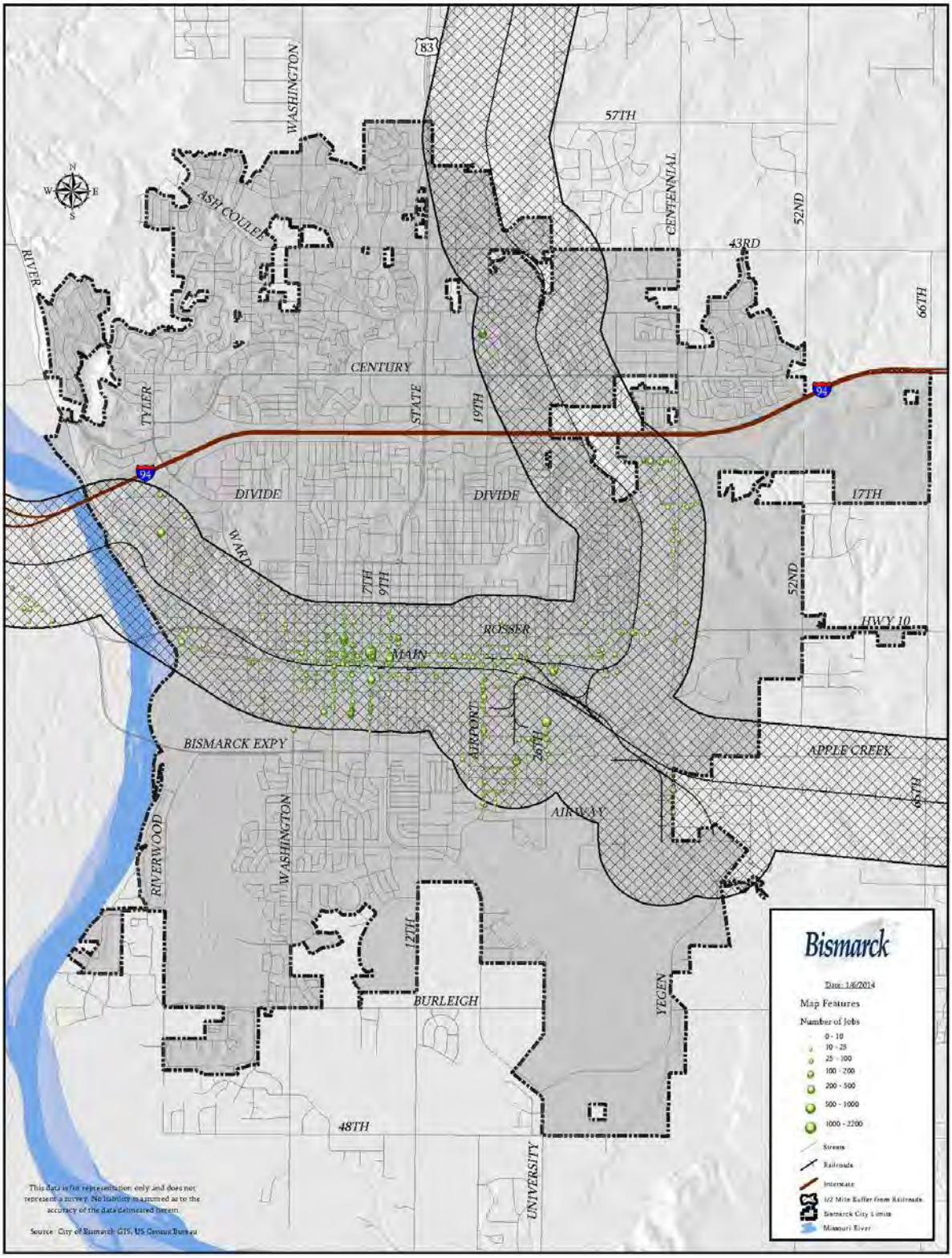
Scenario	Train Derailment Fire/HazMat – Significant Event
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Edgewood Vista 2. St. Vincent's Care Center 3. Marillac Manor 4. Dakota Boys Ranch 5. Elks Pool 6. Custer Home 7. Front Street Plaza 8. Patterson Place 9. The Terrace (Assisted Living) 10. Radisson Inn 11. Crescent Manor 12. Bismarck Community Bowl 13. Kirkwood Mall 14. Bismarck Transition Center 15. ND State Penitentiary 16. Front Street Plaza
Economy (community wide)	Significant impact
Other	

2011 Population and Property Estimates

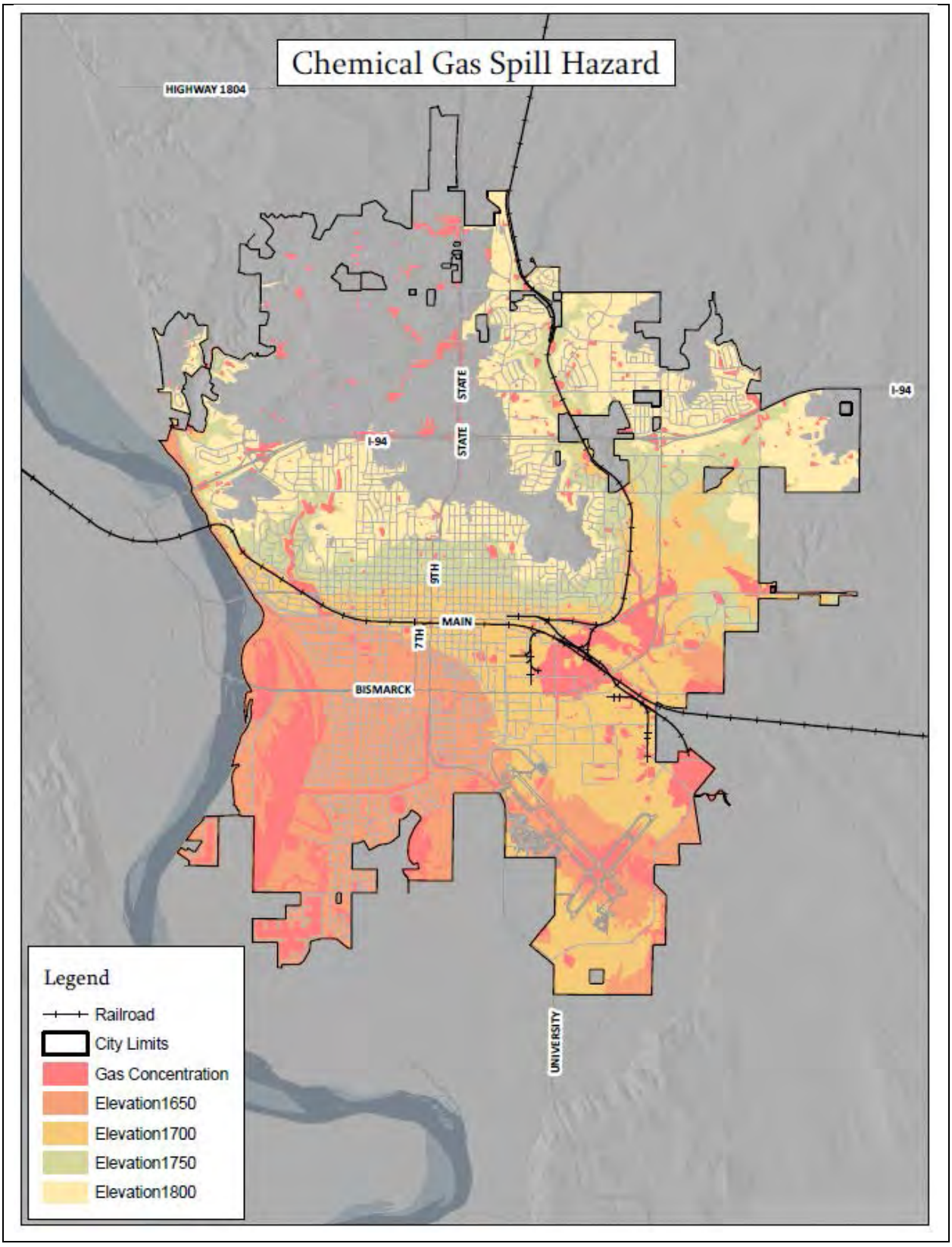
- Total City of Bismarck population within ½ mile: 17,796
- Total Burleigh County Population within ½ mile of railroad: 25,125
- Buildings within ½ mile (Bismarck): 9,384



Year 2011 Employment Estimates 22,068 jobs within ½ mile radius of railroad.



Chemical Gas Spill Hazard – Concentration Risk/Vulnerability based on elevation:


Chemical Gas Spill Hazard
HIGHWAY 1804
I-94
STATE
STATE
I-94
9TH
MAIN
7TH
BISMARCK
UNIVERSITY
Legend
Railroad
City Limits
Gas Concentration
Elevation1650
Elevation1700
Elevation1750
Elevation1800

N
W
E
S

Storm Water Flow

Date: 11/6/2014

1/2 Mile Buffer

Annexation

Storm Netowrk Flow Direction

Potential Affected Outlets

Storm Pipe

Storm Channel

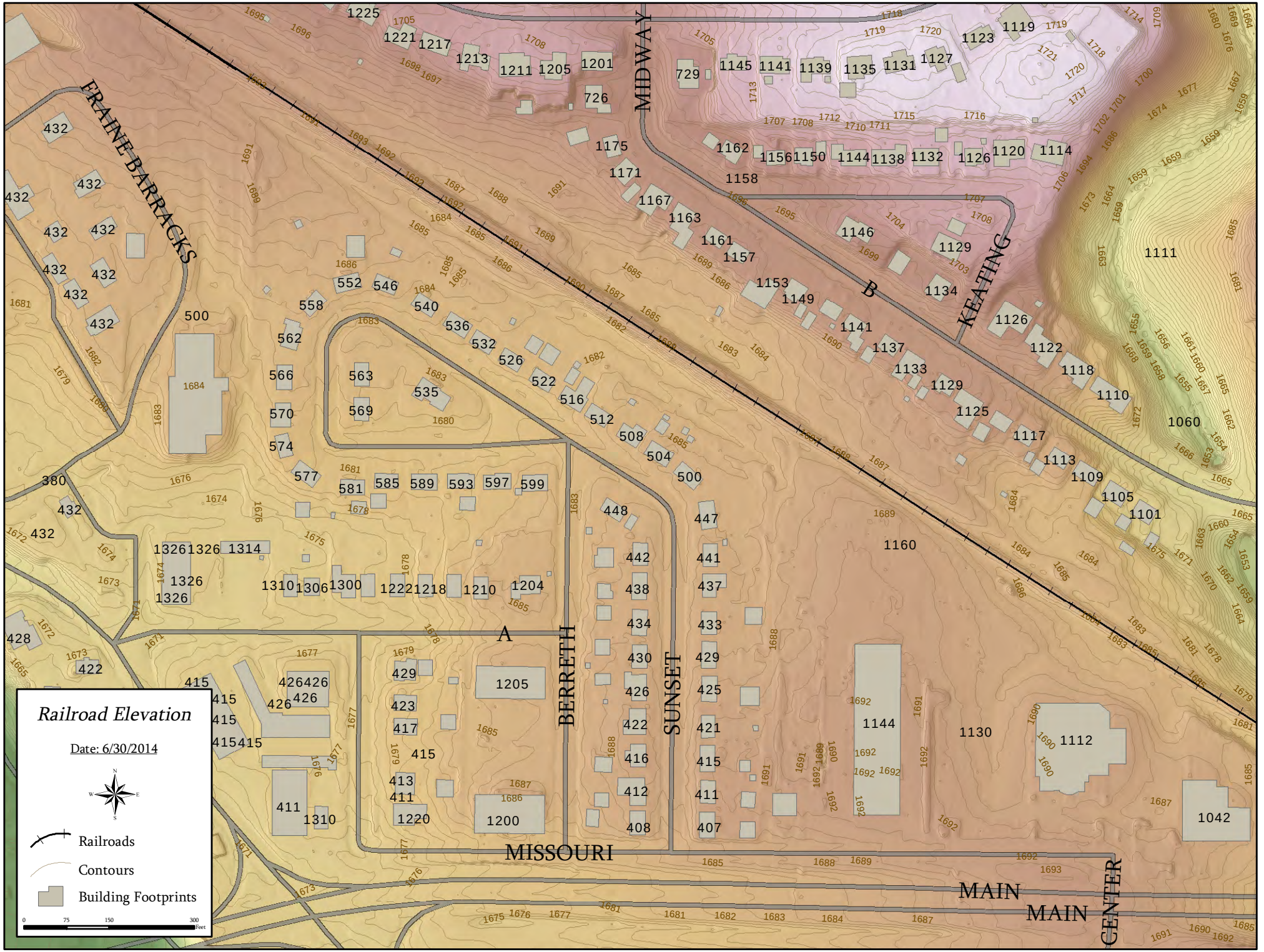
Streams

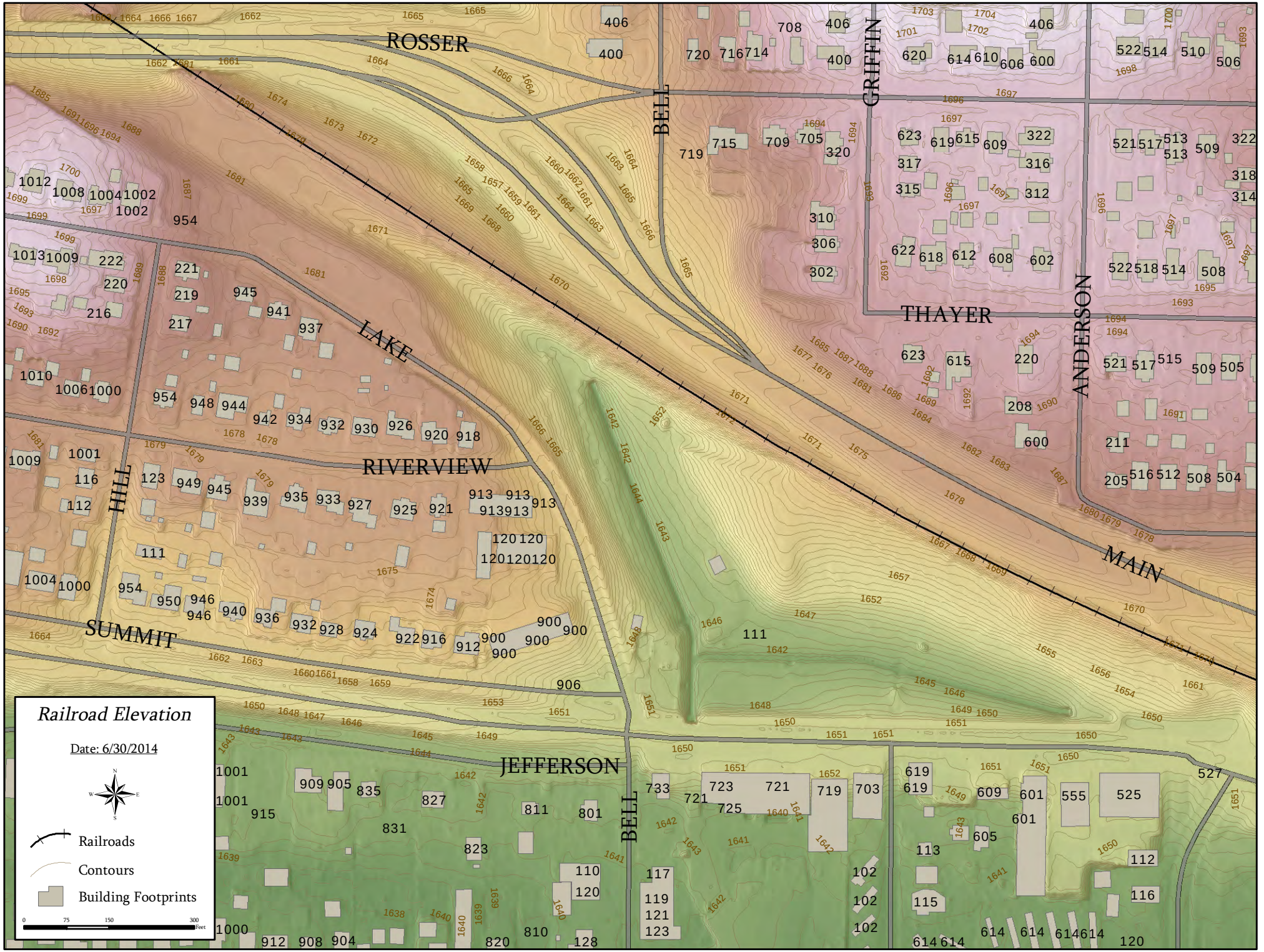
Railroads

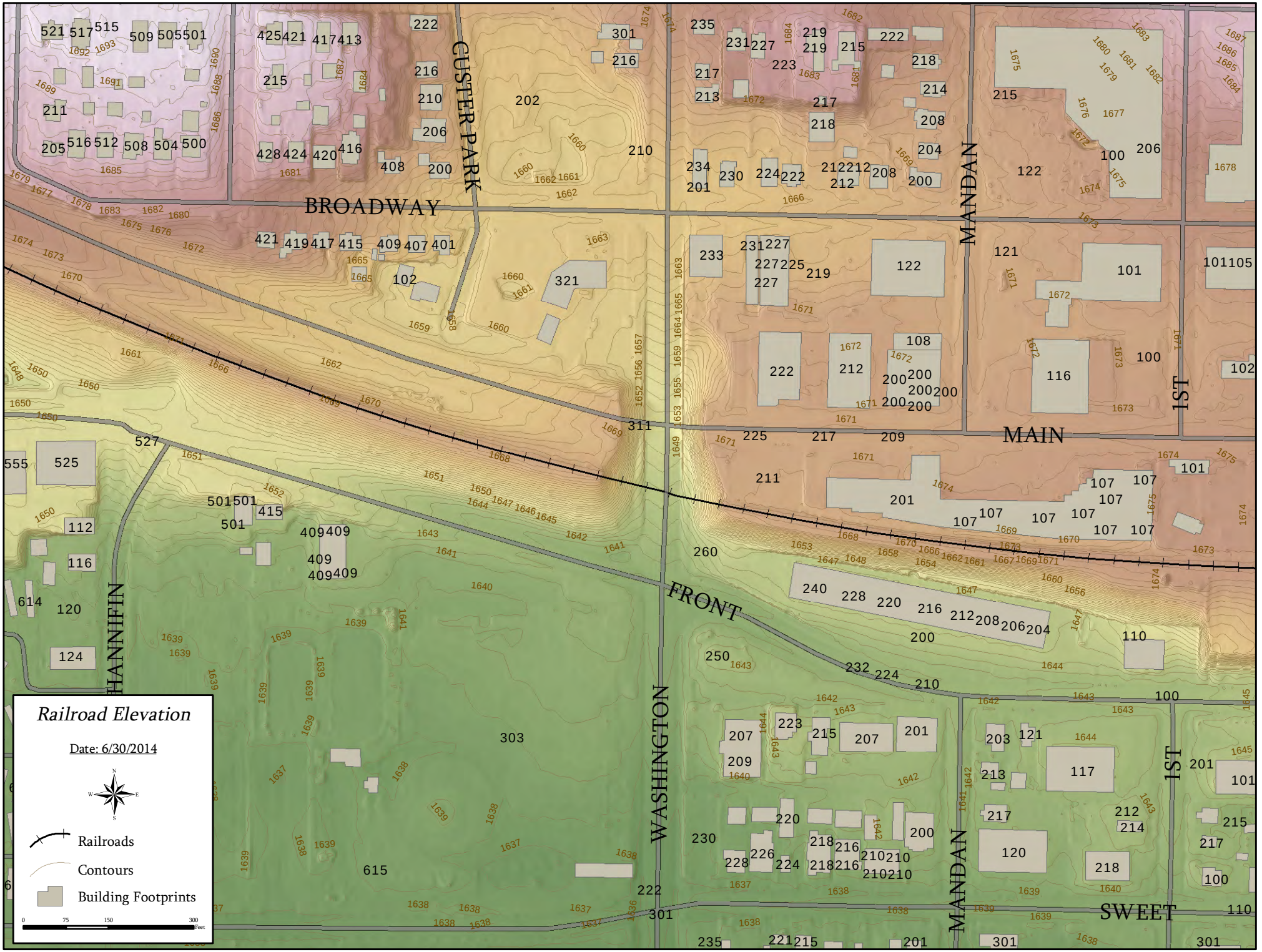
Elevation

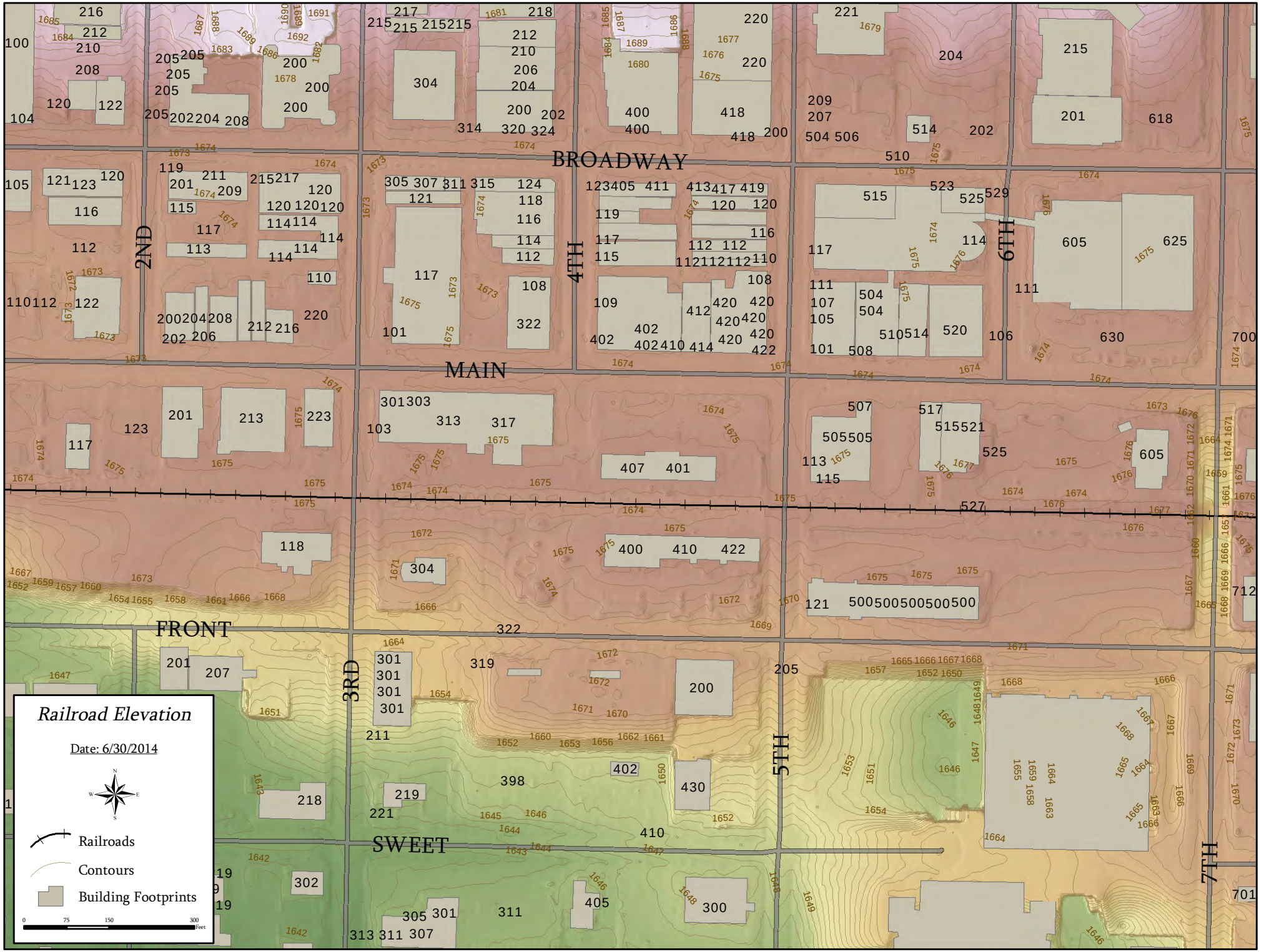
High : 1965.78

Low : 1621.47

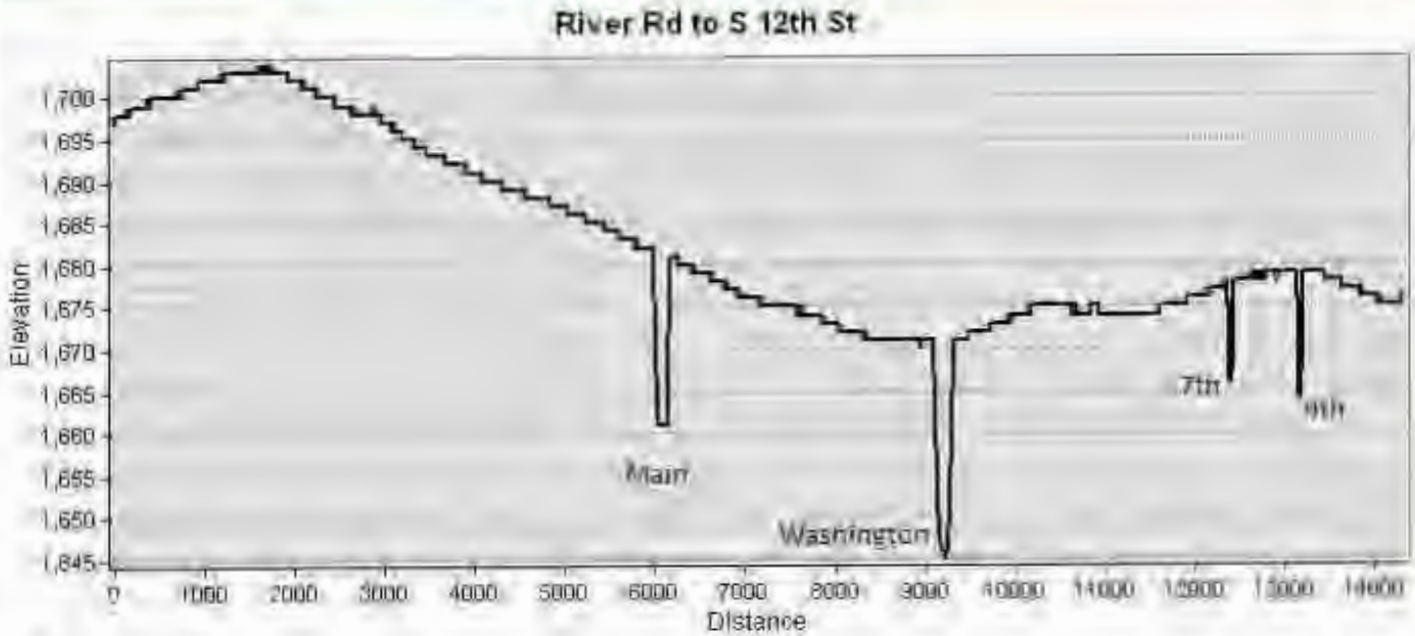

FRAINE BARRACKS
MIDWAY
B
KEATING
A
BERRETH
SUNSET
MISSOURI
MAIN
MAIN
CENTER
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet


ROSSER
BELL
GRIFFIN
THAYER
ANDERSON
LAKE
RIVERVIEW
HILL
SUMMIT
JEFFERSON
MAIN
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet

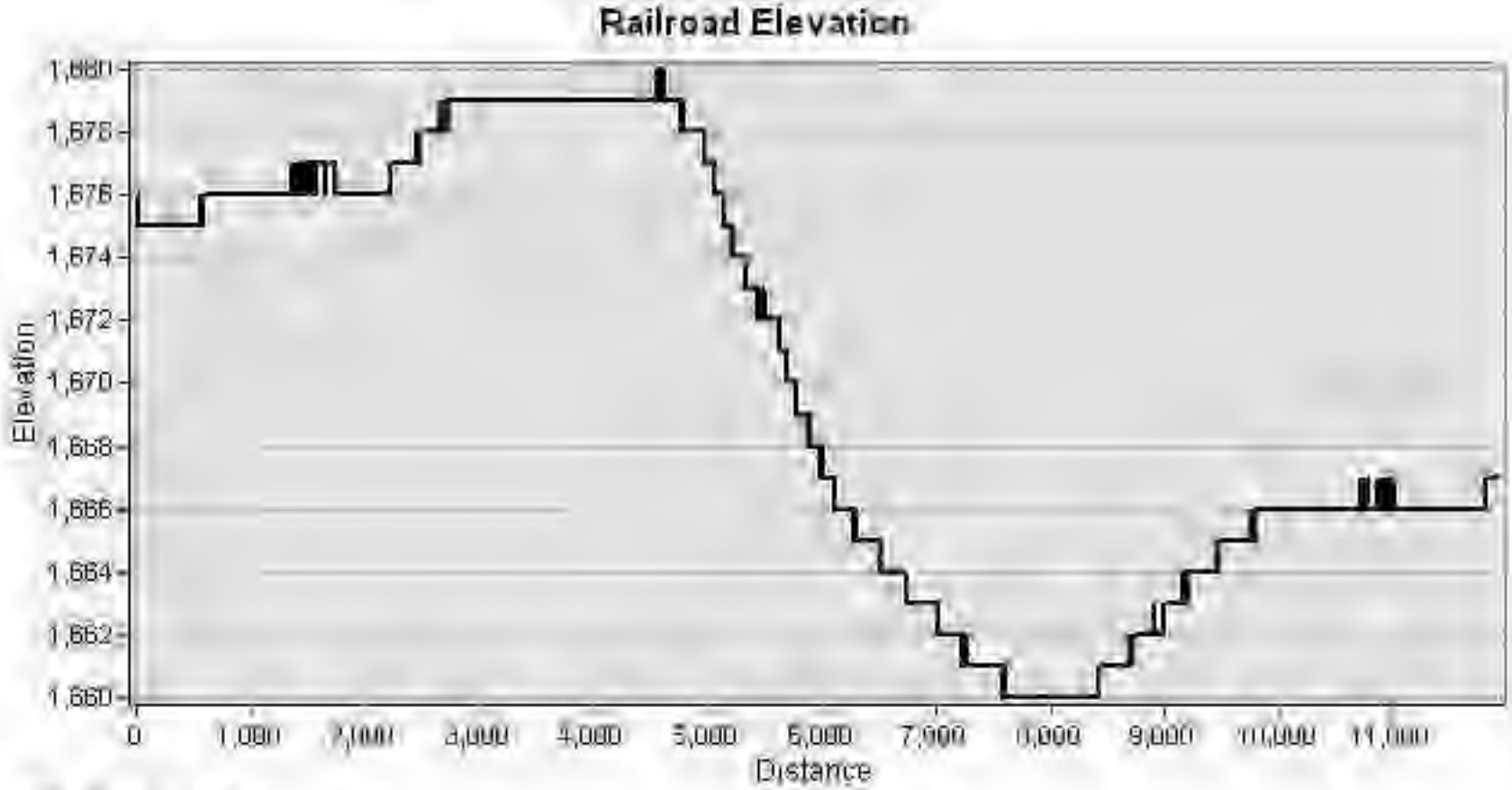

BROADWAY
MAIN
FRONT
SWEET
CUSTER PARK
MANDAN
WASHINGTON
HANNIFIN
1ST
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet


BROADWAY
MAIN
FRONT
SWEET
2ND
3RD
4TH
5TH
6TH
7TH
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet

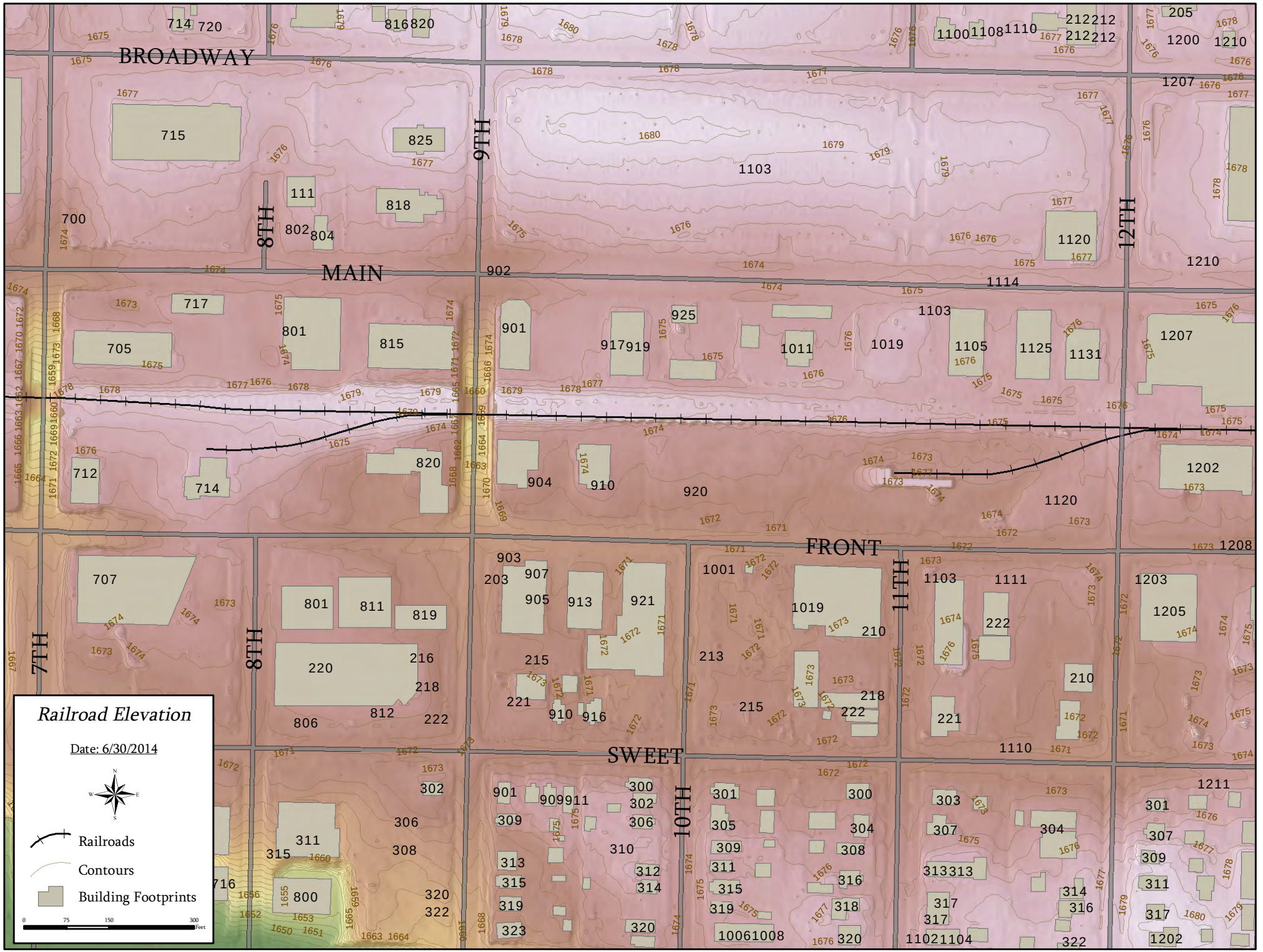
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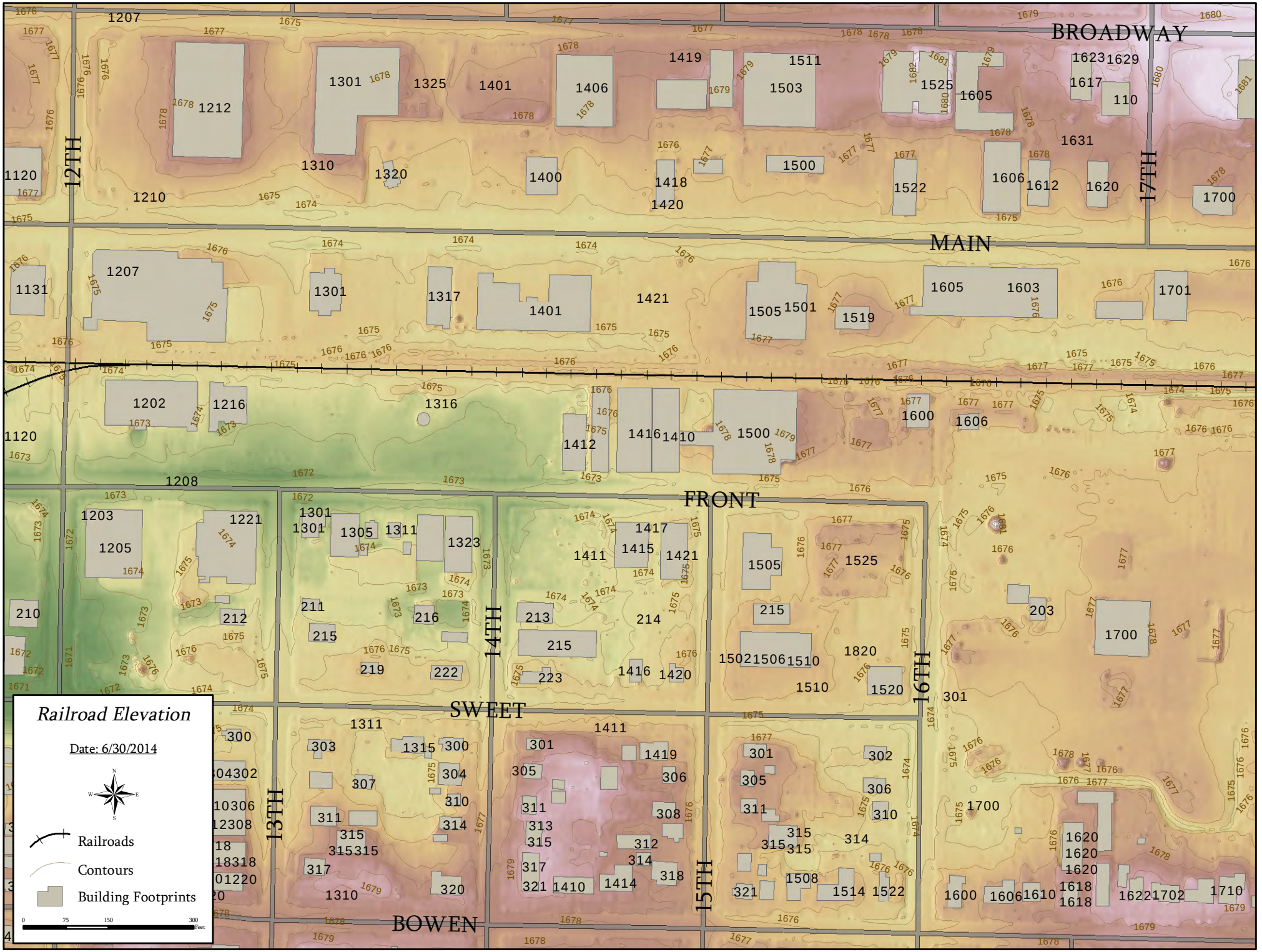


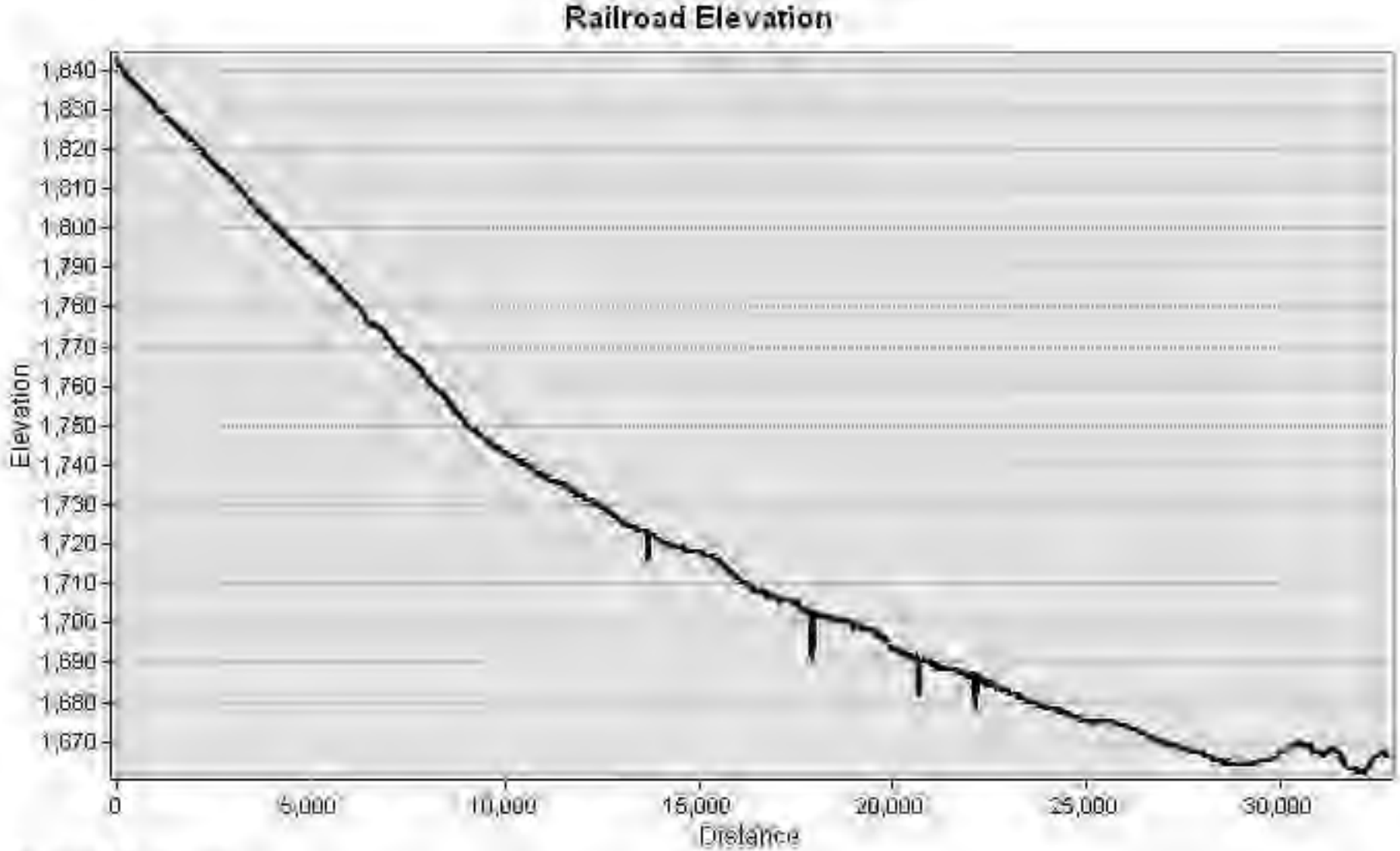
Profile Graph Subtitle



Mt Zion to Yegen Rd


BROADWAY
MAIN
FRONT
SWEET
7TH
8TH
9TH
10TH
11TH
12TH
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet


BROADWAY
MAIN
FRONT
SWEET
BOWEN
12TH
13TH
14TH
15TH
16TH
17TH
Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
0 75 150 300
Feet



71st Av to Railroad Av

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Wildland Fire – Hazard Profile

Wildland Urban Interface (WUI)

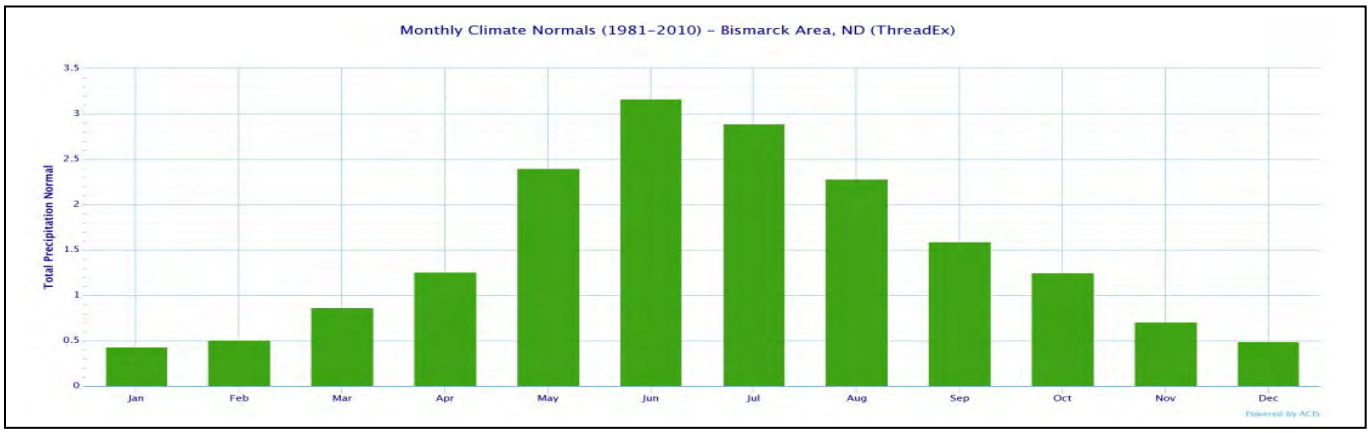
Description

The City of Bismarck has a relatively low potential of significant loss due to wildfire. There are areas in the NW part of the city that interface with larger prairie area where, depending on climatological conditions, including past rainfall, relative humidity and wind, a wildland fire may be able to gain some momentum. These areas are part of a "Wildland Urban Interface" (WUI), defined as areas where homes and other structures are built near or among lands prone to wildland fire. Homes and other structures that are located in these areas should practice wise fire mitigation plans such as those described in www.firewise.org.

Bismarck has a semi-arid climate with average annual precipitation of 17.85". Summer monthly rainfalls include; May: 2.4", June: 3.17", July: 2.89" and August: 2.28"

Monthly Climate Normals (1981-2010) - Bismarck Area, ND (ThreadEx)

Month	Total Precipitation Normal
January	0.43
February	0.51
March	0.87
April	1.26
May	2.40
June	3.17
July	2.89
August	2.28
September	1.59
October	1.25
November	0.71
December	0.49



Prevailing wind in Bismarck is from the WNW in all months other than May (SSE), July (SSE) and August (SSE). There are also some topographical interface areas, mostly in coulees and closer to the Missouri River, where fire may gain momentum as it moves from lower areas to higher areas.

Month	Bismarck		
	Mean Speed	Prevailing direction	Fastest Mile
January	10.2	WNW	54
February	10.2	WNW	54
March	11.4	WNW	65
April	12.8	WNW	63
May	12.5	SSE	66
June	11.3	WNW	66
July	9.8	SSE	72
August	10.0	E	72
September	10.5	WNW	66
October	10.4	WNW	61
November	10.6	WNW	67
December	9.8	WNW	61
Year	10.8	WNW	72
Yrs. of record	30	14	

While the City of Bismarck's risk of a wild-land fire in dry years can be relatively high; the damage potential is relatively low as our vegetation and topography do not readily allow a wild-land fire to gain momentum. The concern lessens even more when property owners have a yard that is cared for with short cut grass creating a buffer between a fire and a home

When compared to mountainous and heavily forested areas similar to Colorado, California and even the Black Hills of South Dakota, we have relatively flat lands providing less risk of a high magnitude event.

Even though our over-all vulnerability is low there are areas that may have more exposure potential than others; those areas would include the northwest portion of the city that is adjacent to undeveloped property and the southwest portion of the city that is adjacent to more heavily forested areas.

Property owners can make their property safer by practicing wise fire mitigation planning. A great resource is www.firewise.com

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Wildland Fire (wildland urban interface)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	None/Negligible	None/Negligible	None/Negligible

Climate Change Impact:

Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease. The intensity of droughts is projected to increase: Droughts are a natural part of the climate system and because precipitation increases are projected to occur during the cooler months, North Dakota will remain vulnerable to periodic drought. Higher temperatures will increase the rate of depletion of soil moisture during dry conditions in the warm season, leading to more serious conditions during future droughts. Mid-summer through early fall wildfires may also become more common.	NOAA Climate Summary (ND)

HISTORY:

The City of Bismarck has not suffered loss of physical property as a result of wild-land fire; none-the-less the city is committed to protect all homes in the city limits from all hazards, including wild-land fires.

The Bismarck Fire Department has responded to 56 natural vegetation fires from November 1, 2014 through October 31, 2019.

Type	Number
Natural Vegetation Fire	14
Grass Fire	19
Brush, or brush and grass mixture fire	17
	0
Forest, woods or wildland fire	4
Total	**54**

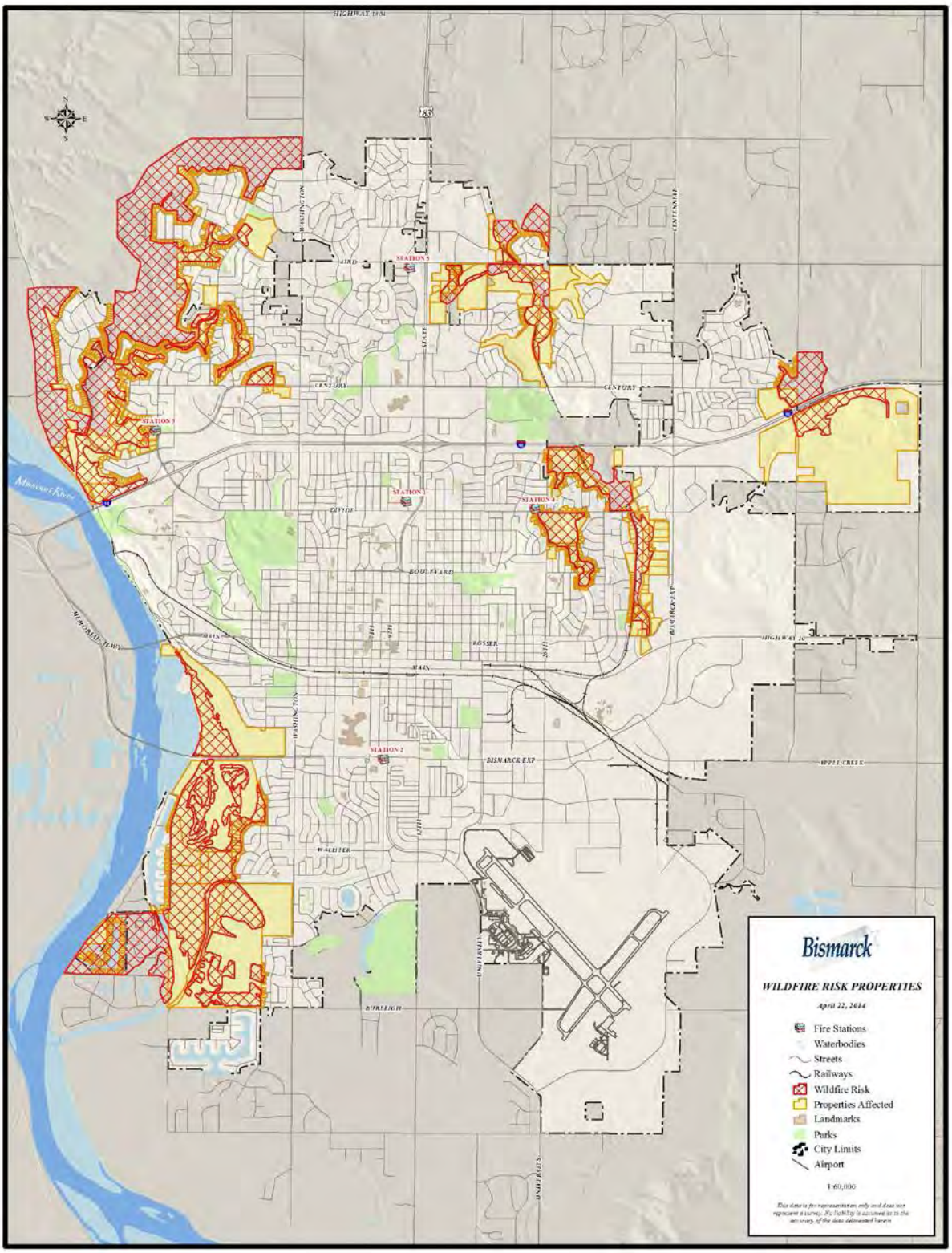
The most significant wildfire with potential impact to Bismarck occurred on April 2, 2005:

- Incident Name: Wildland Fire
- Date: April 2, 2005
- Time: 1448
- Time Cleared: 1711
- Incident Location: 2800 South Washington (West of Tatley Meadows, north of the Waste Water Treatment Plant, south of drainage ditch and walking path)
- Fire was extinguished by Bismarck Fire and Mutual Aid (Bismarck Rural)

September 16, 2020:

At approximately 1:00 PM, a fire occurred between Hay Creek and Hamilton Street to the North side of Interstate 94. Approximately 10 acres of wildland (open field) were burned. Wind was blowing from the north at 8 mph. Five fire department apparatus and 9 firefighters were dispatched to the scene. The Bismarck Rural Fire Department provided mutual aid. The Bismarck Police Department assisted with scene control. Metro Area Ambulance was on scene to provide medical support. There were no injuries to first responders. No structures were damaged.

Bismarck Wildland Fire: Wildland Urban Interface Risk Areas



Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario	Wildland Fire – Wildland Urban Interface
Probability	**Very Likely** However, a high magnitude / high impact event is not likely.
Speed of Onset	No Notice Event
Geographic Area	See map – previous page.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Asphyxiation. A. Those living adjacent to the wildland risk areas that do not evacuate, either by choice or as a result of not receiving notice of the event.
Mass Casualty Incident	Not likely. A high magnitude / high impact event is not likely. • Population within Wildland Fire Risk Area: Near Zero. Areas as mapped are open, vacant land or parks. • Population adjacent to wildland risk areas: Approximately 7,500
Property Losses	A high magnitude / high impact event is not likely. 1. Properties adjacent to wildland risk areas: Approximately 1,800 o based on a distance of 100 feet from within the wildfire risk areas 2. Total number of Structures in or adjacent to wildland risk areas: Approximately 2,200 3. Total building value adjacent to wildland fire risk area: Approximately 516,000,000. 4.
Environmental	1. Temporary air pollution from Wildland Fire itself 2. Erosion as a result of temporary loss of vegetation. 3. Potential loss of mature trees.

Scenario	Wildland Fire – Wildland Urban Interface
COG/COOP	1. Waste Water Treatment Plant
Critical Facilities	1. Capital Electric Coop 2. Wastewater Treatment Plant 3. ND Dept of Health Warehouse 4. St. Alexius Purchasing / Warehouse 5. Fire Station 4 – Northeast 6. American Red Cross
Critical Infrastructure (points of vulnerability – high priority)	1. Wastewater Treatment Plant 2. Sanitary Sewer Pump Station 3. Clear Channel Radio - KFYR/Y93 4. Bis-Man Transit 5. Taxi 9000 6. Capital Electric Coop 7. Public Works – Landfill
Schools	1. Horizon Middle School 2. Discovery Daycare
High Risk Facilities (chemical)	1. South Port Marina~ 125 feet from building 2. Public Works – Landfill ~ 100 feet to building 3. Wastewater Treatment Plant ~ 100 feet from outbuildings, 300 feet to large buildings 4. Cofells Plumbing and Heating ~ 200 feet to nearest building on property
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Dakota Boys Ranch 2. Dakota Zoo 3. Non-ambulatory population requiring evacuation assistance. 4. Holiday Inn 5. Door of Hope 6. Edgewood Vista 7. Missouri River Correctional Facility (Burleigh Co – just SW of city limits)
Economy (community wide)	None/Negligible
OTHER:	

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Winter Storm – Hazard Profile

Including blizzards, heavy snow, ice storms, and extreme cold

Description

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. 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 in North Dakota. Three to four of these storms reach blizzard intensity. As a result, North Dakota typically leads the nation in blizzard frequency. (National Climatic Data Center, 2010; National Weather Service, 2007)

Another hazard associated with Severe Winter Weather is prolonged periods of cold often associated with high winds, which produce life-threatening situations. This type of winter weather sometimes catches people unprepared, resulting in tragedy. 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 businesses, industries, state, tribal, 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.

Blizzards

Blizzards, 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.

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

The impact of a severe blizzard with low visibility, heavy snow, and cold temperatures can bring the entire region to a standstill. Utility and communication systems are often interrupted. Road systems are rendered impassable which causes school, workplace, and commercial shutdowns. This in turn magnifies the emergency and medical management needs of the community.

Heavy Snow

Other hazardous winter storms also exist that do not meet the criteria of a blizzard. Winter storms containing heavy amounts of snow, rapid snowfall rates, or enough wind to reduce visibilities and create hazardous road and outdoor conditions are an annual occurrence in the state. Six inches of snow or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. 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.

Ice Storms

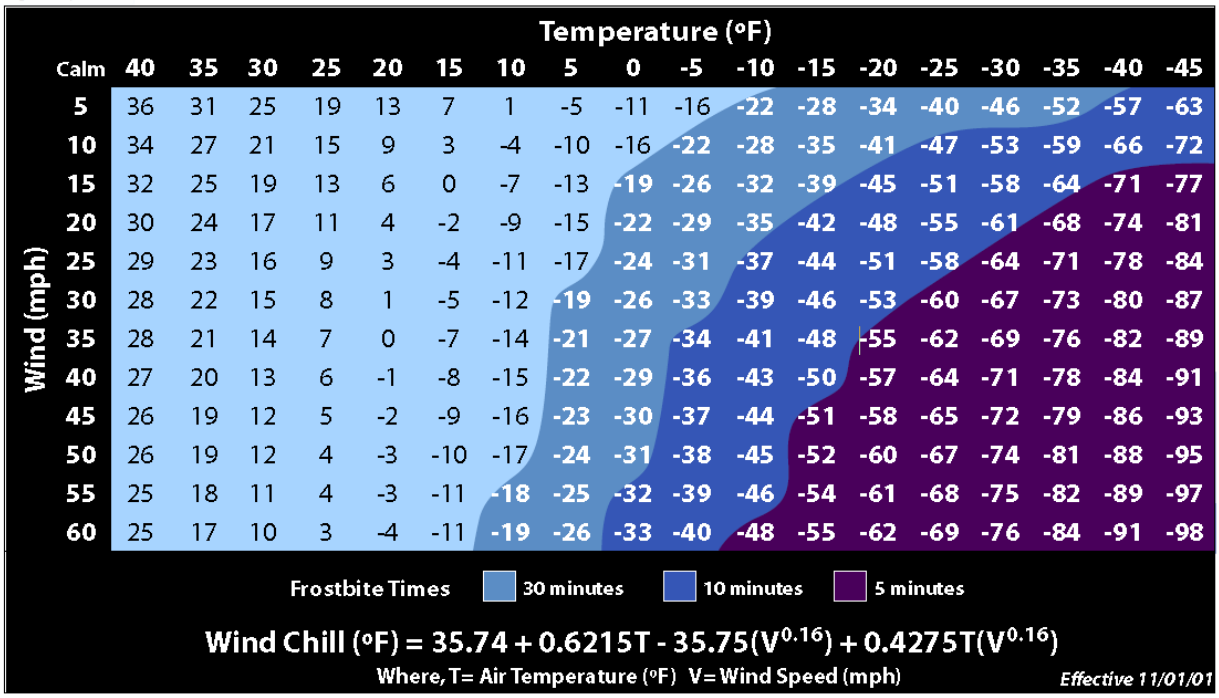
Ice storms develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into a warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating 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.

Extreme Cold

Extended periods of cold temperatures frequently occur throughout the winter months in North Dakota. Heating systems generally compensate for the cold outside. Most people limit their time outdoors 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. (National Weather Service, 2007)

Wind Chill Chart



Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

http://www.nws.noaa.gov/os/windchill/images/windchillchart3.pdf

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. Lowering of the body core temperature leads to the condition known as "hypothermia." 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. In North Dakota, severe winter seasons often translate to severe flooding potential in the spring.

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:

Geographic Location

The winter storm hazards, such as blizzards, ice storms, heavy snow, and extreme cold, usually occur on a regional or even statewide scale. As the historical record indicates, winter storms are a formidable hazard for all parts of the state.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Winter Storm (Severe Winter Weather)**

	Consequence			
Frequency	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Significant	Minor

Climate Change Impact:

Current observed records do not show a positive trend in cold season precipitation so far, however, projections suggest that winter precipitation will increase even under a lower emissions pathway. The warming trend in ND has been concentrated in the winter and spring. The winter warming trend is reflected in a below average number of very cold days (days with maximum temperature less than 0 degrees F) since year 2000. Although there has not been an increase in hot summer temperatures, continued overall warming is expected to eventually lead to an increase in the intensity of heat waves, while cold wave intensity is projected to decrease.	NOAA Climate Summary (ND)
With continued warming, cold-related deaths are projected to decrease and heat-related deaths are projected to increase; in most regions, increases in heat-related deaths are expected to outpace reductions in cold-related deaths.	NCA4 Vol II Summary Findings
There are projected to be many fewer cool days (days with minimum temperatures less than 28°F), an indicator of damaging frost, with decreases of 30 days or more per year by mid-century. These changes would have important implications for the region's snowpack and consequently streamflow and water use."	NCA4 Vol II Chapter 22 (Northern Great Plains)
Surface soil moisture over most of the United States is likely to decrease, accompanied by large declines in snowpack in the western United States and shifts to more winter precipitation falling as rain rather than snow.	NCA4 Vol II Chapter 2

Previous Occurrences

See page 9.

Winter Storm Disaster Declarations – Burleigh County Since 1989			
Declaration	**Incident**	**Incident Period**	**Declaration Date**
DR-1901	Severe Winter Storm	April 1, 2010 to April 3, 2010	Major Disaster Declaration declared on April 21, 2010
DR-1157	Severe Winter Storms/Blizzards	January 3, 1997 to January 31, 1997	Major Disaster Declaration declared on January 12, 1997

http://www.fema.gov/disasters?field_state_tid=11&field_disaster_type_term_tid=6843&field_disaster_declaration_type_value=All&items_per_page=10&page=1

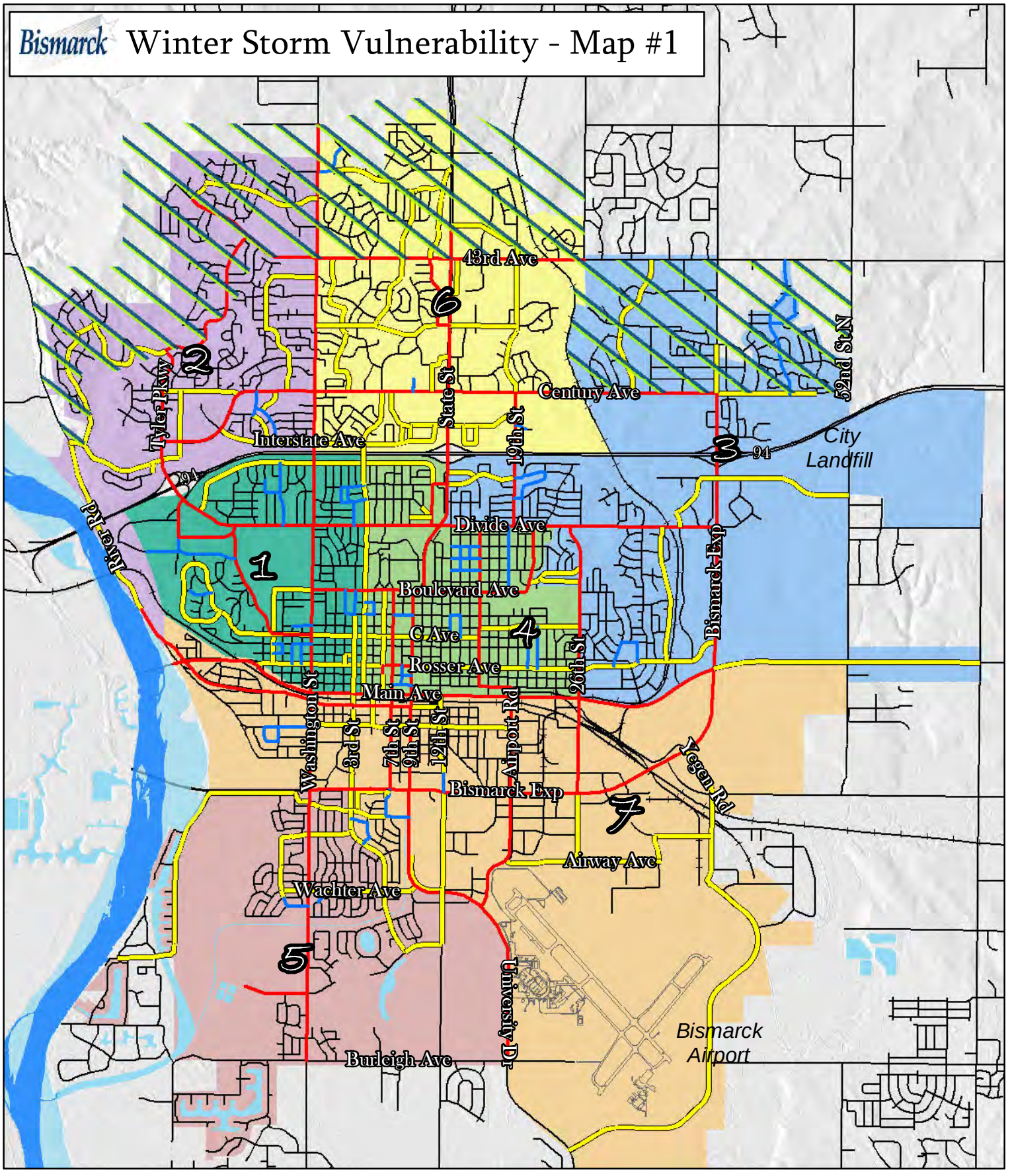
Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Probability	High Probability (and frequency) *Refer to Characteristics and History*	High Probability (and frequency) *Refer to Characteristics and History*	High Probability (and frequency) *Refer to Characteristics and History*	Medium Probability (and frequency) *Refer to Characteristics and History*
Speed of Onset	12 to 24 hours warning	12 to 24 hours warning	12 to 24 hours warning	12 to 24 hours warning
Duration of impact	1 to 5 days (typically)	1 to 5 days (typically)	1 to 5 days (typically)	1 to 5 days (typically)
Geographic Area	Local to regional	Local to regional	Local to regional	Local to regional
Death / Injury 1. Primary Causes	1. Heart Attack (shoveling) 2. Traffic accidents – poor driving conditions 3. Carbon Monoxide – stranded vehicle	1. Traffic accidents – low visibility 2. Snow plow accidents	1. Exposure to weather elements 2. Alternate Heat source 3. Carbon Monoxide Poisoning	1. Traffic accidents 2. Power lines down – coming in contact with live wires 3. Slips/falls
A. Highest vulnerability	A. Elderly or others with heart health issues B. Stranded travelers	A. Travelers – high speed travel (highways)	A. Stranded travelers – attempting to find shelter B. Loss of power / heat C. Mechanical / vent failure – carbon monoxide	A. Travelers B. Proximity to overhead power lines C. Trees falling – pulling down power lines

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Mass Casualty Incident	Possible (traffic accidents)	Possible (traffic accidents)	Possible	Possible (traffic accidents)
Comments: No History of mass casualty events within Bismarck as a result of Winter Storms				
Property Losses (points of vulnerability – high priority)	1. Roof collapse *(large span roofs)*	1. Vehicles – *due to accidents*	1. Mechanical failures more likely 2. Batteries exposed to cold more likely to fail	1. Trees 2. Power lines and power poles 3. Vehicles *(due to accidents)*
Environmental			1. Pipeline breaks	
COG/COOP	1. Essential personnel not able to work 2. Transportation 3. Supplies – not able to deliver / receive	1. Ability to provide services is compromised 2. Transportation 3. Supplies – not able to deliver / receive 4. Safety – working outdoors	1. Water main breaks 2. Safety – working outdoors	1. Power outages 2. Safety of workers
Critical Facilities	1. Roof Collapse (large span roofs) 2. Lack of Access to critical facility	1. Access to critical facility compromised	1. Water main break 2. Power outage	1. Power outage 2. Backup generators in place and functional
Critical Infrastructure	1. Transportation *(Access)*	1. Transportation (visibility)	1. Backup generators – ensure heating capability	1. Power Outages 2. Backup generators – ensure heating capability

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Schools	1. School closures *(due to closed roads/access)* 2. Roof Collapse *(large span roofs)*	1. Bus Travel 2. Students walking to/from school	*1.* Exposure to extreme cold *(students not prepared)*	1. Power outages – school closure. 2. Potential contact with downed power lines *(students)*
High Risk Facilities (chemical)	1. Transporting hazardous materials 2. Roof Collapse	1. Transporting hazardous materials		1. Transporting hazardous materials 2. Power outage at facility 3. Backup generators in place and functional
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Roof collapse (gyms, auditoriums, etc.) 2. Medical attention / prescription needs 3. Travelers	1. Travelers 2. Medical attention / prescription needs	1. Travelers 2. Outdoor recreation	
Economy (community wide)	Affected –discontinued until storm lifts	Affected –discontinued until storm lifts	Affected - minimal business interaction	Affected – reduced business interaction – possible power outages – unsafe travel conditions
OTHER:	Mobile HazMat (transportation) Emergency Response time	Mobile Hazmat (transportation) Emergency Response time	Mobile Hazmat (transportation) Emergency Response time (outdoor work)	Mobile Hazmat (transportation) Emergency Response (travel / slippery conditions) Additional hazards – tree limbs, power lines, falling ice, slippery conditions
Traffic Accidents: As an example, the blizzard on December 30, 2010 affecting 16 counties (not affecting Burleigh) resulted in an estimated 100 car pile-up in eastern ND (Cass County). http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=275692				

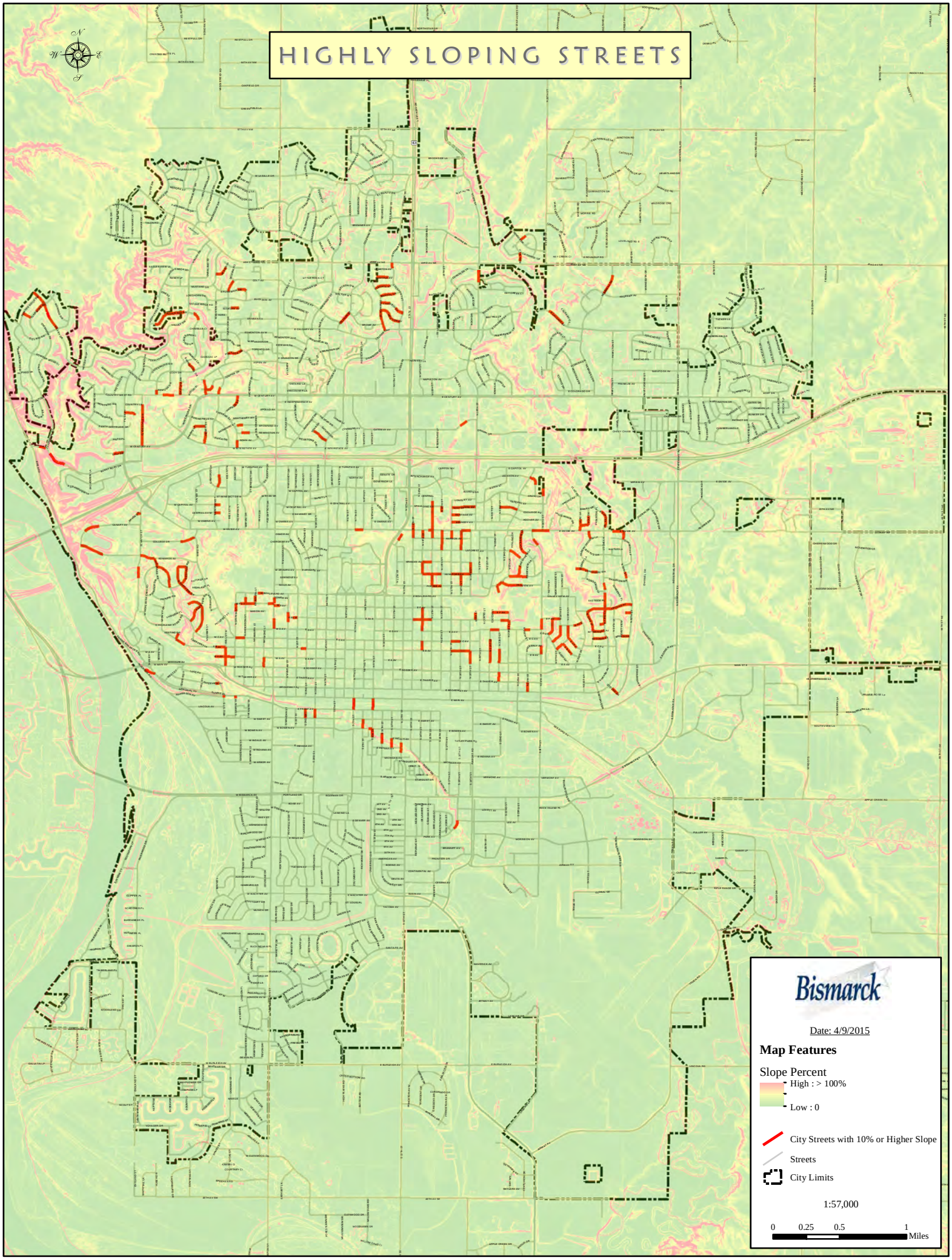


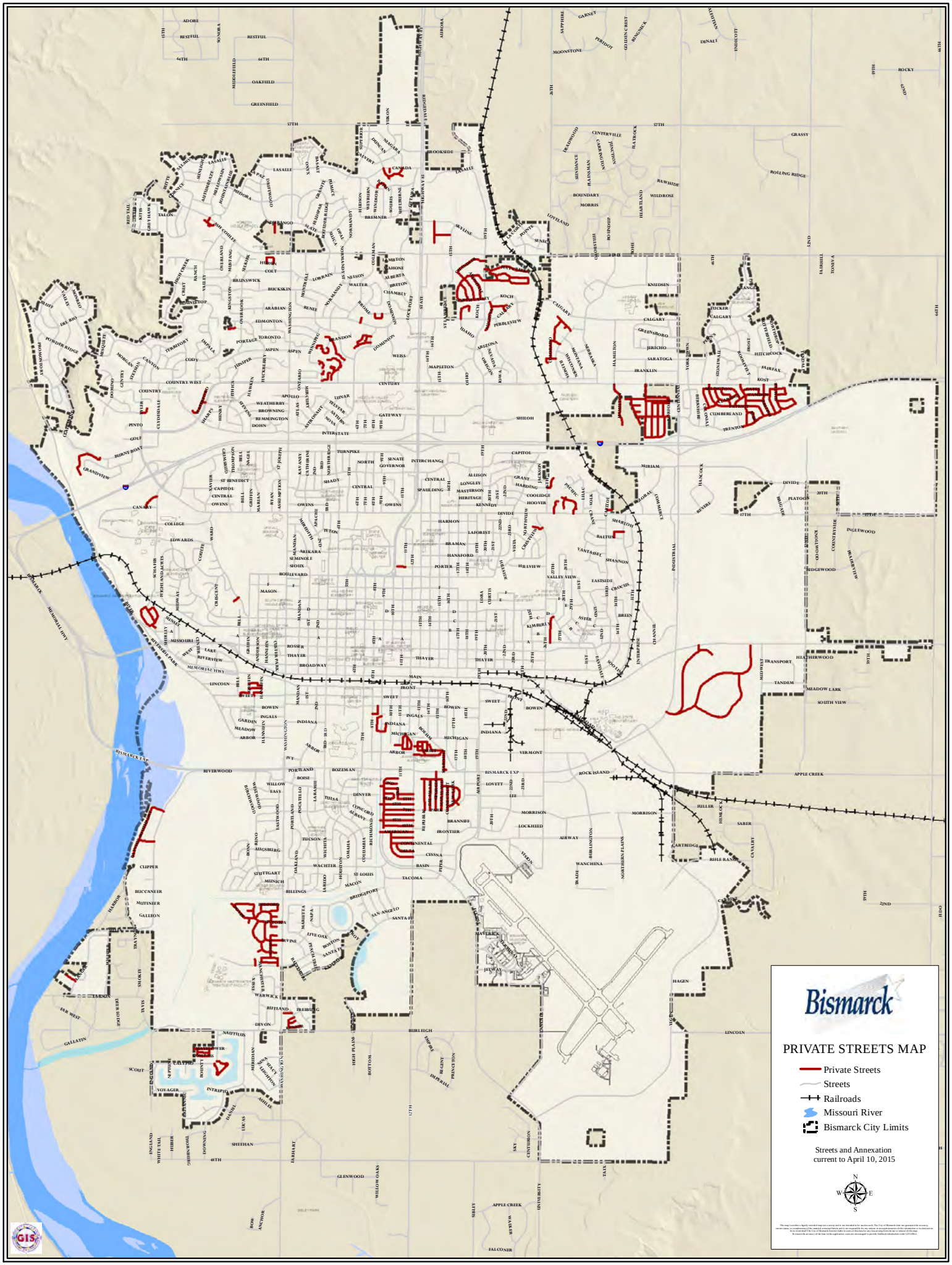
SNOW EMERGENCY ROUTES - PRIORITY 1
SCHOOL EMERGENCY ROUTES - PRIORITY 2
MAJOR ARTERIAL ROUTES - PRIORITY 3
RESIDENTIAL ROUTES - PRIORITY 4

*This map is for representation use only and does not represent a survey.

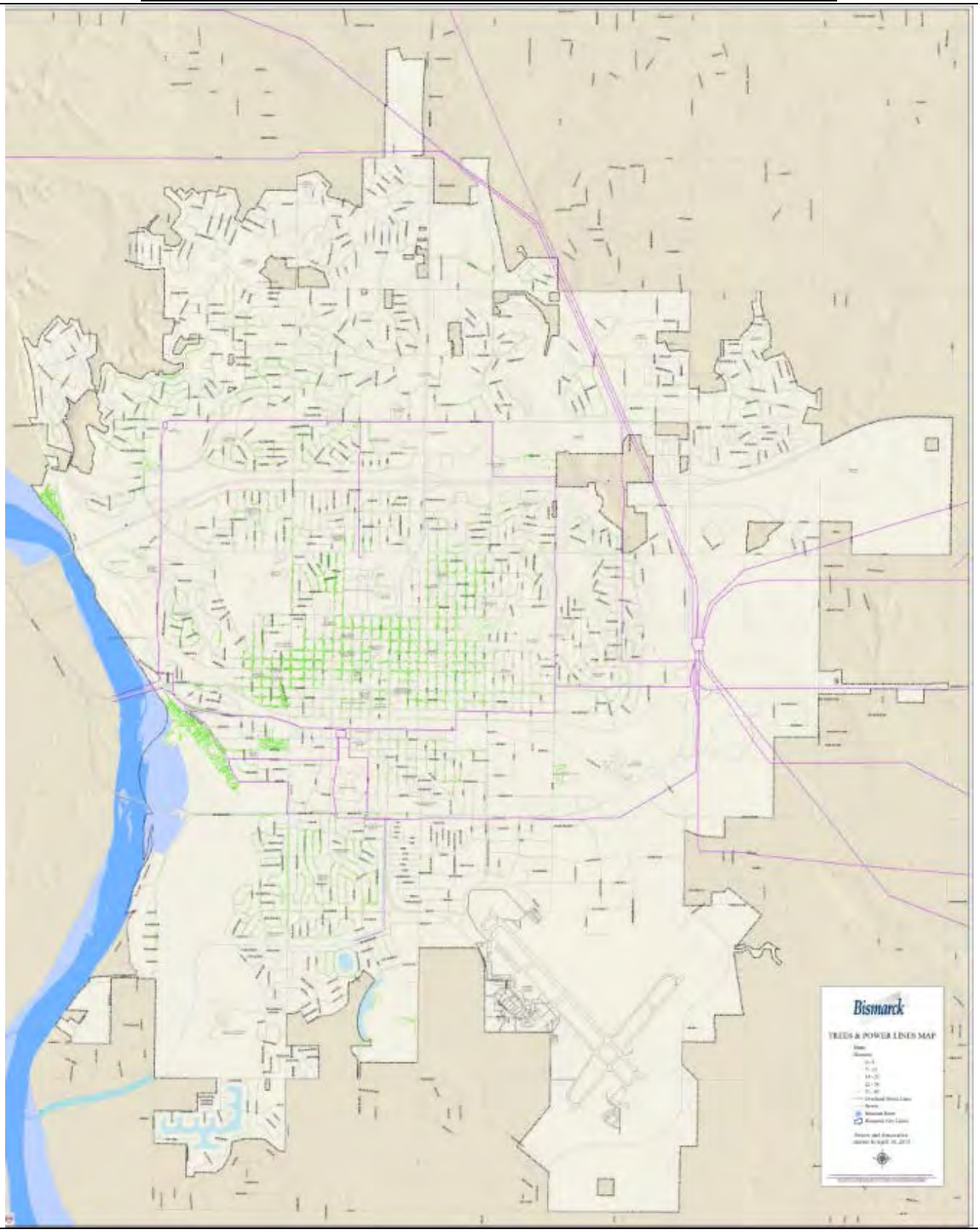
Areas of New Development - (prone to heavy snow drifting)

No liability is assumed as to the accuracy of the data delineated heron.
Map dated: April 2015


HIGHLY SLOPING STREETS
Bismarck
Date: 4/9/2015
Map Features
Slope Percent
High : > 100%
Low : 0
City Streets with 10% or Higher Slope
Streets
City Limits
1:57,000
0 0.25 0.5 1
Miles


Bismarck
PRIVATE STREETS MAP
Private Streets
Streets
Railroads
Missouri River
Bismarck City Limits
Streets and Annexation
current to April 10, 2015
N
W
E
S
GIS

Overhead Power Lines and Overhead Powerline/Tree Intersection

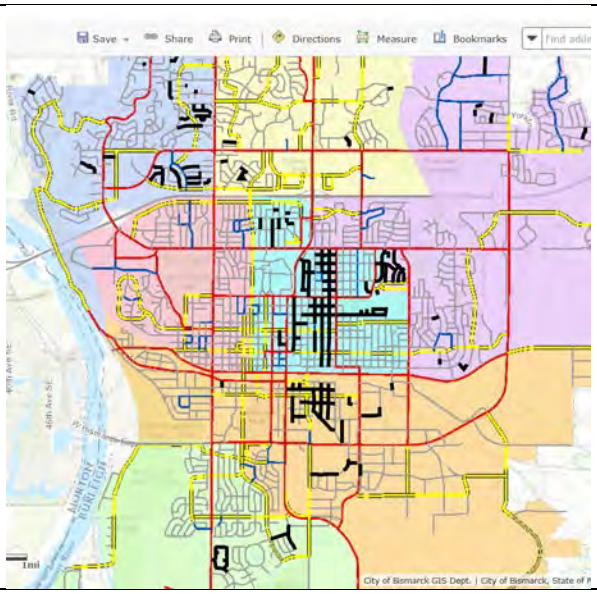


History:

October 10-11, 2019: 11.6 inches of snow fell within a 24 hour period (7am Thursday to 7 am Friday) setting a new record for Bismarck.

January 2017: The total accumulation of snow (July 2016 to January 2, 2017) is 53.1 inches. That is the most amount of snowfall ever accumulated to date, according to the National Weather Service in Bismarck. The 1993-94 snowfall season, July 1 through Jan. 2, held the record prior and now takes second place, with 49.3 inches.

December 25, 2016: As a result of the winter storm which started on Christmas Day, the volunteer snowmobile club was utilized to provide transportation of critical staff to both hospitals and area nursing homes throughout the Day on December 26. Over 30 personnel were transported by snowmobile. On December 25, plows were pulled from the streets and were utilized for providing access based on 911 calls. Clearing of emergency snow routes was resumed on December 26 during the day. As of Thursday December 29, plows still had not reached many of the residential areas. Snowfall was reported at 12.5 inches.

As of December 29, 2016, extensive snow removal operations continued. Streets shown in black still needed to be cleared (again):	

December 6, 2016: The City of Bismarck declares Snow Emergency due to accumulation of snowfall and the blowing and drifting snow conditions (blizzard conditions). Bismarck PD issues a no travel advisory as numerous vehicles were stranded and blocking intersections and creating unsafe conditions for law enforcement, emergency vehicles, first responders and snowplows. Bismarck City offices close. Public Works snow removal crews work 24/7 to remove snow.

April 14-15, 2013: A total of 17.7 inches of snow fell beginning with a trace on April 13 (.1 inch) with a majority of the snow falling on Sunday April 14, 2013 (17.3 inches) and an additional. 3 inches on April 15. The snow had a high moisture content (wet/heavy) and made travel difficult to impossible.

A snow emergency declaration was issued by the city of Bismarck on April 14, 2013. Snow plows focused on clearing emergency routes only (red - priority 1 routes) on April 14th until noon on April 15 before snow plows were able to begin clearing second, third, and fourth level priority routes (residential). No travel was advised and the city of Bismarck closed its offices on Monday April 15 along with many other closings including ND State Government, Burleigh County, and Bismarck Public Schools.

NOAA Storm Event Database:
April 14, 2013 – Blizzard Event: Very heavy snow combined with winds gusting to 40 miles per hour to create a blizzard for much of the day on the 14th.

April 14-15: Winter Storm Event
Strong low pressure pushed across the Rockies April 13th, slowed down over the Dakotas April 14th, then moved east on April 15th. The peak of the storm occurred on Sunday when much of west and central North Dakota received heavy amounts of snow, with portions of the south central and southeast having a blizzard. A combination of favorable moisture feed and strong surface and mid-level dynamics brought historic snowfall to parts of west and central North Dakota. A moist conveyer belt extended from the eastern portions of Iowa and Illinois back northwest into North Dakota, situated along and north of an inverted surface trough stretched from southeast to northwest across South Dakota. Combined with strong diffluent flow aloft associated with the upper level low, snowfall rates approached two inches per hour across south central North Dakota on Sunday.
In addition to the heavy snow, strong surface winds developed across south central North Dakota west of the Missouri River and into the James River Valley. Wind gusts to 40 miles per hour combined with the heavy snow resulting in a blizzard. Storm total snowfall amounts ranged from 15 to 22 inches from the James River Valley into the Missouri River Valley. Lesser amounts were reported across the far west and north, with up to eight inches at Watford City, and around an inch near the Canadian border. The highest snowfall amounts were reported at Center and Flasher with 22 inches. A record snowfall for any calendar day of the year was set at Bismarck, with 15.5 inches falling on April 14th. The storm total in Bismarck was 17.7 inches. This also resulted in setting a new record April snowfall of 21.5 inches. Impacts from this storm were numerous. All roads across the southwest, south central, and southeast were under no travel advisories due to the heavy snow. Interstate 94 was closed from the Montana border to Jamestown, and Highway 83 was closed from Bismarck to Underwood. In addition, multiple school closings occurred on the 15th due to the heavy snow.

March 22-23, 2011: A storm total snowfall amount of 10.4 inches was reported near Bismarck.

April 2, 2010: Five to twelve inches of heavy wet snow and sleet fell across Burleigh County. The combination of strong winds and the wet snow resulted in damages to electrical utilities, causing power outages across the county. In some areas it took several days to restore power. Preliminary damage assessments estimated there was around two million dollars in damage from this storm for Burleigh County. Western portions of the county were hit the hardest.

January 22-23, 2010: A wintry mix of freezing rain, sleet, and snow spread north across the local area. Precipitation eventually changed over to all snow, with up to five inches of accumulations reported by early Saturday morning. Hazardous travel conditions and scattered power outages resulted.

January 5-6, 2010: Six to eight inches of snow fell across Burleigh County. The National Weather Service Office in Bismarck reported 7.1 inches of storm total snowfall. Strong northwest winds of 20 to 40 mph created areas of significant blowing and drifting snow, resulting in near blizzard conditions.

December 25, 2009: Winter Storm / Blizzard Conditions: Bismarck received 9.2 inches of snowfall on Christmas Day and a total of 13.8 inches from December 23 through 26. Most of North Dakota received heavy snow as a result of this storm. A no travel advisory was issued for the entire state on Christmas Day. Blowing snow caused reduced visibility, drifting, and dangerous driving conditions throughout the state. Road closures included I-29 from S.D. border to Canadian border (and from South Dakota to the Iowa border), I-94 from Montana border to Minnesota border, Hwy 83 from Bismarck to the Canadian border and Hwy 2 from Berthold to Devils Lake. Snow plows in Bismarck focused on clearing emergency routes and major arterials. Duration of the storm and impacts is at least 4 days (starting Dec 23 thru 26).

2008/2009 Winter Snowfall total: 100.3 inches (2nd place behind 1996-97 with 101.6 inches). Snow removal assistance (Federal Disaster Declaration) was received by Bismarck and many communities throughout the state.

March 23-24, 2009: A blizzard began later on the 23rd and continued into the 24th. Wind gusts to 47 mph on the 24th with a snow total of 8.1 inches (.2 on the 23rd and 7.9 on the 24th). This blizzard exacerbated the flooding/ice jam situation and caused delay in response/recovery efforts.

March 29 - 30, 2009: Heavy Snow/Blizzard - Strong northwest winds of 20 to 45 mph accompanied the snow and produced widespread blizzard conditions mainly south of Interstate 94 closer to the North Dakota and South Dakota border. Widespread 14 inch or greater storm total snowfall amounts were common across southwest and south central North Dakota during this event, with a few isolated reports greater than 20 inches. No travel advisories, road closures, including Interstate 94 from Bismarck to the Montana border, and school and business closures were common during this significant spring storm.

March 23, 2009: Blizzard: This blizzard occurred at the onset of the Ice Jam Flooding that occurred in Bismarck/Burleigh spring of 2009. A storm total snow amount of 8.1 inches was recorded at the Bismarck National Weather Service Forecast Office. The heavy snow combined with strong northwest winds resulted in widespread blizzard conditions. Storm total snow amounts ranged from 12 to 22.5 inches across southwest North Dakota, to five to 11 inches central. No travel advisories, road closures, power outages, and school and business closures were common during this significant spring storm.

January 11, 2009: Blizzard: Strong northwest winds of 25 to 35 mph, with gusts up to 45 mph, combined with falling snow and existing loose snow cover to create widespread and prolonged blizzard conditions across the county. Storm total snowfall accumulations by Monday morning ranged from two to five inches. The blizzard warning encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, all of which had a blizzard. Periods of light to moderate snow and blizzard conditions, very strong winds creating significant blowing and drifting snow and near zero visibilities, forced numerous road closures and the issuance of no travel advisories by law enforcement officials throughout the event.

January 8, 2009: Heavy Snow - A strong winter storm system brought moderate to heavy snow, areas of freezing rain, and considerable blowing and drifting snow to much of west and central North Dakota from early morning Thursday, January 8th, through Friday afternoon, January 9th. This significant storm resulted in numerous no travel advisories being issued by law enforcement throughout the event due to freezing precipitation, heavy snow accumulations, and blowing and drifting snow blocking roadways.

December 2008: Snowiest month on record (all months /years) with a total of 33.3 inches.

December 29, 2008: Heavy Snow - A fast moving surface low pressure system developed a band of moderate to heavy snow from northwest North Dakota, southeast through much of central North Dakota, Monday night, December 29th, and lasting through the early afternoon of Tuesday, December 30th. Storm total snow amounts ranged from three to four inches around the perimeter of the heavy snow band to around one foot within the center. In addition, occasional winds of 20 to 35v mph a produced considerable blowing and drifting snow and resulted in the issuance of no travel advisories over several counties Monday night into Tuesday morning.

December 20, 2008: Extreme Cold / Wind Chill - Cold Arctic air combined with winds of 15 to 25 mph to create wind chill temperatures of 40 below to near 50 below zero. - from Saturday the 20th, through Sunday morning the 21st.

December 14, 2008: Extreme Cold / Wind Chill - After a significant winter storm that brought a blizzard to western and central North Dakota moved out of the Northern Plains, wind chill continued to be a problem. Strong cold air advection combined with gusty northwest winds and resulted in wind chill temperatures of 40 to 55 below zero from Sunday night the 14th, through Monday morning the 15th.

December 13, 2008: Blizzard - A significant winter storm impacted all of western and central North Dakota beginning Saturday, December 13th, and lasting through much of Sunday, December 14th. A blizzard warning was posted well in advance of the storm, with the warning lead time more than a full day in advance. The blizzard warning encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, all of which verified. Heavy snow and blizzard conditions, significant snow combined with very strong winds and near zero visibility, forced numerous road closures and the issuance of no travel advisories throughout Saturday and Saturday night. A statewide no travel advisory was then issued early Sunday morning by the North Dakota Department of Transportation. Total snow amounts by Monday morning the 15th were as much as 13.8 inches at Williston. Bismarck had 12 inches.

November 6, 2008: Blizzard: - A significant and complex winter storm impacted much of western and central North Dakota beginning Wednesday, November 5th, and lasting into Friday, November 7th. Winter storm warnings and blizzard warnings were posted well in advance of the storm. Warning lead time averaged nearly 27 hours. The warnings encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, though not all counties had events or reached warning criteria. Counties in the Williston area and the Jamestown area were basically missed by the storm. Blizzard conditions, or significant snow with near blizzard conditions, forced many schools and businesses to close and stranded travelers. Numerous roads were closed or no travel was advised due to the conditions. Storm total snowfall ranged from one to three inches around Williston and Jamestown, to six to twelve inches southwest through central, to a maximum of twenty inches in McHenry County. The strong wind resulted in blowing and drifting snow and so amounts had to be estimated. Snow drifts were four to six feet deep.

January 29, 2008: Extreme Cold / Wind Chill - Wind chills of 40 to 45 below zero with wind speeds of 30 to 45 mph persisted for over 24 hours. The lowest wind chill recorded was 44 below zero at Bismarck.

March 30, 2007: Ice Storm - One quarter to one half inch of freezing rain fell across Burleigh County, creating ice covered and dangerous roadways. A few brief power outages occurred in the Bismarck area due to broken tree limbs falling onto power lines (newspaper). No travel was advised for various county, state, and federal highways as a result.

March 2, 2007: Blizzard - Winds of 30 to 45 mph were recorded across central North Dakota for much of Friday. These winds, in combination with recent snowfall of 5 to 12 inches, created widespread areas of significant blowing and drifting snow with near zero visibilities. Conditions were much worse in the open country than they were within urban areas, as numerous rural roadways became impassable due to large snow drifts. As a result, no travel was advised for much of central North Dakota, along with several highways being closed including Interstate 94 from Bismarck to Fargo.

February 28, 2007: Winter Storm - The heaviest snow (9 to 12 inches) fell over far south central and southeastern North Dakota. In addition to the heavy snow, light freezing rain and sleet also fell Wednesday afternoon and night over the central and eastern counties of the Bismarck County Warning Area.

January 24, 2007: Winter Storm - Low pressure over the central Rockies intensified into a major winter storm impacting North Dakota on the weekend of January 24th and 25th. A persistent snow event produced 6 to 12 inches of snow over most of western and central North Dakota. The heaviest band of snow fell from the northwest through central North Dakota where snowfall amounts ranged from 9 to 12 inches. The storm began as freezing rain and sleet over north central North Dakota before turning over to all snow. Gusty winds of 15 to 25 mph accompanied the storm resulting in considerable blowing and drifting snow and wind chills to 30 below zero. Travel throughout the region was impacted due to reduced visibilities and blocked roads.

January 4, 2007: Extreme Cold/ Wind Chill - Temperatures reached 20 to 30 below zero Sunday night and remained between 10 and 20 below zero on Monday. West winds of 10 to 25 mph combined with the subzero temperatures created wind chills ranging from 45 to 58 below zero over western and central North Dakota. The winds also created low visibilities in blowing snow in many areas of the region. Some roads were closed due to the blowing and drifting snow over parts of northern North Dakota. The frigid temperatures lead to power outages and water line breaks in several areas.

December 30, 2006: Heavy Snow - The highest snow totals, in excess of 10 inches, were from Bismarck, to Hazelton, Wishek, and Ashley, and through parts of Stutsman and Foster counties. These were the most significant snow amounts in these areas, from a single storm, in about seven winter seasons. There were many accidents and vehicles in ditches, at least 41 in the Bismarck area and more than 50 in the Jamestown area alone.

February 16, 2006: Wind Chill - Temperatures were in the 15 to 25 degree below zero range with wind speeds of 15 to 25 mph resulting in wind chills mainly in the 40s below.

January 20, 2006: Winter Weather - Around two inches of snow fell over Morton and Burleigh counties this morning. It was enough to cause slippery roads and traffic induced snow fog. Numerous accidents were reported in the two counties.

December 29, 2005: Winter Weather - Snow amounts totaled three to five inches over the area and a snow advisory was in effect. Several accidents were reported in Mandan, Morton County, and about 40 accidents were reported in Bismarck, Burleigh County. Two people were injured (indirect) in one of the Bismarck accidents.

January 13, 2005: Extreme Cold / Wind Chill - An arctic high pressure system dropped southeast out of central Canada on the evening of the 13th of January. The system brought bitter cold temperatures to western and central North Dakota the night of the 13th. The air temperatures overnight dropped between 20 to 35 below zero with daytime temperatures ranging 10 to 20 below zero. The subzero temperatures lasted through the morning of the 15th. Northwest winds up to 20 mph accompanied the cold air producing extreme wind chills of 40 to 60 below zero across the region.

March 10, 2004: Blizzard - The high wind event of March 10th brought afternoon and evening snow showers to central North Dakota. The snow combined with the high wind reduced visibilities to less and one quarter mile (1/4 mile) and in some areas visibilities lowered to near zero at times causing blizzard conditions. The North Dakota Highway Patrol and Department of Transportation closed down portions of highway 83 between Minot and Bismarck due to the extremely hazardous conditions caused by the snow and blowing snow. No travel was advised for the secondary roads in central North Dakota due to the snow, blowing snow and reduced visibilities.

February 10, 2004: Blizzard - The winter storm warning for western and central North Dakota was upgraded to a blizzard warning in the afternoon of the 10th. Strong winds of 50 mph combined with snow had reduced visibilities to zero at times by the late afternoon hours and remained at or near zero through the night.

January 27, 2004: Extreme Cold/Wind Chill - Ambient temperatures ranging 20 to 35 below zero combined with northwest winds to 30 mph resulted in widespread wind chill factors of 40 to 65 below zero.

December 17, 2002: Winter Storm - In the far west and far south central North Dakota 3 to 5 inch snowfall was common. After a relatively mild autumn, it was the first major arrival of winter weather to affect the region.

December 15, 2000: Blizzard - A strong low pressure system moved rapidly across southern Canada ushering frigid arctic air and strong northwest winds across western and central North Dakota. Wind gust to 60 mph were common throughout the region. The frigid arctic air kept daytime temperatures 5 to 10 below zero. The cold temperatures coupled with the high winds brought dangerous wind chills to 75 below zero. Snowfall was light, around an inch total, however existing snow on the ground created near zero visibilities in blowing and drifting snow for an extended period of time. This prompted the closing of many roads throughout western and central North Dakota.

November 7, 2000: Winter Storm – Heavy snow fell across western and central North Dakota with accumulations of 6 to 18 inches reported.

March 8, 2000: Winter Storm - Snow amounts ranged between 3 to 6 inches with the heaviest falling over south central North Dakota. Winds during the storm ranged between 40 to 50 mph which created dangerous winter conditions.

February 26, 2000: Winter Storm - A wide band of heavy wet snow fell from south central North Dakota through portions of extreme north central North Dakota along the Canadian border. Scattered areas of 8 to 12 inches of wet snow fell over this area with numerous reports of 3 to 6 inches within this band. Winds with this storm generally ranged between 30 to 45 mph which caused some blowing and drifting snow.

April 3, 1999: Winter Storm - The storm brought an area of heavy snow over western and central North Dakota. Snowfall ranged from 4 to 8 inches. The heaviest snow fell over the north central area.

April 1, 1999: Blizzard - Gusty northwest winds caused low visibilities in blowing and drifting snow over a wide area of western and central North Dakota. Six to fifteen inches of snow fell over the warned area.

January 1, 1999: Winter Storm - Heavy snow fell with 6 to 8 inches of snowfall during the day. Northwest winds to 40 mph brought bitter cold wind chills to 65 below zero and low visibilities in blowing snow west of the surface trough. Two fatalities were contributed to the storm. In south-central North Dakota at Bismarck a man (age unknown) died from a heart attack while shoveling snow. In north-central North Dakota near Rolette poor visibility stranded a vehicle which an elderly woman left to seek help and died from exposure to the cold. She came within 75 feet of a farm house but was unable to see it.

November 18, 1998: Winter Storm - Snowfall ranged 6 to 15 inches over central and east central North Dakota. The heaviest band of snow of 12 to 14 inches fell over the central and north-central counties.

November 9, 1998: Heavy Snow - A band of heavy wet snow extended from the southwest through much of central North Dakota ending early in the afternoon on the 10th. Amounts ranged from 6 to 9 inches in the southwest and south central to 9 to 13 inches north central.

April 4, 1997: Blizzard - Warm weather the first three days of April lead much of North Dakota to believe that spring had arrived with temperatures in the 60s and 70s. Mother Nature had other plans. A very strong area of low pressure moved out of the Colorado area into the northern plains. Warm moist air ahead of the low collided with cold air coming down from Canada. The result was the worst blizzard of the season for North Dakota, bringing much of the state to a complete halt. The precipitation began to fall during the afternoon of the 4th (Friday), as rain in the east and freezing rain or sleet in the west. By Friday evening the freezing rain and sleet had changed over to all snow in the west. By Saturday afternoon the heavy snow moved into the central part of the state, reaching the eastern part of North Dakota later that night. Snow accumulations were on average 1.5 to 2 inches an hour with 50 to 60 mph winds as well. The blizzard ended in the west on the morning of the 6th (Sunday), but continued into the evening across the east. **The additional snow at Bismarck brought the season snowfall total to 101.4 inches, which set an all-time record.** The old record was 91.8 inches. Many power poles fell from the weight of the ice and snow combined with the strong winds. It's estimated that over 300 wooden poles had to be replaced, with one power company reporting about 100 steel towers damaged or destroyed with over 200 miles of transmission line down. An estimated 75,000 homes were without power for some time over the weekend, with a few houses having to wait 4-5 days before power was fully restored. The state's electrical grid was in such patch work condition that the governor requested that people conserve as much energy as possible for rear of overtaxing the system and creating a widespread brownout. National Guard helicopters were used to help power companies assess the damage done to power poles and lines. With the widespread power outages, many people had to resort to burning wood or running gas powered generators to keep their homes warm. This lead to a few reports of carbon monoxide poisoning. Numerous vehicles were stranded in and out of towns, as well as people. I-94, I-29, and all other major highways in the state were closed for the weekend. **On the 7th(Monday), President Clinton declared North Dakota a disaster area for the 2nd time this winter**, freeing up grants and making low interest loans possible.

March 12, 1997: Winter Storm - The snow was mainly confined in a band from the northwest part of the state to the south-central (7 inches at Bismarck). I-94 was again closed from Bismarck to Fargo.

January 9, 1997: Blizzard - The second blizzard in less than 1 week brought North Dakota to a virtual standstill. This blizzard didn't bring as much snow as the first storm, but the winds gusted from the northwest as high at 40 mph and they lasted for 3 days. Snowfall amounts from this storm varied from 1-2 inches in the southwest to 2-4 inches in the central. But the strong winds combined with this snow as well as the snow from the blizzard a few days earlier created widespread whiteout conditions that lasted for 3 days. There were reports of people getting stranded in vehicles for up to 40 hours. Those that stayed with the vehicle survived, but those that didn't either perished or suffered 2nd and 3rd degree burns over 70-90 percent of their body. As the storm was winding down on the 11th and 12th, bitter cold air moved in, and with the strong northwest winds still blowing, wind chills plummeted to 85-90 below with actual air temperatures 20-30 below. In Elgin (Grant Co), the water tower froze and broke open due to the cold temperatures. With the amount of suffering and hardship going on, Gov. Schafer of North Dakota declared the state a disaster area. This was followed on the 12th with President Clinton approving the 1st ever request to declare a major statewide disaster. The National Guard was called in to help with snow removal as many communities had already spent their snow removal money before this storm.

January 4, 1997: Blizzard - The first blizzard of 1997 hit east-central North Dakota on the morning of the 4th. The blizzard was preceded by freezing rain that lasted most of the day before switching over to snow. The snow became so heavy that the highway department pulled the plows off of the roads the evening of the 4th and all day on the 5th. It was during the evening of the 4th that the northwest winds began to blow. Winds of 25 to 35 mph were common. Although the snow was not as heavy in the western part of North Dakota, the freezing rain made travel very hazardous. This would turn out to be the first of 4 major snow events that would hit western and central North Dakota during January.

December 25, 1996: Extreme Cold - The blizzard of the 16th-18th left in its wake very cold air. Williston set a new state record low of 32 below the morning of the 25th, and Bismarck set a new record low high temperature for the date, with the mercury struggling to 10 below for a high. Lows across the state that morning varied from 20 to 30 below with highs from 10 to 20 below.

December 16, 1996: Blizzard - A strong low pressure center moved southeast out of Canada into the northern plains bringing with it blizzard conditions. The blizzard lasted for 3 days in North Dakota. The blizzard began in the western part of the state the morning of Monday, December 16 and didn't exit the eastern part of the state until the evening of Wednesday, December 18th. This was the first 3 day blizzard since the winter of 1980-81. Snowfall amounts varied from around 2 inches in the Dickinson area...3-4 inches in Williston and Bismarck to 6-8 inches in the Jamestown area. The light snow combined with north winds gusting to 50 mph to produce massive blowing and drifting of snow. Temperatures also plummeted down to 20 below creating wind chills from 40 to 60 below. Visibilities were so poor that the ND Highway dept. pulled the plows off roads the evening of the 16th and didn't allow them to return to the roads until the afternoon of the 18th. Snow drifts as high as 10 feet were common. All of I-29 in North Dakota and I-94 from Bismarck to Fargo were closed, stranding hundreds of travelers.

November 23, 1996: Winter Storm - For the 2nd time is less than 1 week, more snow fell on parts of western and central North Dakota. Again, the lack of wind made the storm more bearable than what it could have been. Bismarck received almost 9 inches of snow. Bitter cold air also accompanied the storm system.

November 19, 1996: Winter Storm - Another winter storm hit North Dakota bringing more unwanted snow to the state. Although there wasn't enough wind associated with the storm system to qualify the storm as a blizzard, the 10 to 20 mph winds were enough to create some blowing and drifting snow in open areas. Bismarck received from 6-8 inches of snow.

November 5, 1996: Winter Storm - Although at first the storm appeared to be warm enough to only produce rain, once snow began to fall on the morning of the 5th, dynamic cooling lead to an all snow event across south-central and east central North Dakota. Snowfall totals include 6 inches at Bismarck.

March 23, 1996: Winter Storm - An early spring snow storm moved up out of the 4-corners region of the country to bring another round of severe winter weather to the northern plains. Snowfall totals include Bismarck with 13 inches. I-94 in Morton county was reported to have 6 foot snow drifts blocking lanes...and I-94 was closed from Saturday morning to Monday morning. Many travelers ended up being stranded for the weekend in North Dakota. Due to the warm weather received a few days before...roadways were warm. When the storm began...strong northeast to east winds blew the snow across the road...leaving the roadway wet. When the temperature began to fall, roadways became extremely icy. There were numerous reports of vehicles in the ditch, and a few roll-overs were also reported.

February 26, 1996: Blizzard - A strong low pressure system moving east out of the central Rockies brought another blizzard to North Dakota. Winds of 20-30 mph combined with the snow to produce white-out conditions. Snowfall totals include 11 inches at Bismarck, 10 inches at Grand Forks, 6.5 inches at Fargo, and 4-5 inches at Dickinson and Jamestown.

February 1, 1996: Extreme Cold / Wind Chill - Dangerously cold weather once again hit North Dakota. Many places reported lows from 35 to 45 below. Daytime highs faired no better, as Bismarck reached a high of 26 below. Northwest winds up to 30 mph created wind chills to **100 below**. Electric companies reported peak loads, while natural gas companies had trouble keeping gas flowing through pipelines. Numerous schools closed and many water main breaks occurred. There were also shortages of #1 diesel fuel.

January 29, 1996: Extreme Cold / Wind Chill - A 57 year old Bismarck man died from a heart attack while operating a snow blower. The day before the man died, the Bismarck area received 5 inches of snow. On the day he died, high temperatures were in the teens below zero with wind chills from 40 to 60 below.

January 17, 1996: Blizzard - A strong low pressure center located over the central plains combined with strong arctic high pressure moving south out of Canada to bring blizzard conditions to North Dakota. Snowfall amounts range from 8 inches at Williston in the northwest to 20 inches at Wahpeton in the southeast. Fargo and Bismarck set new records for 24 hr. snowfall, receiving 18 and 7.9 inches respectively. Winds gusting to 55 mph created 3 to 5 foot drifts in the central, while drifts up to 10 feet were found in the east. Law enforcement officials advised no travel and closed I-29 in North Dakota, I-94 from Bismarck to Fargo, and US Highway 2 from Grand Forks to Devils Lake. Many people who did not heed the travel warnings got stranded for several hours on the interstate and state highways. Fortunately no deaths were reported. With temperatures dropping to 10 to 20 degrees below zero, wind chills varied from 60 to 80 below zero, snow removal was hampered with hydraulic and cooling systems freezing on snow plows.

February 9, 1995: Blowing Snow - Strong northerly winds combined with recently fallen snow created near zero visibilities in parts of northwest, central, and eastern North Dakota. Along with the blowing snow were wind chills 40 to 60 below zero. Several counties advised no travel, many schools were cancelled; parts of Interstate 29 and parts of Interstate 94 were closed for the second time in as many days. Among the many problems caused by the weather was a serious accident at 1730 CST on the 10th, 15 miles west of Mandan on Interstate 94. Zero visibility caused several vehicles to slow or stop on the interstate. Other cars, 23 in all, continued travel causing a chain reaction of accidents resulting in 1 death and 13 injuries. In addition to the injuries from the accident, several rescue workers suffered frostbite in their rescue efforts.

November 26, 1994: Heavy Snow - Six to ten inches of snow fell in central North Dakota. In addition to the snow, freezing drizzle fell in the south central. The North Dakota Highway Patrol advised no travel in much of the central part of the state.

April 25, 1994: Heavy Snow / Blizzard - A late season winter storm came a few days after temperatures of 80 degrees. Parts of southern North Dakota received almost a foot of heavy wet snow. Some thunder occurred with the snowfall. Winds of 25 to 45 mph caused blizzard conditions at times, and snow drifts three feet high. This late storm brought record seasonal snowfall to many parts of the state. Snowfall for the winter season topped 100 inches in some places. The storm closed schools and businesses, and shut down travel.

March 22, 1994: Heavy Snow - Up to 14 inches of heavy wet snow fell over much of southern North Dakota. The snow began in southwest and south-central North Dakota the night of the 22nd, persisted throughout the day on the 23rd, then ended that evening. In southeast North Dakota, the snow began later on the 23rd and lasted late into the night. The heaviest snowfall occurred in the southwest and south-central sections, near the South Dakota border. Twelve inches of snow was reported in Bowman, in the southwest corner of the state. About eight inches of snow fell in the cities of Bismarck and Fargo.

November 22, 1993: Heavy Snow - A slow moving and enormous storm over North America brought record single-storm snowfall to much of North Dakota. Over two feet of snow fell over a large part of central and southeast North Dakota, and most of North Dakota had over a foot of snow from this storm. The greatest snowfall amount was reported at Oakes, in Dickey County in southeast North Dakota, 31 inches. At the National Weather Service office in Bismarck, 28.3 inches of snow was measured during the 108-hour snow event. This amount set a new single-storm record for snow in Bismarck. The snow began the evening of the 22nd and did not end until the morning of the 27th. Except for about six hours during the day on the 26th, the snow was continuous through this period. The snowfall was intermittent over most of North Dakota during this lengthy event. Fortunately, the wind was only 10 to 25 MPH during this storm, so it was well below blizzard conditions and blowing and drifting of snow was not a problem. The storm occurred during the week of Thanksgiving, so many travelers were stranded. The prolonged snowfall kept snow removal crews working around the clock, and a few motorists crashed into the snowplows. Out in the rural areas, some farm buildings collapsed in the heavy snow.

October 27, 1991 – Snow and ice storm
October 23, 1991 – Snow storm
December 19, 1990 – Extreme cold
November 7, 1986 – Blizzard, heavy snow, and ice storm
April 13, 1986 – Blizzard, heavy snow, ice storm
February 1, 1986 – Fog and freezing drizzle
December 23, 1983 – Extreme cold
March 4, 1983 – Severe storm with snow
January 5, 1980 – Blizzard
April 11, 1979 – Heavy snow
March 18, 1979 – Winter storm
February 22, 1979 – Winter storm
February 14, 1979 – Winter storm
January 24, 1978 – Blizzard
December 16, 1977 – Ice storm and wind

December 6, 1977 – Winter storm with one fatality
November 18, 1977 – Blizzard, wind, and snow
January 1, 1976 – Snow and blizzard
December 30, 1975 – Snowstorm
March 26, 1975 – Blizzard
January 10, 1975 – Blizzard
July 4, 1972 – Frost
June 20, 1972 – Frost
February 23, 1969 – Severe snow and ice storm
January 22, 1969 – Blizzard
December 22, 1968 – Snow and blizzard
April 29, 1967 – Ice storm
April 16, 1967 – Ice storm and blizzard
February 23, 1967 – Blizzard
April 25, 1966 – Rain, freezing rain, and heavy snow

March 2, 1966 – Blizzard Worst Blizzard in state history happened in 1966: KFYR TV Article: https://www.kfyrtv.com/content/news/Worst-blizzard-in-state-history-happened-in-1966-475786173.html	**Worst blizzard in state history happened in 1966**  (KFYR) By Cynthia McLaughlin *Published: Mar. 4, 2018 at 8:44 PM CST*

December 15, 1964 – Blizzard
December 6, 1963 – Blizzard
April 23, 1961 – Blizzard
March 28, 1960 – Blizzard with heavy snow
March 16, 1960 – Glaze with 3 injuries
January 1, 1960 – Cold wave and blizzard

Blank Page - Intentional

Plan Maintenance

Hazard mitigation planning is an on-going process. Bismarck Emergency Management coordinates with stakeholders to ensure this plan remains effective and relevant for the city of Bismarck.

This plan section establishes the method and schedule for monitoring, evaluating, and updating the Hazard Mitigation Plan during a five-year plan-update cycle. This section also identifies how Bismarck will maintain community involvement in the plan.

Plan Monitoring
The plan will be monitored jointly by Bismarck Emergency Management and all city departments which are assigned to complete mitigation actions or conduct on-going mitigation projects. At a minimum, the plan is reviewed after each disaster, or in the absence of such, annually. Emergency Management and all departments will monitor progress of their assigned mitigation projects and maintain their own list of projects completed to be noted in future plan updates.

The plan will be reviewed annually throughout the 5-year planning cycle for updates based on any actual incidents or additional mitigation planning needs identified as a result of on-going input from the public, city departments, or stakeholders.

Plan Evaluation and Updating
Evaluation and updating of the plan is coordinated by Bismarck Emergency Management in cooperation with the city departments and applicable stakeholders. Significant disaster or emergency incidents will be evaluated for mitigation recommendations that should be added to the plan. New stakeholders and interested parties are identified and invited to participate in the implementation and update process.

Public Participation
The Bismarck Multi-Hazard Mitigation Plan is posted to the Bismarck Emergency Management website. The website will invite and provide opportunity for on-going public input regarding the mitigation plan. Bismarck Emergency Management will also promote awareness of the mitigation plan and make it available for public review during various public forums including public education emergency preparedness presentations and site or community group-specific settings.

Annual Reporting
The City of Bismarck participates in the Community Rating System (CRS) program, and to comply with the requirements of CRS participation, a flood mitigation action item progress report is communicated to the city commission and city residents via the city website and/or a scheduled city commission meeting. This activity supports updating and maintaining the Multi-Hazard Mitigation Plan.

Schedule of Plan Review and Updates			
Plan Section/Content	**Post-Disaster**	**Annually**	**Every 5 Years**
Adoption Documentation			X
Executive Summary and Introduction Sections			X
Mitigation Strategy	X		X
Hazard Vulnerability & Mitigation Actions Summary	X		X
Mitigation Implementation Action Plan	X	X	X
Mitigation Actions – Prioritizing	X		X
Integration of Plans/Programs & Mitigation Capabilities Inventory			X
Community Profile			X
Community Assets		X	X
Risk Assessment Summary			X
Hazard Identification	X		X
Hazard Profiles	X	Update per incidents	X
Planning Process	X	X	X
Plan Maintenance		X	X

Planning Process & Public Input

The City of Bismarck recognizes that the planning process is as important as the plan document. Involvement in the planning process enhances understanding and awareness of the hazards, the associated risks and vulnerabilities, as well as mitigation opportunities to minimize potential impact. The Bismarck Multi-Hazard Mitigation Plan is a combined effort among various stakeholders including local, state, federal government entities as well as public and private sector and citizens. The various planning meetings were facilitated by the city emergency manager.

This section illustrates the planning process to include significant involvement by community stakeholders and opportunity for public input. The current Bismarck Multi-Hazard Mitigation Plan remains available on the city's website and open to the public for comment and recommendations at any time.

Mitigation Plan Update Meetings Summary	
Meeting Title	**Date**
Kick-Off Meeting – Mitigation Plan Update Kick-Off Meeting	October 14, 2019
Public Input Survey (online)	December 2019
Public Input Meeting at Bismarck Public Library	January 9, 2020
Lead Planner Coordination Meeting (Flood Hazard)	January 6, 2020
Climate Change Planning Committee Meeting	January 22, 2020
Hazard Planning Team Meeting: Communicable Disease, Climate Change, Dam Failure, Geologic Hazard, Shortage/Outage of Critical Material	March 2, 2020
Hazard Planning Team Meeting: Fire, Wildland Fire, Flood, Drought	March 9, 2020
Hazard Planning Team Meeting: Hazmat Release, Train Derailment, Aircraft Accident, Active Threat, Civil Disturbance	March 12, 2020
Hazard Planning Team Meeting: Biological Infestation, Severe Summer Weather, Tornado, Winter Storm	July 30, 2020
Community Emergency Response Committee Meeting	October 20, 2020
Public Input Opportunity – pre-final	October 29 through November 13, 2020

Hazard Mitigation Planning Teams

Hazard Planning Teams were established to support the update or development of the hazards as noted within the tables shown below. Bold letters within the 2nd table indicate Lead (or co-lead) for plan updates relating to each hazard.

Team A	**Team B**	**Team C**	**Team D**	**Team E**
Fire	HazMat	Tornado	Active Threat	Dam Failure
Wildland Fire	Train Derail	Severe Summer Weather	Civil Disturbance	Climate Change
Flood	Geological Hazard	Biological Infestation		Outage of Critical Material
Drought	Aircraft Accident	Winter Storm		Communicable Disease

City Departments *Hazard Planning Teams Participation*	Active Shooter	Aircraft Accident	Biological Infestation	*Civil Disturbance	**Climate Change		Communicable Disease	Dam Failure	Drought	Fire	Flood	Geological Hazard	HazMat Release	Severe Summer Wx	Tornado	Outage/Critical Material	Train Derailment	Wildland Fire (WUI)	Winter Storm
Administration					E		E	**E**								E			
Airport		**B**										B	B				B		
Attorney	*Support All Teams upon request for legal guidance*																		
CenCom	D			D															
Comm Dev					X				A	A	**A**							A	
Emerg Mgmt					E		E	E								E			
Engineering		B										**B**	B				B		
Event Center	D			D															
Finance	D			D															
GIS	*Support All Teams (ie: Hazard specific Mapping Needs)*																		
IT	D			D															
Fire		B	C						A	**A**	A	B	**B**	**C**	**C**		**B**	**A**	C
Human Res	D			D															
Library					E		E	E								E			
Police	**D**			**D**															
Public Health					E		**E**	E								E			
Env Health			X		E		E	E								E			
Public Works Service Ops			C						A	A	**A**			C	C			A	**C**
Forestry			**C**											C	C				C
Public Works Utility Ops								E	**A**	A	**A**							A	

Bismarck Multi-Hazard Mitigation Plan Update Planning Team Participants

Planning Team A	**Hazards: Drought, Flood, Fire, and Wildland Fire**	
Name	Title	Department or Organization
Michelle Klose	Director of Utility Operations	Bismarck Public Works
Terry Halstengard	Storm Water Program Coordinator	Bismarck Public Works
Jim Kershaw	Water Plant Superintendent	Bismarck Public Works
Jeff Heintz	Director of Service Operations	Bismarck Public Works
Douglas Wiles	City Forester	Bismarck Public Works - Forestry
Brady Blaskowski	Building Official and Flood Plain Administrator	Bismarck Community Development – Building and Inspections
Keith Glass	Superintendent - Streets	Bismarck Public Works
Michael Greer	Design & Construction Engineer	Bismarck Engineering
Dean Meyer	Deputy Fire Chief	Bismarck Fire Department
Kurt Leben	Battalion Chief	Bismarck Fire Department
Mary Nelson	RSVP West Region Coordinator	RSVP
David Mayer	Operations Director	Bismarck Parks and Recreation District
Darrel Nucech	GIS Coordinator	Bismarck Finance – GIS Division
Gary Stockert	City Emergency Manager	Bismarck Fire/Emergency Management Division
Planning Team B	**Hazards: Aircraft Accident, Active Threat, Civil Disturbance, Geological Hazard, Hazardous Materials Release and Train Derailment**	
Name	Title	Department or Organization
Tim Thorsen	Assistant Airport Director	Bismarck Airport
Michael Greer	Design & Construction Engineer	Bismarck Engineering
Rob Carlson	Battalion Chief	Bismarck Fire Department
Tom Painter	Airport Fire Chief	Airport Fire
Glen Ternes	Lieutenant	Bismarck Police Department
Nelson De LaVergne	Major, Commanding Officer	The Salvation Army
Charlie Jeske	Director	Bismarck Event Center
Andrew Milas	IT/GIS Manager	Bismarck Finance – IT Division
Robert McConnell	Director	Bismarck Human Resources
Dean Meyer	Deputy Fire Chief	Bismarck Fire Department
Darrel Nucech	GIS Coordinator	Bismarck Finance – GIS Division
Gary Stockert	City Emergency Manager	Emergency Management Division
Planning Team C	**Hazards: Biological Infestation, Severe Summer Weather, Tornado, and Winter Storm**	
Douglas Wiles	City Forester	Bismarck Public Works - Forestry
Chad Gee	Battalion Chief	Bismarck Fire Department
Jeff Heintz	Director of Service Operations	Bismarck Public Works
Keith Glass	Superintendent - Streets	Bismarck Public Works
Dean Meyer	Deputy Fire Chief	Bismarck Fire Department
Darrel Nucech	GIS Coordinator	Bismarck Finance – GIS Division

Gary Stockert	City Emergency Manager	Emergency Management Division
Planning Team D	Planning Team D was eliminated, and combined with Planning Team B above.	
Planning Team E	**Hazards: Communicable Disease, Climate Change, Dam Failure, and Outage/Shortage of Critical Materials.**	
Name	Title	Department or Organization
Jason Tomanek	Assistance City Administrator	City of Bismarck
Kate Waldera	MLS, Head of Information Services	Bismarck Veterans Memorial Public Library
Ben Ehreth	Director	Community Development
William Hutchings	Planner	Community Development – Planning Division
Anton Sattler	Administrator	Public Health – Environmental Health Division
Crystalynn Kuntz	Emergency Preparedness SWC Regional Coordinator	Bismarck/Burleigh Public Health
Renae Moch	Director	Bismarck/Burleigh Public Health
Gary Stockert	City Emergency Manager	Bismarck Fire/Emergency Management Division
Community Emergency Response Committee	Plan Review and Preliminary Plan Approval at Local Level.	
Name	Title	Department or Organization
Keith Hunke	City Administrator	City of Bismarck
Jason Tomanek	Assistance City Administrator	City of Bismarck
Joel Boespflug	Fire Chief	Bismarck Fire Department
Dave Draovitch	Chief of Police	Bismarck Police Department
Jeff Heintz	Director of Service Operations	Bismarck Public Works
Michelle Klose	Director of Utility Operations	Bismarck Public Works
Renae Moch	Director	Bismarck/Burleigh Public Health

The City of Bismarck Multi-Hazard Mitigation Plan Update Kick-Off Meeting was held on October 14, 2019. Below is the agenda and summary. The hazard planning teams identified on page 2 were established as one of the kick-off meeting action items.

Bismarck Mitigation Plan Update Kick-Off Meeting
October 14, 2019 Bismarck Public Works, 1:30 PM

Agenda

1. **Plan Update Requirements**

2. **Kick-Off Meeting Focus Items**:
   A. Proposed Method of Plan Update
   B. Hazard Identification
   C. Hazard Mitigation Goals/Priorities
   D. Mitigation Plan Informational Requests
   E. Identify Hazard Mitigation Planning Teams

Meeting Summary
Bismarck Mitigation Plan Update Kick-Off Meeting
October 14, 2019 Bismarck Public Works, 1:30 PM

1. **Plan Update Requirements**
   Gary Stockert, City Emergency Manager, provided an overview of planning requirements as it relates to plan approval by ND Department of Emergency Services and the Federal Emergency Management Agency.

2. **Kick-Off Meeting Focus Items**:
   A. Proposed Method of Plan Update: *Gary Stockert, City Emergency Manager, provided a proposed method of plan updating to ensure plan update would meet planning process requirements such as allowing for public input opportunities as well as engaging community stakeholders in the planning process. To meet Federal and State mitigation planning requirements, the plan must address natural hazards. The Bismarck Multi-Hazard Mitigation Plan also addresses technological and human caused hazards.*
   B. Hazard Identification: *All hazards identified within the 2015 Bismarck Multi-Hazard Mitigation Plan will be included in the plan update. Based on discussion, the mitigation plan update will address Climate Change as well as Cyber Security and Civil Disturbance.*
   C. Hazard Mitigation Goals/Priorities: *Participants were invited to review the current goals and priorities identified in the 2015 Bismarck Multi-Hazard Mitigation Plan and provide comment or suggested updates. Participants were informed that changes or suggestions are welcome anytime during the planning process throughout the next several months.*
   D. Mitigation Plan Informational Requests: *Participants were provided with informational requests (by Department) to aid in the updating of the mitigation plan.*
   E. Identify Hazard Mitigation Planning Teams: *Participants discussed and revised a proposed planning team matrix to address existing and new hazards, as well as Climate Change. It was determined that all departments would be involved in the development of plan content relating to the Cyber Security hazard. Participants were informed that additional planning team members may be added from various community stakeholder agencies or even individuals who may express interest though public input opportunities.*

Participant Roster
Bismarck Mitigation Plan Update Kick-Off Meeting
October 14, 2019

Bismarck Mitigation Plan Update Kick-Off Meeting Invite List (City Departments)			
Name	**Department or Division**	**Name**	**Department or Division**
Keith Hunke	City Administration	Jason Tomanek	City Administration
Joel Boespflug	Fire	Gloria David	City Administration/PIO
Jeff Heintz	Public Works	Dave Draovitch	Police
Ben Ehreth	Community Development	Randy Ziegler	Police
Brady Blaskowski	Building & Inspections	Jason Stugelmeyer	Police
Greg Haug	Airport	Renae Moch	Public Health
Tim Thorsen	Airport	Gabe Schell	Engineering
Matthew Remynse	Airport	Anton Sattler	Environmental Health
Jannelle Combs	Attorney	Bob McConnell	Human Resources
Mike Dannenfelzer	Central Dakota Communications Center (CenCom)	Christine Kujawa	Library
Andrew Milas	Information Technology	Charlie Jeske	Event Center
Michelle Klose	Public Works – Utility Ops	Dmitriy Chernyak	Finance
Doug Wiles	Forestry	Darrel Nucech	GIS
Justin Messner	ND DES	Neil Johnson	ND DES

SIGN IN
Bismarck Multi-Hazard Mitigation Plan Update Kick-Off Meeting
October 14, 2019 Bismarck Public Works

Name	Position Title	Department - Bismarck
Brady Blaskowski	Building Official	Community Development
Jim Kershaw	WTP Superintendent	Water Plant
Justin Messner	Deputy Recovery Chief	NDDES
BEN EHRETH	DIRECTOR	COMMUNITY DEVELOPMENT
Jared Auck	GIS Analyst	GIS/IT
Neil Johnson	Sw Regional Coordinator	NDDES
Crystalynn Kuntz	EPA	BBPH
Renae Moch	Director Public Health	BBPH
Mike Dannenfelzer	Communication Director	CenCom
CHARLIE JESKE	EVENT CENTER - DIRECTOR	BEC
Andrew Milas	IT manager	
Doug Wiles	Forester	PW-SOPS
Dean Meyer	Deputy Fire Chief	Fire
Anton Sattler	Env. Health Administrator	BBPH
Jason Stugelmeyer	Bismarck Police DC	BPD
Dave Draovitch	Bismarck PD chief	BPD
Randy Ziegler	Bismarck PD DC	BPD
Jason Tomanek	City Administration/Asst. City Administrator	Admin.
Keith Hunke	City Administrator	Admin
Gabe Schell	City Engineer	Engineering
Jerod Fueller	Distribution & collection Pub. Utilities	PW Utilities
Travis Carufel	Wastewater Plant Supt.	PW Utilities

SIGN IN
Bismarck Multi-Hazard Mitigation Plan Update Kick-Off Meeting
October 14, 2019 Bismarck Public Works

Name	Position Title	Department - Bismarck
Michelle Klose	Director Utility Ops - Public Works	PW Utilities
Jeff Heintz	Director of PW-SO	PW-SO
Gloria David	Public Information Officer	Admin.
Jannelle Combs	City Attorney	City Attorney
Dmitriy Chernyak	FINANCE DIRECTOR	FINANCE

Community Stakeholders were invited to participate in the hazard specific planning teams.

The Invitation to participate went out to the following community stakeholders via e-mail on February 13, 2020:

Bismarck *Fire Department*

February 13, 2020

Hello City of Bismarck Multi-Hazard Mitigation Plan community stakeholders:

Bismarck Emergency Management is in the process of coordinating the update of the 2015 City of Bismarck Multi-Hazard Mitigation Plan. An important component of the planning process is obtaining public input from community stakeholders.

The purpose of this communication is to invite you to provide your thoughts relating to any of the hazards addressed in the current mitigation plan (or identify new hazards) as well as to provide any thoughts relating to risk, vulnerability, or mitigation opportunities relating to any of the hazards.

In order to adequately review the vulnerabilities and mitigation ideas relating to 17 hazards, four multi-hazard planning team meetings have been scheduled. Each team meeting will review vulnerability and mitigation ideas relating to four or five hazards. **If you would like to participate in one (or more) of the mitigation plan update meetings, please respond via e-mail** to Gary Stockert, City Emergency Manager at gstockert@bismarcknd.gov. **See attachment for meeting details and hazards addressed at each meeting.**

As noted in the attachment, a 5th meeting option is made available exclusively to accommodate stakeholders who may want to provide input on the mitigation plan in an open discussion regarding any section of the Bismarck Multi-Hazard Mitigation Plan - as desired by participating stakeholders.

Whether or not you're are able to participate in one of the meetings as outlined in the attachment, please be aware that public input regarding the city's mitigation plan is welcome at any time – before, during, or even after plan updates are completed. Comments regarding the plan may be directed to Bismarck Emergency Management.

The 2015 Bismarck Multi-Hazard Mitigation Plan is available via the city website at

https://www.bismarcknd.gov/DocumentCenter/View/22621/Bismarck-MHMP-2015-Public?bidId=

Defining "Mitigation."

Mitigation is the effort to reduce loss of life and property by lessening the impact of potential disasters. Mitigation is taking action now—before the next disaster—to reduce human and financial consequences later. Mitigation may also reduce or minimize the extent of response efforts or resources required following a disaster event.

Please see attachment for meeting options including date and location of meeting options.

Thanks,

Gary Stockert

Emergency Manager
City of Bismarck, Fire Department/Emergency Management Division
2301 University Drive, Bldng 21

Phone: 701-355-1400 ★ Fax: 701-222-6524 ★ TDD: 711 ★ 1020 E Central Ave ★ Bismarck, ND 58501-1936
www.bismarcknd.gov ★ facebook.com/bismarcknd.gov ★ twitter.com/BismarckNDGov
An Equal Opportunity-Affirmative Action Employer

Bismarck Multi-Hazard Mitigation Plan Update Meetings

The meeting purpose is the same for each meeting which is to review and identify updates to the hazard profiles (ie: vulnerability/risk) as well as to review and identify mitigation action items for purposes of reducing impact. See meeting description for meeting option #5.

Option 1
March 2, 2020 | 10:30 am to noon |EOC Conference Room (*see directions below)
Hazards Addressed

- *Communicable Disease Hazard*
- *Climate Change*
- *Outage of Critical Material*
- *Dam Failure*
- *Geological Hazard*

Option 2
March 9, 2020 |10:00 to 11:30 am | Bismarck Public Works – 601 South 26th Street
Hazards Addressed

- *Fire*
- *Wildland Fire*
- *Flood*
- *Drought*

Option 3
March 12, 2020 |10:30 to noon | Bismarck Public Works – 601 South 26th Street
Hazards Addressed

- *Hazmat Release*
- *Train Derailment*
- *Aircraft Accident*
- *Active Shooter*
- *Civil Disturbance*

Option 4
March 19, 2020 | 1:30 – 3:00 PM |EOC Conference Room (*see directions below)
Hazards Addressed

- *Winter Storm*
- *Biological Infestation*
- *Severe Summer Weather*
- *Tornado*

Option 5
April 2, 2020 | 1:30 – 3:00 PM | Public Works Large Training Room
This Mitigation Plan Update Meeting for Stakeholders is scheduled to accommodate those community stakeholders who may wish to provide feedback on the mitigation plan in more general terms or to provide feedback on a cross-section of those hazards listed above. This meeting will allow for open discussion on the mitigation plan as it relates to any of the hazards, vulnerabilities, or mitigation opportunities.

*EOC location is just south of the Airport at 2301 University Drive, Building #21.
From University Drive, take a left on Jetway Avenue. The EOC is the first building on the right – Building #21. If you get to United Tribes – you went too far south.

Meeting Changes due to COVID-19 incident: The March 19, 2020 meeting was re-scheduled and completed on July 30, 2020. The April 2, 2020 general meeting for stakeholders was cancelled due to COVID-19 and due to minimal response to participate.

Community Stakeholders invited to participate in the Multi-Hazard Mitigation Plan Update			
First Name	**Last Name**	**Position Title**	**Agency**
Brad	Erickson	Safety Director	Sanford Health
Doris	Weiss	Safety & Emergency Manager	CHI St. Alexius
Dan	Schaefer	Operation Chief	Metro Area Ambulance
Becky	LaBella	Safety Coordinator	Bismarck Public Schools
Nelson	DeLaVergne	Major, Corps Officer	Salvation Army
Wes	Engbrecht	Communications Director	Capital Electric
Craig	Lohstreeter	Region Director	Montana Dakota Utilities
Courtney	Vetter	Manager, Electric System Compliance	Montana Dakota Utilities
Doug	Wiseman	Region Electric Superintendent	Montana Dakota Utilities
Randy	Aden	Chief Mechanical Officer/General Manager	DMVRR
Paul	Hester	Manager HaMat Field Ops & Emergency Response	BNSF
Mary	Nelson	West Region Coordinator	RSVP
Corey	King	Emergency Response Specialist	National Weather Service
Randy	Bina	Executive Director	Bismarck Parks and Recreation
Kevin	Klipfel	Facilities and Programs Director	Bismarck Parks and Recreation
Tom	Painter	Fire Chief,	Metro Rural Fire (Bismarck Airport)
Greg	Carr	Lead Chaplain	Chaplaincy
Roy	Rickert	Executive Director	BisMan Transit
Frank	Dot	Executive Director	Bismarck/Mandan Homebuilders Association
Brian	Ritter	President	Bismarck Mandan CEDC

Hazard Planning Teams Meetings:

Agenda

Multi-Hazard Mitigation Plan Update Meeting
March 2, 2020

Introductions

Mitigation Plan Updating:

1. Hazard Profiles
2. Vulnerability Statements
3. Community Changes (ie: changes in vulnerability)
4. Mitigation Action Items
    a. Status Updates
    b. New Mitigation Action Items
5. Ranking of Mitigation Ideas (new)
6. Mitigation Implementation (new)

Hazards:
Communicable Disease, Climate Change, Dam Failure, Geologic Hazard, Shortage/Outage of Critical Materials

City of Bismarck - Mitigation Planning
Hazards: Communicable Disease, Climate Change, Dam Failure, Geologic Hazard, Shortage/Outage of Critical Materials
March 2, 2020 EOC Conference Room

Name	Agency	Position Title
Toby Gross	MDU	Ops Mgr
Julie Fernstedt	Bis Parks + Rec	Admin Services Mgr.
Crystalynn Kuntz	BBPH	EPR Coordinator
Kelen Ost	BBPH	EP Information Specialist
Anton Sattler	BBPH	Env Health Administrator
Jason Tomanek	City Administration	Assistant City Administrator
Wm Hutchings	Planning - City of Bismarck	Planner
Gary Stockert	Bismarck Emergency Mgmt	Emergency Manager

Meeting Summary: Lead planners summarized updates made or required for each hazard profile. Changes in the community were reviewed as it relates to any updates to vulnerability, risk assessment, and new mitigation ideas. Status of Mitigation Action items were reviewed and updated. Several new mitigation action items were identified for Communicable Disease hazard. Climate Change draft plan content developed based on the January 22, 2020 Climate Change Committee meeting was reviewed again by the planning team to establish summary statements as to the impact to each of the other hazards addressed in plan. One new mitigation action was identified for the Geologic Hazard.

Agenda

Multi-Hazard Mitigation Plan Update Meeting
March 9, 2020

Introductions

Mitigation Plan Updating:

1. Hazard Profiles
2. Vulnerability Statements
3. Community Changes (ie: changes in vulnerability)
4. Mitigation Action Items
    a. Status Updates
    b. New Mitigation Action Items
5. Ranking of Mitigation Ideas (new)
6. Mitigation Implementation (new)

Hazards:
Fire, Wildland Fire, Flood, Drought

City of Bismarck - Mitigation Planning
Hazards: Fire, Wildland Fire, Flood, Drought
March 9, 2020 Public Works

Name	Agency	Position Title
Mary Nelson	RSVP	Western ND Coordinator
James Kershaw	C.B. Water Plant	Superintendent
Major Nelson DeLaVergne	The Salvation Army	Corps Officer
Keith Glass	Public Works	Superintendent
Michelle Klose	PW	Director Utility Operations
Jeff Hentz	PW-50	Director of PW Service Ops
Mike Greer	Eng	Design & Const Engr
Gary Stockert		
David Mayer	Bismarck Parks and Recreation District	Operations Director
Terry Hollstegaard	Public Works	Storm Water

Meeting Summary: Lead planners summarized updates made or required for each hazard profile. Changes in the community were reviewed as it relates to any updates to vulnerability, risk assessment, and new mitigation ideas. Status of Mitigation Action items were reviewed and updated. One new mitigation action item was identified relating to pursuing Class 7 for the Community Rating System program (CRS).

Agenda

Multi-Hazard Mitigation Plan Update Meeting
March 12, 2020

Introductions

Mitigation Plan Updating:

1. Hazard Profiles
2. Vulnerability Statements
3. Community Changes (ie: changes in vulnerability)
4. Mitigation Action Items
    a. Status Updates
    b. New Mitigation Action Items
5. Ranking of Mitigation Ideas (new)
6. Mitigation Implementation (new)

Hazards:
Hazmat Release, Train Derailment, Aircraft Accident, Active Shooter, Civil Disturbance

City of Bismarck - Mitigation Planning
Hazards: Hazmat Release, Train Derailment, Aircraft Accident, Active Shooter, Civil Disturbance
March 12, 2020 Public Works

Name	Agency	Position Title
Tom Painter	Airport Fire	Chief
Glen Terres	Bismarck PD	Lieutenant
Nelson DeLaVergne (Major)	The Salvation Army	Commanding officer
Dean Meyer	Bis Fire	Deputy Chief
CHARLIE JESKE	BISMARCK EVENT CENTER	DIRECTOR
Jim Thorsen	Bismarck Airport	Asst Airport Director
Andrew Miles	IT/GIS	IT/GIS Manager
Gary Stockert	Bismarck Parking Mgmt	Emergency Manager
Bob McConnell	Bismarck HR Office	HR Director

Meeting Summary: Lead planners summarized updates made or required for each hazard profile. Changes in the community were reviewed as it relates to any updates to vulnerability, risk assessment, and new mitigation ideas. Status of Mitigation Action items were reviewed and updated. It was recommended to change "Active Shooter" to "Active Threat" to be more inclusive of related threats. No new mitigation action items were identified. Many of the previous mitigation action items are noted as completed, and many are on-going.

Agenda

Multi-Hazard Mitigation Plan Update Meeting
July 30, 2020

Introductions

Mitigation Plan Updating:

1. Hazard Profiles
2. Vulnerability Statements
3. Community Changes (ie: changes in vulnerability)
4. Mitigation Action Items
    a. Status Updates
    b. New Mitigation Action Items
5. Ranking of Mitigation Ideas (new)
6. Mitigation Implementation (new)

Hazards:
Biological Infestation, Severe Summer Weather, Tornado, Winter Storm

SIGN-IN

City of Bismarck - Mitigation Planning

Hazards: Biological Infestation, Severe Summer Weather, Tornado, Winter Storm

July 30, 2020 - Bismarck Public Works

Name	Agency	Position Title
Doug Wiles	City of Bismarck	City Forester
Chad Ilg	Bis. Fire	BC (Battalion Chief)
[signature]	Bis PW	Director of PW
Gary Stockert	Bismarck Emergency Mgmt	Emergency Manager

Meeting Summary: Lead planners summarized updates made or required for each hazard profile. Changes in the community were reviewed as it relates to any updates to vulnerability, risk assessment, and new mitigation ideas. Status of Mitigation Action items were reviewed and updated. One new mitigation action was identified for further review as it requires city commission action.

Community Emergency Response Committee (CERC) Agenda
Final Mitigation Planning Meeting
October 20, 2020

Finalizing Bismarck Multi-Hazard Mitigation Plan

1. Meeting Purpose
    a. Plan Review and Approval Process: Local, State, Federal
    b. Plan Adoption via City Commission
2. Mitigation Plan Updates Overview
    a. Mitigation Action Items Status Updates: Section 4
    b. New Mitigation Action Items: Section 5
    c. Climate Change and Climate Change Impact Statements: Section 9
    d. Historical Events Updates: Section 10 Hazard Profiles
3. Executive Summary and Mitigation Strategy Overview
    a. Risk Assessment Overview
        i. Hazard Ranking – review and finalize
4. Mitigation Implementation Action Plan
    a. Additional Mitigation Action Items (updates)
    b. Review/update mitigation action time frame, cost and funding source where applicable
    c. Review and Integration of Public Input
5. Mitigation Plan Sections Overview – See Introduction
6. Post- Meeting: Discussion of Next Steps
    a. Comment Period / Public Review of Plan
    b. Submitting to DES
    c. Mitigation Grants – general discussion

SIGN-IN
City of Bismarck – Final Mitigation Planning Meeting
Community Emergency Response Committee (CERC)
October 20, 2020

Name	Department	Position Title
Joel Boespflug	Fire	Chief
Jeff Heintz	Public Works Sa	Director
Dave Draovitch	Police	Chief
Jason Tomanek	Administration	Ass. Admin.
Barry Stockert	Emergency Management	City Emergency Manager
Keith Hunke via MS Teams	Administration	City Administrator
Renee Mich via MS Teams	Public Health	Director

Meeting Summary: All agenda items were discussed to ensure the CERC group was aware of the current status and content of the mitigation plan update. Emphasis of discussion was on the mitigation action items status including new mitigation action items, as well as the overall hazard ranking and an awareness of the more significant plan changes including inclusion of climate change information and adding the Civil Disturbance hazard.

Flood Lead Planner Meeting – Jan 6, 2020

Participants: Jeff Heintz, Terry Halstengard, Jim Kershaw, Darrel Nucech, Michael Greer, Gary Stockert
Additional Invites: Community Development/Building & Inspections

Discussion:
Hazard profile updates were made and additional updating needs were discussed to include history of events and draft climate change statements impacting flood potential. A water shed map to be added to the mitigation plan flood hazard profile was reviewed for updates. Information regarding the Jackman Coulee Dam will be transferred to the Dam Failure hazard profile.
Mitigation Action items status was reviewed and updated. No new flood mitigation action items were identified. However, there will be updates after FEMA updates the 100-year floodplain map in the near future. Additional updates regarding existing mitigation activities (section 3) were identified. Terry will provide the minutes for the August 2016 public input meeting regarding stormwater drainage solutions.

Climate Change Planning Committee Meeting: January 22, 2020

Participants: Jason Tomanek, William Hutchings, Kate Waldera, Crystalynn Kunts, Anton Sattler, and Gary Stockert.

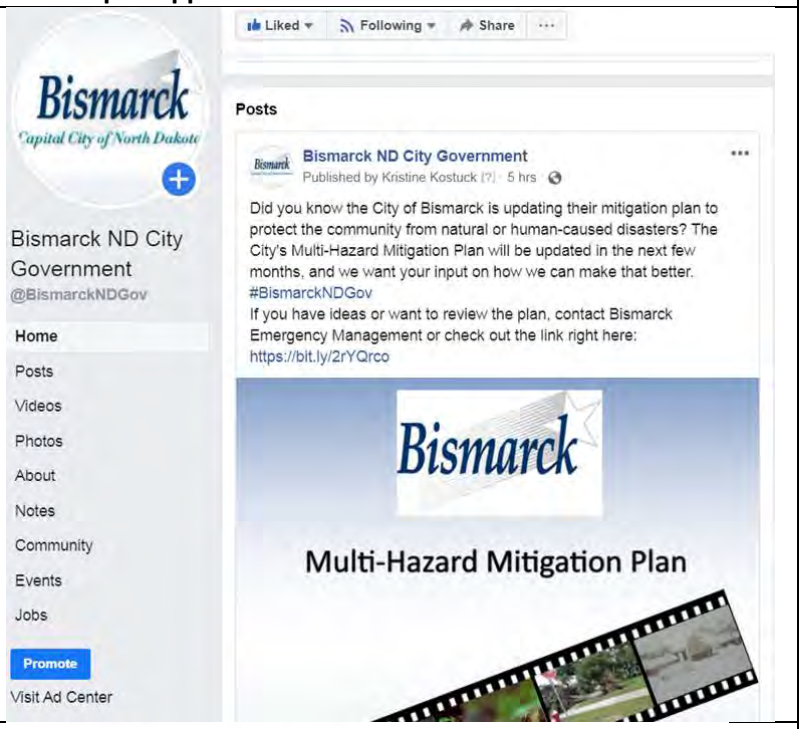
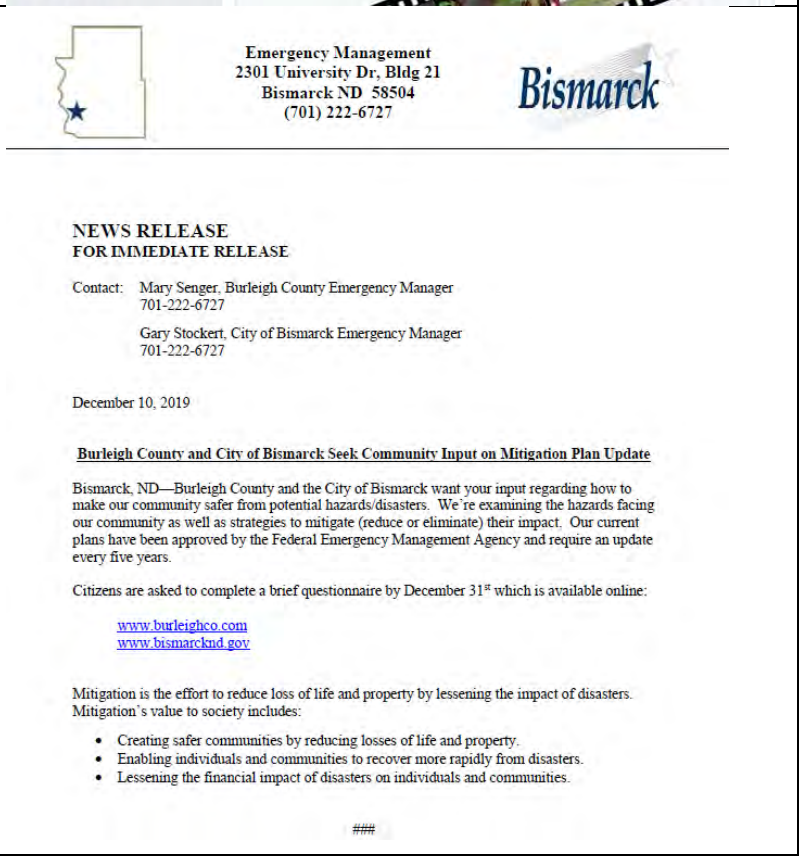
The central objective of the meeting was to identify the credible sources of climate change science information and climate change impact information. Those credible sources identified included the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) including the NOAA State Climate Summaries, the Fourth National Climate Assessment, and Science2017.globalchange.gov. Climate Change information to be included within the mitigation plan update would be reference those sources.

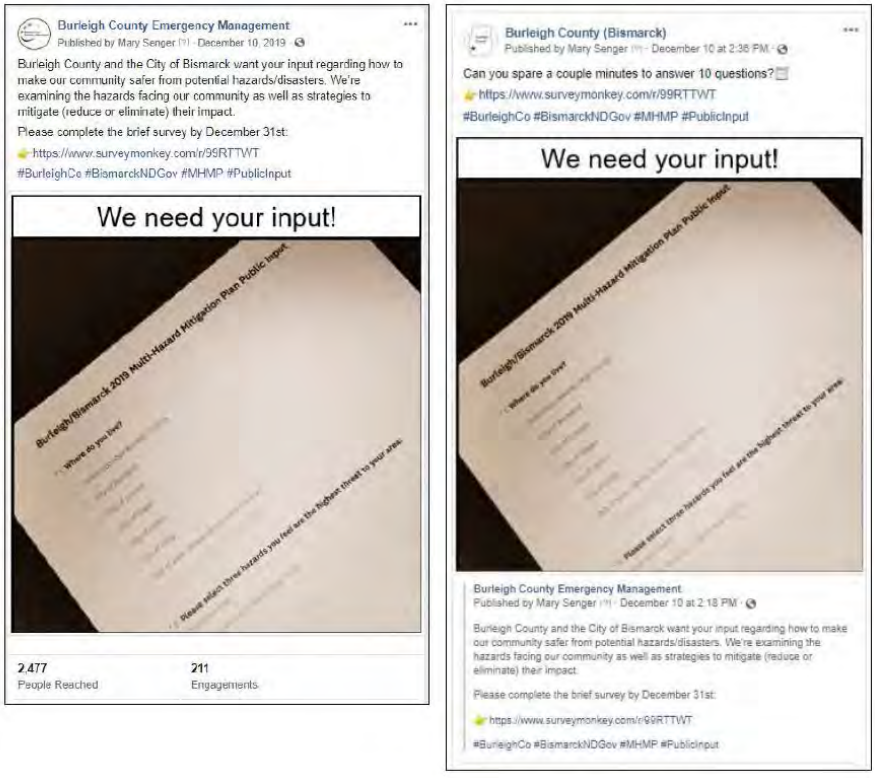
Discussion Topics:

- Defining Climate Change
- Concurrence & Confidence Level of the Scientific Community
- Current Impacts of Climate Change – with focus on ND
- Future Impacts – with focus on ND
- Identify how does Climate Change information applies to the remainder of the mitigation plan (ie: how it relates to other hazards).
- Identify climate change information to be included in the plan based on relevant to North Dakota and hazards addressed within the plan.

Mitigation Plan Updates via E-mail Communications Many individuals from various organizations supported the 2020 Mitigation Plan update by providing information requested by Bismarck Emergency Management. The list below identifies those individuals along with a brief note of the type of information or assistance provided. Although these are not formal meetings, the collective contribution to the plan update is significant.			
Ackerman	Laura	ND Water Commission	Flood – depth to water table info and map
Boespflug	Joel	Bismarck Fire Dept	Fire and Hazmat statistics – updates to Fire and Hazmat Hazard profiles.
Dannenfelzer	Michael	CenCom	Update to community assets – narrative
David	Gloria	Bismarck Public Information	Public Information to promote Public Input
Donahue	Kathleen	ND Dept of Emergency Services	Review and Comment on Community Profile and general planning guidance
Greer	Michael	Bismarck Engineering	Hazard Profile Update: Geologic Hazard
Grabow	Damon	State Water Commission	Probable Maximum Precipitation information
Gunsch	Michael	Houston Engineering, Inc.	Flood mapping – updated links
Halstengard	Terry	Bismarck Public Works	Bismarck Watershed map development
Haynes	Dionne	ND Water Commission	Flood Insurance information
Hester	Paul	BNSF	Hazmat Hazard Profile Review and Comment
King	Corey	National Weather Service	Climate Info and Climate Change Science
Lindquist	Todd	USACE	2001 Maximum Inflow at Garrison Dam
Lohstreeter	Craig	Montana Dakota Utilities	Hazard Profile Review and Comment: Shortage/Outage of Critical Materials
Martin	John Paul	National Weather Service	ND Severe Weather History
Nucech	Darrel	Bismarck – GIS	Extensive mapping support, community profile and community assets, community changes
Schlag	Allen	National Weather Service	Ice Jam events and river freeze-in stats
Senger	Mary	Burleigh County Emergency Management	Public Input Survey and Public Input joint meeting with Bismarck Emergency Mgmnt.
Spears	Emily	BNSF	Hazmat Flow information to support update to Hazmat Hazard Profile
Vetter	Courtney	Montana Dakota Utilities	Hazard Profile Review and Comment: Shortage/Outage of Critical Materials & update on status of EMP planning.
Waldera	Kate	Bismarck Veterans Memorial Public Library	Climate change research

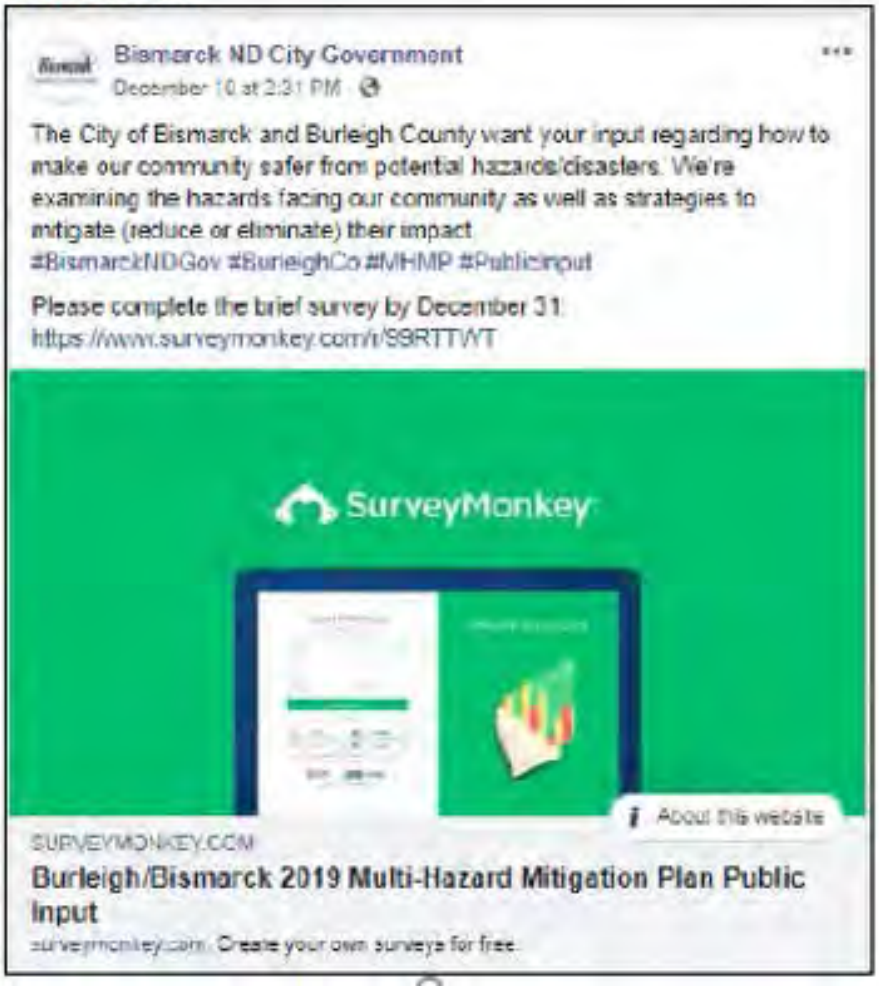
Public Input:

<table>
<tr><th colspan="2">Public Input Opportunities</th></tr>
<tr><td>Promote Opportunity to review the existing Mitigation Plan and to extend invite for public input. This was done via Facebook on November 19, 2019 as a “Tidbit Tuesday” item:</td><td> 
</td></tr>
<tr><td>Public Input Survey Opportunity News Release Dated December 10, 2019 inviting public input via on-line questionnaire. This was a combined press release as both Bismarck and Burleigh County initiated plan updates. Citizens were invited to complete a survey as noted in the news release.</td><td> 
</td></tr>
</table>

Link to survey via Burleigh County Webpage:	
	All Emergency Management personnel from contiguous counties were invited to complete the survey. The invite to the complete the survey went out via e-mail on December 10, 2019. The e-mail included the previous December 10, 2019 news release shown on previous page.
Burleigh County Social Media promoting Public Input Opportunity (survey). December 10, 2019	**December 10, 2019 Burleigh County Social Media** 

Bismarck Social Media promoting Public Input Opportunity (public input survey):
December 10, 2019

City of Bismarck Social Media



December 11, 2019: The Bismarck Tribune

BISMARCK TRIBUNE DAKOTA SUNDAY, DECEMBER 8, 2019 | B3

DAKOTA BRIEFS

Patrol conducts enforcement campaign

The North Dakota Highway Patrol is conducting a special enforcement effort this month focusing on speed, right of way, impairment, distracted driving and seat belt violations.

Overtime hours have been approved for troopers during the campaign. The goal is to have an increased patrol presence and awareness to encourage drivers to voluntarily comply with traffic laws.

There have been 92 fatalities resulting from motor vehicle crashes on North Dakota roads this year.

More information about traffic safety initiatives can be found at ndsafetyzero.nd.gov or on the Vision Zero ND Facebook or Twitter page.

Coyote Catalog program activated in ND

More than 100 North Dakota schools are participating in an "Year of Code" on Thursday as part of an annual nationwide event that includes numerous activities at school districts.

"Teaching coding, computer science and other technology skills to today's students will help them succeed in tomorrow's economy while also advancing the state's agriculture industry," Wahl said.

Other dispensaries are in Bismarck, Fargo, Grand Forks, Minot, Williston, Devils Lake and Jamestown.

North Dakota voters approved medical marijuana in November 2016. The Health Department has been working on the rules and laws governing the program.

The first known shipment of cannabis arrived in the state last year.

Dickinson medical marijuana dispensary to open

The eighth and final medical marijuana dispensary in North Dakota is slated to open in Dickinson on Friday.

Herbology will be located at 316 24th St. E. in Dickinson, near a Walmart Supercenter.

"The final dispensary opening in Dickinson signifies the successful implementation and establishment of the Medical Marijuana Program," said Jason Wahl, director of the state Division of Medical Marijuana.

"In 2016, the program has seen tremendous growth, including opening eight regional dispensaries across the state, issuing over 1,850 identification cards to qualifying patients and becoming the first state in the nation to add an electronic card option for patients, caregivers and agents of dispensaries and manufacturing facilities," Wahl said.

Other dispensaries are in Bismarck, Fargo, Grand Forks, Minot, Williston, Devils Lake and Jamestown.

North Dakota voters approved medical marijuana in November 2016. The Health Department has been working on the rules and laws governing the program.

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Statewide 'Hour of Code' event Thursday

More than 100 North Dakota schools are participating in an "Hour of Code" on Thursday as part of an annual nationwide event that includes numerous activities at school districts.

"Teaching coding, computer science and other technology skills to today's students will help them succeed in tomorrow's economy while also advancing the state's agriculture industry," Wahl said.

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North Dakota voters approved medical marijuana in November 2016. The Health Department has been working on the rules and laws governing the program.

The first known shipment of cannabis arrived in the state last year.

Glen Ullin wind farm powers up

A new wind farm that straddles Morton and Mercer counties has started generating electricity, project developer Allete Clean Energy said Tuesday.

Xcel Energy is purchasing power from the 105-megawatt Glen Ullin Energy Center.

Construction of the wind farm employed about 150 people, and 10 will work there to operate the windturbines, Allete said.

The facility is north of Interstate 94 between Glen Ullin and Beulah. It's made up of 43 turbines manufactured by General Electric.

This is the third wind farm Allete has developed in North Dakota.

ND teen charged as adult in fatal shooting

A 17-year-old accused of shooting one person to death and wounding another in November was charged as an adult Tuesday.

Ian Laboyd was charged with murder, attempted murder, delivery of a controlled substance, possession of stolen property and tampering with physical evidence.

Laboyd is accused of killing 19-year-old Matthew York in an alley behind a Williston convenience store the night of Nov. 16. He is also accused of wounding Parker Holden, also 19, in the same incident.

According to court documents, Laboyd had arranged to meet someone behind the store to sell them LSD. That person, accompanied by York, Holden and one other person, drove to the alley and waited for Laboyd. During the transaction, court records indicate that Laboyd fired a .22-caliber pistol and York and Holden were both shot in the chest. York died from his wounds.

After the shooting, Laboyd fled and was spotted on surveillance video discarding a pistol in a dumpster, which was recovered.

York's death was the second homicide of 2019 in Williams County and the sixth in Williston.

Public input sought on hazard mitigation

Burleigh County and Bismarck are seeking public input on how to make the area safer from potential hazards and disasters.

Plans to mitigate potential hazards are approved by the Federal Emergency Management Agency and require an update every five years.

Area residents are asked to complete a brief questionnaire by Dec. 31. It's available online at www.surveymonkey.com/r/BismarckBurleigh.gov.

— Compiled from area websites, press releases and staff reports

December 11, 2019 KFYR Television Interview

YOURNEWSLEADER.com

Weather | Sports | Promotions | ND Today | Livestream

Home | Community | Article

Bismarck, Burleigh County looking at hazard mitigation



By John Salling | Posted: Wed 10:40 PM, Dec 11, 2019

BURLEIGH COUNTY, N.D. - Bismarck and Burleigh County emergency managers are looking to the community to help reduce hazards and disasters.

Residents are asked to fill out a hazard mitigation survey on the city or county website.

It's part of the FEMA certification process and helps the government develop a plan to protect the communities from things like floods and tornadoes.

'Help us identify some projects cause we don't have eyes on everything and we might not be aware of something that's in your community or close to your home. Something that you see on your way to work or just traveling around in Burleigh County. So it's really anywhere in Burleigh County that we're looking at projects,' said Mary Senger, Burleigh County emergency manager.

They're hosting a public input meeting scheduled on Jan. 20.

Bismarck and Burleigh County Emergency Management developed an electronic survey utilizing "SurveyMonkey" to gather input from the public. A total of 117 responses were received which more than doubled the previous survey responses (57) received in 2015. The survey was emailed to area stakeholders, community responders, and contiguous counties. The survey results and the information captured were compared to the risks analysis and were closely aligned. Additionally, information received was factored into the mitigation projects. The survey was publicly advertised: Radio, Television, The Bismarck Tribune, Burleigh County website, Burleigh County social media, City of Bismarck website, City of Bismarck social media.

The survey and responses are shown on the following pages.

Survey Questionnaire made available to the public:

1. **Where do you live?**
   - ☐ Unincorporated Burleigh County
   - ☐ City of Bismarck
   - ☐ City of Lincoln
   - ☐ City of Regan
   - ☐ City of Wilton
   - ☐ City of Wing
   - ☐ Out of area. Where do you currently live?

2. **Please select three hazards you feel are the highest threat to your area:**
   - ☐ Civil Disturbance
   - ☐ Criminal, Terrorist, or Nation/State Attack
   - ☐ Cyberattack
   - ☐ Dam Failure
   - ☐ Drought
   - ☐ Fire (including urban fire or structure collapse and wildland fire)
   - ☐ Flood (including riverine, levee failure, closed basin, ice jam, and flash floods
   - ☐ Geologic Hazards (including landslide, earthquake, abandoned land mines, expansive/unstable soils, environmental minerals, meteorite falls, volcanic hazards)
   - ☐ Hazardous Materials Release
   - ☐ Infectious Disease and Pest Infestations (including human, animal, and plant diseases)
   - ☐ Severe Summer Weather (including downbursts, extreme heat, hail, lightning, high wind, and tornado)
   - ☐ Severe Winter Weather (including blizzards, extreme cold/wind chill, heavy snow, ice storms, structure collapse)
   - ☐ Space Weather
   - ☐ Transportation Incident (including vehicular, railway, and aircraft accidents)
   - ☐ Other (please specify)

3. **What preventative measure(s) would you recommend for any of the hazards you selected above?**

4. **Are there areas of critical vulnerability/risk to identify in our community?**

5. **Do you have an emergency preparedness kit (i.e. water, food, radio, flashlight, batteries, first aid kit, etc.) for your home?**
   - ☐ Yes
   - ☐ No

6. **Do you have flood insurance?**
   - ☐ Yes
   - ☐ No
   - ☐ I don't know

7. **If "No," why not?**
   - ☐ Not located in floodplain
   - ☐ Too expensive
   - ☐ No necessary because I'm elevated or otherwise protected
   - ☐ Never really considered it
   - ☐ Other (please explain)

8. **What is the most effective way for you to receive information about how to make your home and area more resistant to hazards?**
   - ☐ Newspaper
   - ☐ Television
   - ☐ Radio
   - ☐ Email
   - ☐ Regular Mail
   - ☐ Website
   - ☐ Social Media
   - ☐ Public Workshops/Meetings
   - ☐ Other (please explain)

9. **Please share any additional comments regarding mitigation and risk reduction.**

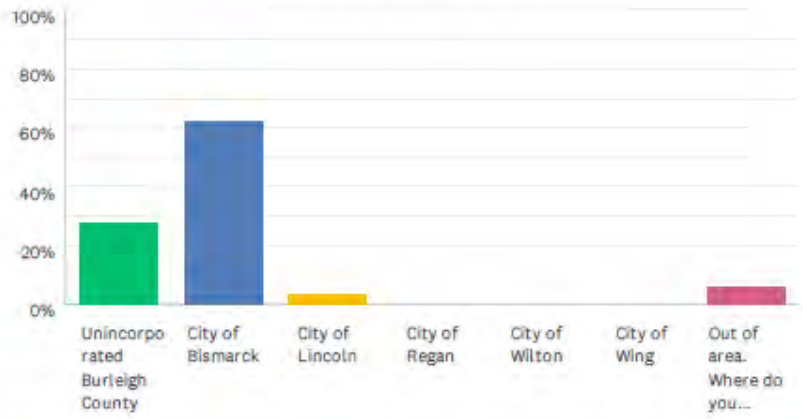
10. **This survey may be submitted anonymously; however, if you provide your contact information, we will have the ability to follow up with you to learn more about your ideas or concerns (optional)**

Survey Results:

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

Q1 Where do you live?

Answered: 117 Skipped: 0

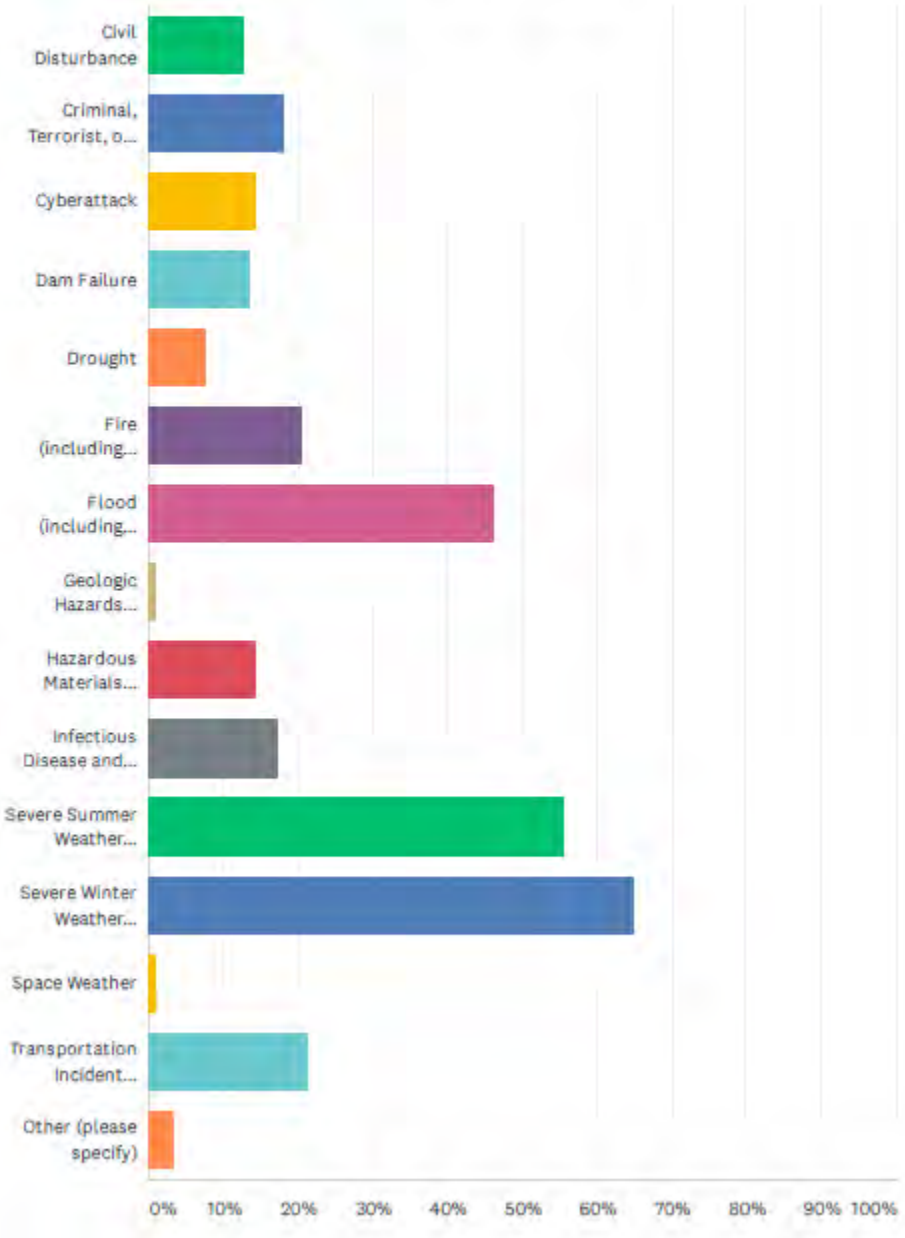


ANSWER CHOICES	RESPONSES	
Unincorporated Burleigh County	28.21%	33
City of Bismarck	62.39%	73
City of Lincoln	3.42%	4
City of Regan	0.00%	0
City of Wilton	0.00%	0
City of Wing	0.00%	0
Out of area. Where do you currently live?	5.98%	7
TOTAL		117

#	OUT OF AREA. WHERE DO YOU CURRENTLY LIVE?	DATE
1	Mandan	12/17/2019 2:46 PM
2	BRFD Survey	12/11/2019 8:32 AM
3	Mandan	12/10/2019 10:30 PM
4	Mandan	12/10/2019 7:34 PM
5	McLean County	12/10/2019 4:21 PM
6	Steele	12/10/2019 4:03 PM
7	Mandan	12/10/2019 3:46 PM

Q2 Please select three hazards you feel are the highest threat to your area:

Answered: 117 Skipped: 0



ANSWER CHOICES	RESPONSES	
Civil Disturbance	12.82%	15
Criminal, Terrorist, or Nation/State Attack	17.95%	21
Cyberattack	14.53%	17
Dam Failure	13.68%	16
Drought	7.69%	9
Fire (including urban fire or structure collapse and wildland fire)	20.51%	24
Flood (including riverine, levee failure, closed basin, ice jam, and flash floods)	46.15%	54
Geologic Hazards (including landslide, earthquake, abandoned land mines, expansive/unstable soils, environmental minerals, meteorite falls, volcanic hazards)	0.85%	1
Hazardous Materials Release	14.53%	17
Infectious Disease and Pest Infestations (including human, animal, and plant diseases)	17.09%	20
Severe Summer Weather (including downbursts, extreme heat, hail, lightning, high wind, and tornado)	55.56%	65
Severe Winter Weather (including blizzards, extreme cold/wind chill, heavy snow, ice storms, structure collapse)	64.96%	76
Space Weather	0.85%	1
Transportation Incident (including vehicular, railway, and aircraft accidents)	21.37%	25
Other (please specify)	3.42%	4
Total Respondents: 117		

#	OTHER (PLEASE SPECIFY)	DATE
1	Lack of road maintenance	12/30/2019 8:14 PM
2	Gravel roads	12/15/2019 6:57 PM
3	Oil-fracking; causing of geological hazards and scarcity of wildlife/natural habitat	12/11/2019 10:14 PM
4	Time warp	12/11/2019 12:11 PM

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

Q3 What preventative measure(s) would you recommend for any of the hazards you selected above?

Answered: 88 Skipped: 29

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

#	RESPONSES	DATE
1	Shelters set up for people to go to that are affected by the disaster. They must be on both the north and south side of the city to account for incidents on either side. Also, it must be well-communicated to the public as to where they are and what they are meant for.	12/31/2019 8:44 AM
2	Prayers stupid people are not involved in the dam levels anymore. And people that run the road crews realize that this is a real public road and not a private driveway for 5 homes.	12/30/2019 8:14 PM
3	Not sure	12/30/2019 7:28 PM
4	Don't keep bringing in people from other countries.	12/30/2019 6:20 PM
5	More snow fences (living and artificial) to reduce the impacts of drifting on the roads. Encourage citizens to emplace snow fences to better keep development roads open, to include providing technical assistance on where to place the fences/plant trees.	12/30/2019 6:15 PM
6	More road prep for winter/ice conditions such as more frequent application of deicing solution and or sand	12/30/2019 5:20 PM
7	None.	12/30/2019 5:07 PM
8	More severe weather sirens as BISMARCK continues to grow to the north	12/30/2019 4:56 PM
9	Making sure infrastructure for the Dam is updated and free of any hazards - Civil Disturbance - not letting things get out of control like they did during the DAPL protest - be proactive instead of reactive.	12/30/2019 4:45 PM
10	Dike wall planning based on raising low places, rather than ring-diking every individual home.	12/27/2019 8:42 PM
11	Notification (text, cell phone call) when tornados are identified in our area; something equivalent to tornado sirens in towns. Better method of communicating (other than phone calls, voicemails) blocked roads due to winter storms or rutted gravel due to wet conditions.	12/27/2019 11:26 AM
12	Proper drainage	12/27/2019 5:19 AM
13	Natural Weather - everything being done as far as awareness and preparedness Cyberattack - monitoring, teams, investigative services	12/19/2019 8:10 AM
14	None known	12/18/2019 9:50 PM
15	Review for adequate funding to agencies involved in these areas	12/17/2019 2:59 PM
16	Proper planning and development of roadways and multiple access points to all developments.	12/17/2019 10:55 AM
17	Better sidewalks connectivity, safer intersections for pedestrians and vehicles.	12/16/2019 12:19 PM
18	Improvement of gravel roads. Better support of rural fire dept such as staffing, equipment and additional locations.	12/15/2019 6:57 PM
19	Public Information/Notification	12/15/2019 12:24 PM
20	Nothing that isn't already in place.	12/13/2019 4:01 PM
21	Strategic planning, including mock outbreak response exercises	12/13/2019 3:34 PM
22	More public information regarding the result of potential releases from local plants (such as the refinery in Mandan) would be helpful. Local hospitals could also do a better job of identifying and reporting unusual disease clusters/presentations to the state.	12/13/2019 3:19 PM
23	having a plan in place and the right resources to assist these hazards	12/13/2019 12:57 PM
24	I sure don't know	12/12/2019 10:33 PM
25	x	12/12/2019 2:09 PM
26	Best expert guesses are that a child born today in the US has a 1 in 10 chance of dying early due to nuclear warfare accident or attack. We should eliminate land-based ICBMs from North Dakota, so we're less of a target, and mandate reinforced shelters for all new construction, which could also be used for tornado protection (some residents, such as apartment dwellers, lack even basements). We're also underprepared for a disease pandemic, which is certain to	12/12/2019 10:42 AM

	come, and we're reliant on fragile supply chains for food and energy. To offset both we should have local food/energy storage on hand to ride out any disruptions.	
27	Dam and river considerations, limited fracking exposing the depth of crust.	12/11/2019 10:14 PM
28	More rural fire stations. Dam failure would just need a quick notice. Flood requires proper space to work from and historical flood information.	12/11/2019 8:00 PM
29	Provide proper funding for our fire and police departments to have adequate equipment to help prevent and respond to these hazards.	12/11/2019 5:36 PM
30	Haven't thought about it	12/11/2019 4:17 PM
31	Dissemination of useful information to the public on how they can prepare themselves for potential hazards.	12/11/2019 4:10 PM
32	Move	12/11/2019 3:17 PM
33	Have more trained first responders	12/11/2019 3:12 PM
34	-Flood Control/Protection Projects -Continue to address and update Flood Plain & Zoning Ordinances with restrictions/guidelines in regards to building within floodplains or areas of potential flooding. -Get communities to join the Community Rating System to reduce Flood Insurance Premiums, which at the same time will help to alleviate risks. -Communities utilize Base Level Engineering data from FEMA & the NDSWC to determine areas of flooding potential in planning new development - Get rid of "100 Year" & "500 Year" nomenclature. Use the "1% Flood" & "0.2% Flood" instead to remove the public confusion of having these events occur more often than "only one time in 100 years" - Public Outreach & Education on NFIP, Elevation Certificates, LOMAs, LOMR-Fs, etc to remove their structures and lots from floodplains.	12/11/2019 12:49 PM
35	We can rebuild	12/11/2019 12:11 PM
36	maintenance and checking of fire hydrants, maintenance and checking of storm sewers and pipes, maintenance of water intakes and water treatment plant and pumping stations and reservoirs.	12/11/2019 11:29 AM
37	Communication/social media training for first responders and law enforcement to allow proactive, positive messaging to rebut and disprove biased, erroneous idealogical messaging from radical environmental zealots.	12/11/2019 9:15 AM
38	Road maintenance this spring/summer county roads were impassable. Disrupting access to emergency services. I have seen minimum maintenance roads in better condition then emergency routs? why?	12/11/2019 9:06 AM
39	Another roadway in and out of Lincoln to help with traffic congestion, especially in the winter months when roads are tougher.	12/11/2019 8:47 AM
40	I am not sure on how you prevent natural disasters but I do feel the recovery preparedness is very important.	12/11/2019 8:41 AM
41	Develop a county WUI plan Conduct a summer related training scenario Develop a County winter ops plan with triggers tied to forecast from the NWS.	12/11/2019 8:32 AM
42	Barriers along the Interstate like Fargo/Moorhead Tornado shelters - MANY residents do not have adequate shelter for these weather monsters	12/11/2019 8:04 AM
43	zoning- keep buildings out of the flood plain education about consequences of on-line behavior and over reliance on devices and connected technology review adequacy of public shelters for tornado/hail events	12/11/2019 7:40 AM
44	In order to prevent people from illegally dumping toxic household waste and electronics , The households and electronics hazardous waste facility located at Bismarck hours of operation need to be extended. The fee schedule also also needs to be reviewed, and opened up to the entirety of Burleigh County .	12/11/2019 7:34 AM
45	River level management. Personal and police protection. Blizzard prepairedness.	12/11/2019 1:27 AM
46	-develop a dam failure notification and alert system -keep communicating -change the hours at the hazardous material collection site, closed at 2pm is not sustainable	12/10/2019 10:30 PM

47	Keep roads clear and well maintained. Review drainage plans.	12/10/2019 9:10 PM
48	Rebuild safer roads	12/10/2019 8:52 PM
49	I'd like the tornado siren near my house to be louder or have another installed closer as with all the wind during severe storms you cant hear the siren	12/10/2019 8:37 PM
50	The train (DMVWRR) that runs thru east Bismarck should take more precautions and not leave train cars with Hazardous Materials parked close to houses. They have plenty of side tracks away from occupied houses to park the cars.	12/10/2019 8:35 PM
51	- Better and increased number of signs for pedestrian crosswalks and intersections with no stop signs - Suggestions from the county on how to prepare for sever winter weather-how many days of meals to have on hand, if generators are necessary, how to check for inefficiencies in your house, ie drafty windows, etc	12/10/2019 7:58 PM
52	Have a properly staffed and trained police force with high community involvement. Check! For weather concerns, have updated building codes, structurally sound utilities and drainage to keep power, heat, water, and communications going, improve our road maintenance fleet (more plows, more road crews). Consider updating/creating tornado shelters.	12/10/2019 7:42 PM
53	Water management competency	12/10/2019 7:38 PM
54	Tougher consequences on offenders	12/10/2019 7:34 PM
55	enhanced preparedness	12/10/2019 7:07 PM
56	A dike system or drainage Chanel's to divert the water for lower Bismarck	12/10/2019 7:06 PM
57	I live on N16th St just S of Divide. Traffic is often heavy. A traffic light would be good. Civil unrest simply arises from people that walk from this neighborhood to Soup Kitchen daily. Their perspective is that refugees have taken precedence over them.	12/10/2019 6:27 PM
58	Increased PD personnel for more traffic patrols.	12/10/2019 5:44 PM
59	Better warnings and frequent updates regarding the issues at hand	12/10/2019 5:21 PM
60	Neighborhood crime watch, timely snow removal (our neighborhood does seem to be last), weather warnings which are already pretty good.	12/10/2019 4:59 PM
61	Stronger vaccine initiatives and more work in public health disease prevention and awareness. The weather stuff I suppose more prepared disaster staff so people know where to go in horrible weather incidents.	12/10/2019 4:35 PM
62	I don't have any suggestions as I feel you do a great job of doing what you can already.	12/10/2019 4:21 PM
63	Be a cautious driver, use safe passwords, insurance on property	12/10/2019 4:14 PM
64	Have a go kit and rapid evacuation Plan. Ready access to dike building materials, and pumps. Fire Extinguishers, Weather Radio	12/10/2019 4:07 PM
65	planning	12/10/2019 4:03 PM
66	More control over what is happening in and around our state such as possible protests, better preparedness for harsh weather, updates on the safety of the dam	12/10/2019 3:56 PM
67	contigency planning	12/10/2019 3:55 PM
68	Emergency warning systems, good communication, prevention (global warming education, pipeline remediation)	12/10/2019 3:54 PM
69	More funding for rural fire deparments.	12/10/2019 3:50 PM
70	better early warning system	12/10/2019 3:47 PM
71	Public education	12/10/2019 3:46 PM
72	stay alert and vigilant with forecasts. survival kits for cars/homes/camper	12/10/2019 3:46 PM
73	Emergency plans and public info campaign so people know what to do in the event of . Publicized shelter plans part for low income or mobile home folk.	12/10/2019 3:30 PM
74	Improved road system. Drive around town and you can see there are almost zero right hand	12/10/2019 3:28 PM

	turning lanes. As we grow this has become a huge issue.	
75	Effective evacuation plans for Missouri River basin in unlikely but possible event of a dam failure. Continue improving drainage/ infrastructure where budget allows and attention is needed.	12/10/2019 3:25 PM
76	Communication to remain in place, seek immediate shelter, and location of area affected. Too many times the info isn't descriptive enough for me to decide to act or not.	12/10/2019 3:12 PM
77	Ensure good infrastructure.	12/10/2019 3:06 PM
78	Sharing if information, transparency	12/10/2019 3:03 PM
79	The city and county are already doing a good, proactive job of preparing for these threats. That said, Expressway and 12th street has a flooding problem that needs to be addressed, even if the cost to upgrade the storm drains is expensive.	12/10/2019 2:54 PM
80	Safety of children going to school	12/10/2019 2:52 PM
81	Better weather warning systems outside city limits.	12/10/2019 2:52 PM
82	Our county should do a better job on issues like the refugee issue they just voted on, they made a decision without all of the information they should have obtained. I live in the county and the city of Bismarck has a say on what i do with my property therefore i should be able to vote in city elections also.	12/10/2019 2:51 PM
83	Armed citizens	12/10/2019 2:41 PM
84	Notification system and information	12/10/2019 2:33 PM
85	Police protection	12/10/2019 2:29 PM
86	Vaccinations, environmental control, cleaner roads, lanes repaved	12/10/2019 2:25 PM
87	Better media out reach .	12/10/2019 2:24 PM
88	Pest management	12/10/2019 2:22 PM

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

Q4 Are there areas of critical vulnerability/risk to identify in our community?

Answered: 77 Skipped: 40

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input — SurveyMonkey

#	RESPONSES	DATE
1	It has gotten better, but I am still wary of the train tracks running through our city. I live on them and have seen the improvements, but it doesn't take much for something to happen.	12/31/2019 8:44 AM
2	Lack of care for people who really need it, consistent medical care in this town.	12/30/2019 8:14 PM
3	Yes	12/30/2019 6:15 PM
4	Fake news or advice caused by social media	12/30/2019 5:07 PM
5	N/a	12/30/2019 4:56 PM
6	I really don't think so, besides the few here and there that like to or want to change names on things they find offensive - representing 200 out of over 65,000.	12/30/2019 4:45 PM
7	We've had a few minor tense public meetings, like the refugee discussion, and I saw deputies there, but wondered what their training is for situations like that.	12/27/2019 8:42 PM
8	Poor road conditions are a risk; the gravel roads turn to complete mud, making travel difficult when wet and dangerous when the ruts dry out.	12/27/2019 11:26 AM
9	Not sure	12/27/2019 5:19 AM
10	Large population facilities: schools, churches, Capitol, penitentiary, detention center, malls, sports venues, long-term care facilities, hospitals	12/19/2019 8:10 AM
11	Do not know enough about subdivision to answer this	12/18/2019 9:50 PM
12	yes	12/17/2019 10:55 AM
13	Homelessness, poverty.... more support for these people is the best way to reduce risk	12/16/2019 12:19 PM
14	Helter skelter rural housing development. The builders/developers are in control of developments not the county.	12/15/2019 6:57 PM
15	Already being done.	12/15/2019 12:24 PM
16	Flood seems to be top of the list.	12/13/2019 4:01 PM
17	Yes - infectious disease outbreaks, disasters involving mass casualties, etc.	12/13/2019 3:34 PM
18	Poor communication from industry surrounding how their work affects local health.	12/13/2019 3:19 PM
19	Homelessness and drug addiction	12/13/2019 12:57 PM
20	Probably	12/12/2019 10:33 PM
21	x	12/12/2019 2:09 PM
22	Biggest existential risks are probably pandemic, nuclear warfare (accidental mostly), and supply chain disruption due to disease or unrest.	12/12/2019 10:42 AM
23	Not my specific community	12/11/2019 10:14 PM
24	Not aware of any	12/11/2019 8:00 PM
25	Not enough police officers	12/11/2019 5:36 PM
26	None that I'm aware of	12/11/2019 4:17 PM
27	Flood zones	12/11/2019 4:10 PM
28	No	12/11/2019 3:17 PM
29	Nothing that hasn't already been addressed in other plans, studies, reports, and annexes. Although, some do need updating for the upcoming mitigation plan in my opinion.	12/11/2019 12:49 PM
30	racist bigot hotheads--unevenly and variably distributed	12/11/2019 11:29 AM
31	Roads	12/11/2019 9:06 AM
32	none that I can think of	12/11/2019 8:47 AM

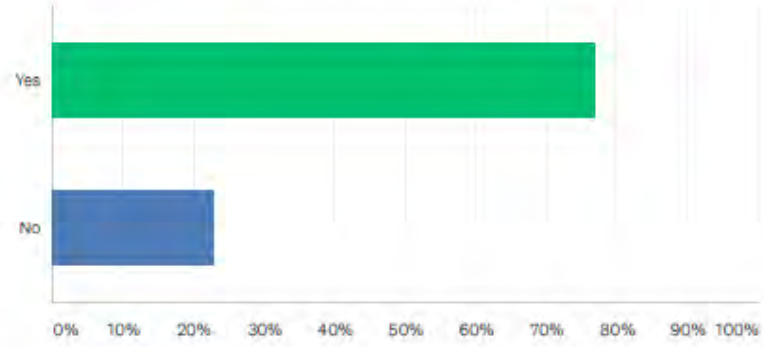
33	Bismarck is a city with a high dual working family, which means young children are generally not in the care of their parents for large portions of the day, so knowing where local child care locations are and how to assist them and some of our most vulnerable populations children birth to age 5 yrs old is very important and should be considered in planning just as public schools or nursing homes would be.	12/11/2019 8:41 AM
34	Too numerous to list.	12/11/2019 8:32 AM
35	Lack of tornado shelters	12/11/2019 8:04 AM
36	Certainly the flood plain- keep housing out or engineered to be out of high water; Bicycling and pedestrian safety (education and enforcement)	12/11/2019 7:40 AM
37	See No. 3 above.	12/11/2019 7:34 AM
38	Flood risk, crime rate	12/11/2019 1:27 AM
39	-strong flood prevention response is critical	12/10/2019 10:30 PM
40	Refinery leak	12/10/2019 9:12 PM
41	To have 71st made wider with shoulder on the road, less steep ditches.	12/10/2019 8:52 PM
42	Downtown area	12/10/2019 8:37 PM
43	Low income areas	12/10/2019 7:58 PM
44	We need to address mental health issues like depression, addiction, and bullying in a more direct manner.	12/10/2019 7:42 PM
45	Influx of out of staters creates an environment of possible civil unrest, more crime	12/10/2019 7:38 PM
46	Drug offenders	12/10/2019 7:34 PM
47	storm shelters inadequate	12/10/2019 7:07 PM
48	Flooding in lower Bismarck	12/10/2019 7:06 PM
49	I think we simply need to address our homelessness/poverty situation. It is more prevalent than most realize.	12/10/2019 6:27 PM
50	Increase in aggressive driving through city. In ability to keep roads open during major snow storm for emergency services.	12/10/2019 5:44 PM
51	south bismarck is lower altitude for flooding. crime areas in midtown.	12/10/2019 4:59 PM
52	South Bismarck seems like a disaster every time it rains	12/10/2019 4:35 PM
53	Nothing that I can think of off the top of my head.	12/10/2019 4:21 PM
54	Yes. Schools, the malls, outdoor municipal areas	12/10/2019 4:14 PM
55	Dam Failure would be short notice	12/10/2019 4:07 PM
56	Safety and not enough law enforcement presence, need more law enforcement and for there to be 2 law enforcement personnel per vehicle.	12/10/2019 3:56 PM
57	yes	12/10/2019 3:55 PM
58	Don't Know.	12/10/2019 3:50 PM
59	n/a	12/10/2019 3:47 PM
60	elderly , animals	12/10/2019 3:46 PM
61	Evacuation plans for nursing homes and other dependent care facilities, mobile homes, low income multi family residences.	12/10/2019 3:30 PM
62	Traffic	12/10/2019 3:28 PM
63	Un-vetted refugees. Homelessness. Drug Addiction. Overtaxation. Under-representaton by certain elected officials.	12/10/2019 3:25 PM
64	Major roadways/intersection, refinery, close quarters public venues	12/10/2019 3:12 PM

65	roads and bridges in need of repair. flood protection.	12/10/2019 3:06 PM
66	Flood plains, roads/bridges	12/10/2019 3:03 PM
67	Expressway and 12th street during flooding.	12/10/2019 2:54 PM
68	Low-income in extreme weather situations	12/10/2019 2:52 PM
69	Drugs	12/10/2019 2:52 PM
70	The city having a say on my county residence and me not be able to elect city officials that have control of my county property that is not in city limits.	12/10/2019 2:51 PM
71	Homeless population	12/10/2019 2:41 PM
72	Schools, hospitals, Capitol, cyber threats, out-of-area protesters coming in	12/10/2019 2:33 PM
73	Jungle	12/10/2019 2:29 PM
74	No	12/10/2019 2:25 PM
75	Not sure	12/10/2019 2:24 PM
76	Flooding in south Bismarck	12/10/2019 2:23 PM
77	?	12/10/2019 2:22 PM

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

Q5 Do you have an emergency preparedness kit (i.e. water, food, radio, flashlight, batteries, first aid kit, etc.) for your home?

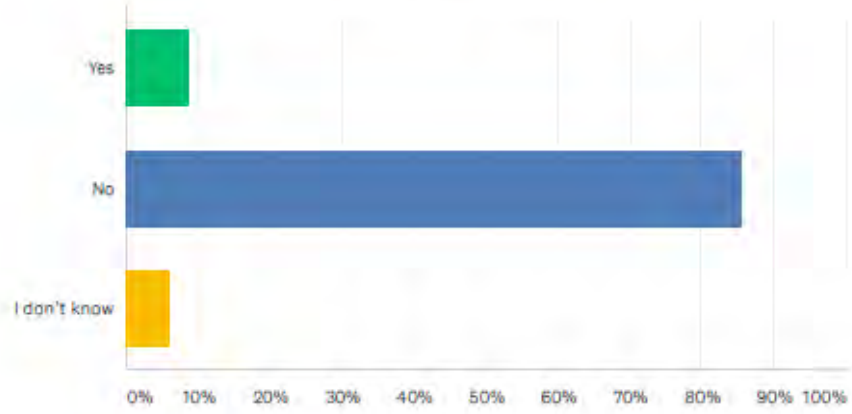
Answered: 117 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	76.92%	90
No	23.08%	27
TOTAL		117

Q6 Do you have flood insurance?

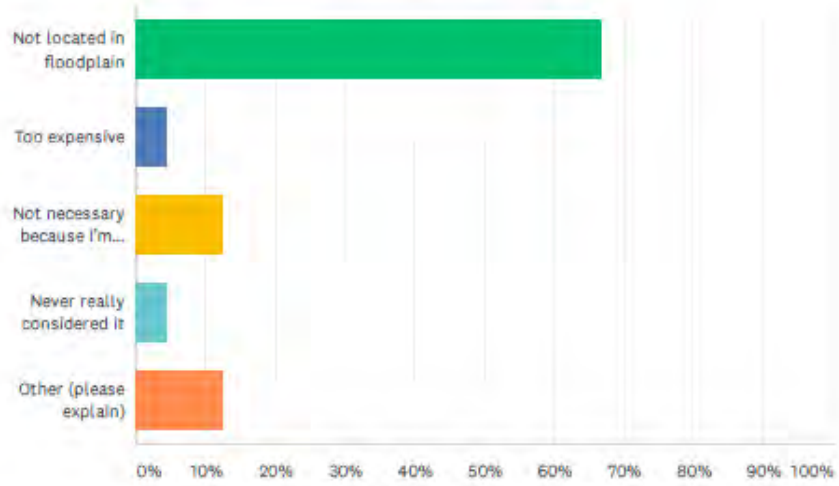
Answered: 117 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	8.55%	10
No	85.47%	100
I don't know	5.98%	7
TOTAL		117

Q7 If "No", why not?

Answered: 114 Skipped: 3



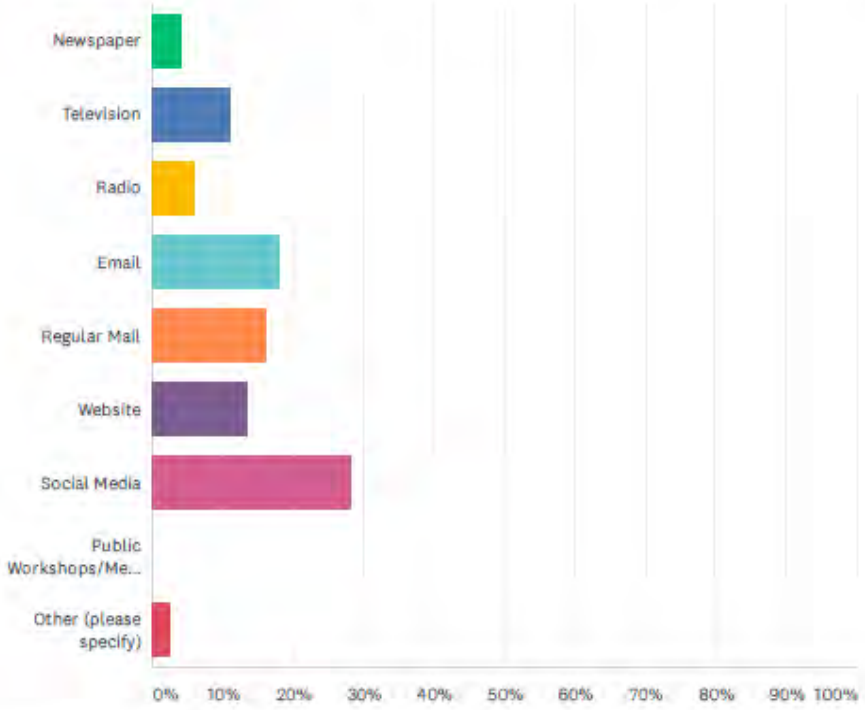
ANSWER CHOICES	RESPONSES	
Not located in floodplain	66.67%	76
Too expensive	4.39%	5
Not necessary because I'm elevated or otherwise protected	12.28%	14
Never really considered it	4.39%	5
Other (please explain)	12.28%	14
TOTAL		114

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

#	OTHER (PLEASE EXPLAIN)	DATE
1	Not effective based on the structures surrounding me. My entire house would need to be underwater and at that rate all of Bismarck would be under water	12/28/2019 11:22 AM
2	The city has prepared for overland flooding and flood insurance does not cover ground water which is the biggest issue in my area.	12/15/2019 12:24 PM
3	N/A - FYI, you can use logic to make this question show only if the question above was answered "No"	12/13/2019 3:34 PM
4	It's is semi worthless	12/11/2019 8:00 PM
5	Have it	12/11/2019 3:12 PM
6	I decide to purchase it in the late winter (March) pending flood forecasting and looking at snowpack and moisture conditions in the basin.	12/11/2019 12:49 PM
7	I would NEVER build or buy in a flood plain or on unstable land. I know that much.	12/11/2019 7:40 AM
8	Not in floodplain but purchased it for additional protection	12/10/2019 10:30 PM
9	I have flood insurance	12/10/2019 7:09 PM
10	Spoke with insurance and they stated I don't need it.	12/10/2019 3:56 PM
11	Error in survey— I have insurance	12/10/2019 3:30 PM
12	just not sure how much it would help and what it would cover	12/10/2019 3:06 PM
13	I am not the homeowner	12/10/2019 2:54 PM
14	i have flood insurance	12/10/2019 2:51 PM

Q8 What is the most effective way for you to receive information about how to make your home and area more resistant to hazards? (pick one)

Answered: 117 Skipped: 0



ANSWER CHOICES	RESPONSES	
Newspaper	4.27%	5
Television	11.11%	13
Radio	5.98%	7
Email	17.95%	21
Regular Mail	16.24%	19
Website	13.68%	16
Social Media	28.21%	33
Public Workshops/Meetings	0.00%	0
Other (please specify)	2.56%	3
TOTAL		117

#	OTHER (PLEASE SPECIFY)	DATE
1	Website if I am actively looking for information. However, for those who are not knowing to look because they are unaware the hazard exists to them, then regular mail would be the way to go to inform them of the potenital hazard they are in and how to mitigate for it.	12/11/2019 12:49 PM
2	NA	12/11/2019 8:32 AM
3	Cell phone	12/10/2019 7:06 PM

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

Q9 Please share any additional comments regarding mitigation and risk reduction.

Answered: 44 Skipped: 73

Burleigh/Bismarck 2019 Multi-Hazard Mitigation Plan Public Input SurveyMonkey

#	RESPONSES	DATE
1	N/A	12/31/2019 8:44 AM
2	Consistency for low income and high incomes homes.	12/30/2019 8:14 PM
3	People need to have more common sense	12/30/2019 5:07 PM
4	I've seen quite a few flood projects from the county, raised roads, Fox Island levee, flood control structure by River, and notifications	12/19/2019 8:10 AM
5	For this neighborhood we have several industrial sites across the creek. I do not know what industrial hazards be represented in this area but a survey of those businesses might reveal any specific risks. We have two railroads in close proximity to each other, both crossing multiple residential streets. Likely the most obvious possible risk	12/18/2019 9:50 PM
6	I feel pretty safe here overall	12/16/2019 12:19 PM
7	None	12/15/2019 6:57 PM
8	None	12/15/2019 12:24 PM
9	I don't think it's wise to chose one "best" way to communicate with the public. In order to reach the majority of people in today's society, messaging should be distributed in a variety of ways - social media, mail, television, radio, etc.	12/13/2019 3:34 PM
10	Having a safe from harm awareness team and disaster relief teams available such as Red Cross and Salvation Army	12/13/2019 12:57 PM
11	None	12/12/2019 10:33 PM
12	Nothing is being done about the nuclear threat. It's disheartening. Flood, fire, tornado, drought, etc. are all minor events that can be overcome easily and yet we ignore the bigger, existential risks.	12/12/2019 10:42 AM
13	More dikes less sandbags	12/11/2019 8:00 PM
14	Make our emergency departments a PRIORITY. Provide them with the equipment and funding they need to keep us safe	12/11/2019 5:36 PM
15	None	12/11/2019 4:17 PM
16	Are cops and EMS are overworked and our fire Dept is understaffed	12/11/2019 3:12 PM
17	There is a ton of educational information out there that Emergency Services / FEMA / and other agencies have done to help mitigate risk. However, I believe that most citizens are unaware that they are at risk, and that they need to be notified and be told what they can do to help mitigate that risk. Even if the citizens choose to do nothing, at least the governing agencies have informed the citizens of the risk they are in.	12/11/2019 12:49 PM
18	Who pays and why	12/11/2019 12:11 PM
19	An analysis of hazardous/explosive materials transported regularly through the middle of Bismarck on The Rail lines should be part of this project. Any efforts the city and county can make to reduce the amount of hazardous nd explosive materials (i e oil tankers) through the city could save hundreds of thousands if not millions of dollars in property damage and possibly dozens of lives.	12/11/2019 9:15 AM
20	We need good roads.....	12/11/2019 9:06 AM
21	It has to be a community effort to some degree. But it's hard to get people to care until they're in the event.	12/11/2019 8:47 AM
22	thank you for the time to seek public input	12/11/2019 8:41 AM
23	The protective wall along the Interstate going through Bismarck would also provide an excellent sound barrier	12/11/2019 8:04 AM
24	People need to remember they are responsible for their own safety and preparations	12/11/2019 7:40 AM
25	Dam release control. Continuing to allow concealed carry for personal protection.	12/11/2019 1:27 AM

26	Educate public about volunteer opportunities to get involved	12/10/2019 10:30 PM
27	Traffic! Put stop signs at all residential intersections or a have a traffic plan to direct flow. Better crossing solutions for kids walking to school.	12/10/2019 7:42 PM
28	None	12/10/2019 7:38 PM
29	nothing specific	12/10/2019 7:07 PM
30	Our officials need to get on flood control now not a few days before it happens	12/10/2019 7:06 PM
31	Burleigh Co and City of Bismarck do a good job of communication. I would implore those that complain to go to Mandan or Fargo. Either end of the spectrum. Mandan small town feel and Fargo big enough to just do it and blow people off.	12/10/2019 6:27 PM
32	Thank you for asking me to take this survey :)	12/10/2019 4:21 PM
33	Special needs populations' information - What is the special need and address.	12/10/2019 4:07 PM
34	More cameras around town to watch what is happening in public and open spaces such as streets. More street lights in areas that have hardly any (N 19th by 43rd).	12/10/2019 3:56 PM
35	yes	12/10/2019 3:55 PM
36	None	12/10/2019 3:50 PM
37	n/a	12/10/2019 3:47 PM
38	monitor waterways for flooding, reduce water use for draughts , keep preparedness kits	12/10/2019 3:46 PM
39	Where are emergency storm shelters?	12/10/2019 3:30 PM
40	N/A	12/10/2019 3:28 PM
41	N/A	12/10/2019 3:12 PM
42	The city should not have the final say on my county property unless i am able to vote in city elections. I can't no say in local city elections but the city has the say on what i do with my county property, that is just wrong.	12/10/2019 2:51 PM
43	-	12/10/2019 2:25 PM
44	N/A	12/10/2019 2:22 PM

Public Input Meeting Opportunity (January 9, 2020):

The News Release below, promoting public input opportunity was issued jointly by Burleigh County and the City of Bismarck. The meeting was also a joint Bismarck/Burleigh Public Input Meeting for mitigation plan updating for both entities.

Emergency Management
2301 University Dr, Bldg 21
Bismarck ND 58504
(701) 222-6727

Bismarck

NEWS RELEASE
FOR IMMEDIATE RELEASE

Contact: Mary Senger, Burleigh County Emergency Manager
701-222-6727

Gary Stockert, City of Bismarck Emergency Manager
701-222-6727

January 6, 2020

Burleigh County and City of Bismarck Emergency Managers Host Mitigation Planning Public Input Meeting January 9, 2020

BISMARCK, ND—Burleigh County and City of Bismarck Emergency Managers are seeking input regarding how to make the community safer from potential hazards. Residents can share ideas and identify potential hazards, related vulnerabilities, and mitigation approaches to minimize risk and impact to the community.

The public input meeting is scheduled for:

January 9th, 6 PM
Bismarck Veterans Memorial Public Library, Room B, 515 N. Fifth St., Bismarck.

The meeting is part of updating the mitigation plans and no training or previous experience with mitigation planning is necessary.

For more information visit www.burleighco.com or www.bismarcknd.gov

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Home › Headlines & Announcements

Administration

Posted on: January 6, 2020

City of Bismarck/Burleigh County Emergency Managers Host Mitigation Planning Input Meeting Jan. 9

City of Bismarck and Burleigh County Emergency Managers are seeking input regarding how to make the community safer from potential hazards. Residents can share ideas and identify potential hazards, related vulnerabilities, and mitigation approaches to minimize risk and impact to the community.

The public input meeting is scheduled for:

January 9, 6:00 P.M.

Bismarck Veterans Memorial Public Library, Room B, 515 N. Fifth St., Bismarck.

The meeting is part of updating the mitigation plans and no training or previous experience with mitigation planning is necessary.

View the City of Bismarck Mitigation Plan

View the Burleigh County Mitigation Plan

For more information visit www.bismarcknd.gov or www.burleighco.com

Next →





Emergency Management
2301 University Dr, Bldg 21
Bismarck ND 58504
(701) 222-6727

Bismarck

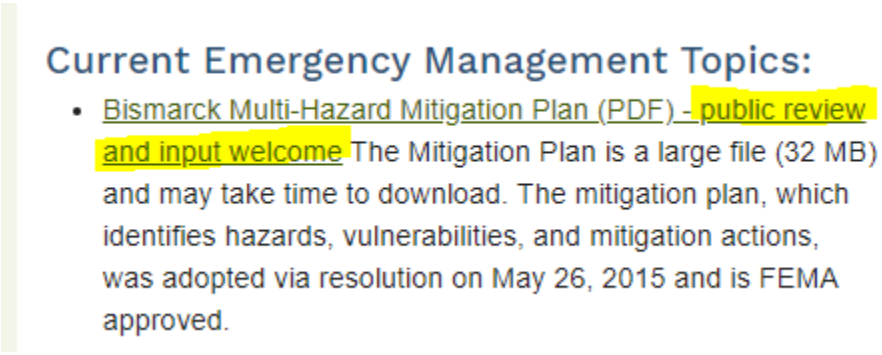
Local Mitigation Plans
Public Input Meeting

January 9, 2020
6:00 PM
Bismarck Library, Room B

Agenda

1. Mitigation Plans and Purpose
2. Hazards Overview
3. Public Input: Hazard Identification
4. Public Input: Identification of Hazard-Related Vulnerabilities
5. Public Input: Identification of Mitigation Actions

On a year-round basis, the Bismarck Mitigation Plan is available on the city's website for public review and comment at any time:
https://www.bismarcknd.gov/496/Get-Prepared



Current Emergency Management Topics:

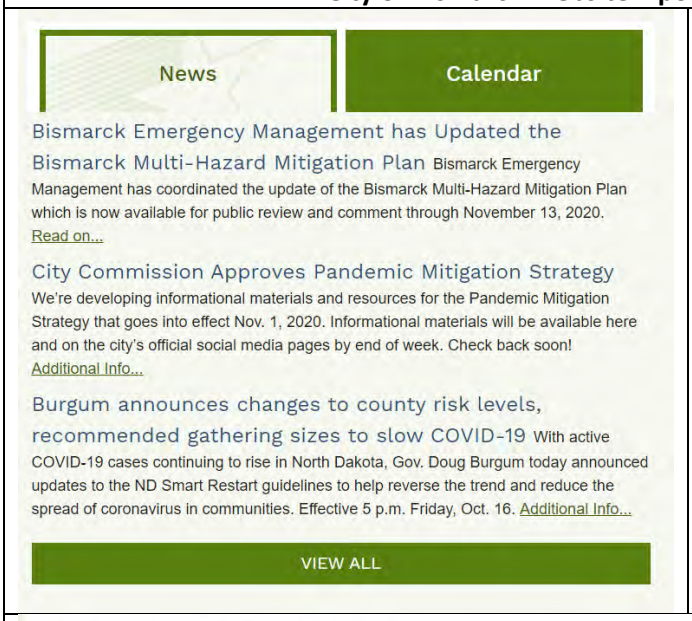
- Bismarck Multi-Hazard Mitigation Plan (PDF) - public review and input welcome The Mitigation Plan is a large file (32 MB) and may take time to download. The mitigation plan, which identifies hazards, vulnerabilities, and mitigation actions, was adopted via resolution on May 26, 2015 and is FEMA approved.

Public Review and Comment – Prior to Plan Approval

Prior to plan approval, another opportunity was provided to allow for the public to review and comment on the plan. Although Bismarck Emergency Management only received one response, the response was very detailed and thorough with suggested edits and corrections. Although the recommended edits did not impact identified mitigation action items, hazard ranking, or vulnerability, many of the recommendations were valid corrections and were made prior to plan approval.

The public review and comment period was advertised on October 29, 2020 with the comment period extending to November 13, 2020. The public was also notified that the plan allows for public comment at any time on a year-round basis. The public review and comment period was advertised via the Bismarck Tribune, as well as on the City's Website and Social Media. Bismarck Emergency Management also notified planning team members of the opportunity for review and comment.

Public Review and Comment Period
City of Bismarck Website – posted October 29, 2020


News

Calendar

Bismarck Emergency Management has Updated the Bismarck Multi-Hazard Mitigation Plan Bismarck Emergency Management has coordinated the update of the Bismarck Multi-Hazard Mitigation Plan which is now available for public review and comment through November 13, 2020. Read on...

City Commission Approves Pandemic Mitigation Strategy

We're developing informational materials and resources for the Pandemic Mitigation Strategy that goes into effect Nov. 1, 2020. Informational materials will be available here and on the city's official social media pages by end of week. Check back soon! Additional Info...

Burgum announces changes to county risk levels, recommended gathering sizes to slow COVID-19 With active COVID-19 cases continuing to rise in North Dakota, Gov. Doug Burgum today announced updates to the ND Smart Restart guidelines to help reverse the trend and reduce the spread of coronavirus in communities. Effective 5 p.m. Friday, Oct. 16. Additional Info...

VIEW ALL


Administration

Posted on: October 29, 2020

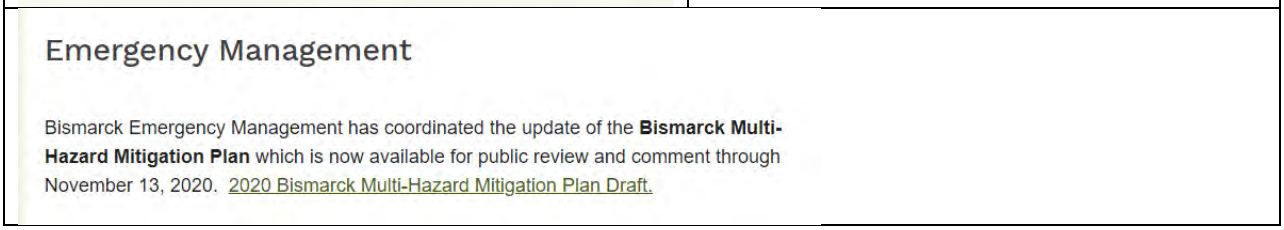
Bismarck Emergency Management has Updated the Bismarck Multi-Hazard Mitigation Plan

Bismarck Emergency Management has coordinated the update of the Bismarck Multi-Hazard Mitigation Plan which is now available for public review and comment through November 13, 2020.

The plan identifies and profiles hazards to assess risk and vulnerability relating to natural, technological, and human-caused hazards, and identifies mitigation strategies and specific mitigation actions for reducing potential impact. Comment regarding the plan including recommendations on how to make our community safer from potential hazards/disasters is welcome.

The updated Bismarck Multi-Hazard Mitigation Plan is available for review and comment at www.bismarcknd.gov/emergencymanagement. Comments regarding the plan can be e-mailed to Gary Stockert, Emergency Manager at gstockert@bismarcknd.gov or by calling 701-222-6727. Written comments regarding the plan should be postmarked by November 13, 2020 and mailed to Gary Stockert, Emergency Manager, Bismarck Emergency Management, 2301 University Drive Bldg. #21, 58504.

Once the Multi-Hazard Mitigation Plan is finalized and approved, it will remain available at www.bismarcknd.gov/emergencymanagement for review and comment at any time throughout the 5-year planning cycle.


Emergency Management

Bismarck Emergency Management has coordinated the update of the **Bismarck Multi-Hazard Mitigation Plan** which is now available for public review and comment through November 13, 2020. 2020 Bismarck Multi-Hazard Mitigation Plan Draft.

Public Review and Comment Period
Bismarck Tribune – Posted November 5, 2020

The News Release was distributed on November 2, 2020

Bismarck hazard plan available for public comment

Bismarck Tribune staff 9 hrs ago

An update of Bismarck's Multi-Hazard Mitigation Plan is available for public comment through Nov. 13.

The plan identifies potential hazards and strategies to mitigate them. It's available at **www.bismarcknd.gov/emergencymanagement**.

Comments can be directed to Emergency Manager Gary Stockert at **gstockert@bismarcknd.gov** or 701-222-6727. Written comments must be postmarked by Nov. 13 and mailed to Gary Stockert, Emergency Manager, Bismarck Emergency Management, 2301 University Drive, Building No. 21, Bismarck ND 58504.

Once the plan is finalized and approved by the North Dakota Department of Emergency Services, the city will receive a letter of concurrence from the Federal Emergency Management Agency. That ensures the city is eligible to apply for federal funding, according to the city.

Once the plan is approved, it will remain available at **www.bismarcknd.gov/emergencymanagement** for review and comment at any time throughout the 5-year planning cycle.

Bismarck

NEWS RELEASE

For Immediate Release:
November 2, 2020

For More Information, Media Contact:
Gary Stockert, Bismarck Emergency Manager
Phone: 701-222-6727
Email: gstockert@bismarcknd.gov

Bismarck Multi-Hazard Mitigation Plan Available for Review and Public Comment

BISMARCK, N.D. – Bismarck Emergency Management has coordinated an update of the Bismarck Multi-Hazard Mitigation Plan which is now available for public review and comment through November 13, 2020.

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The updated Bismarck Multi-Hazard Mitigation Plan is available for review and comment at www.bismarcknd.gov/emergencymanagement. Comments regarding the plan can be e-mailed to Gary Stockert, Emergency Manager at gstockert@bismarcknd.gov or by calling 701-222-6727. Written comments regarding the plan must be postmarked by November 13, 2020. Mail comments to Gary Stockert, Emergency Manager, Bismarck Emergency Management, 2301 University Drive Bldg. #21, 58504.

Once the Multi-Hazard Mitigation Plan is finalized and approved, it will remain available at www.bismarcknd.gov/emergencymanagement for review and comment at any time throughout the 5-year planning cycle.

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Additional Public Input, Awareness, and Involvement in local Mitigation Planning Efforts:

Administration

Posted on: August 15, 2016

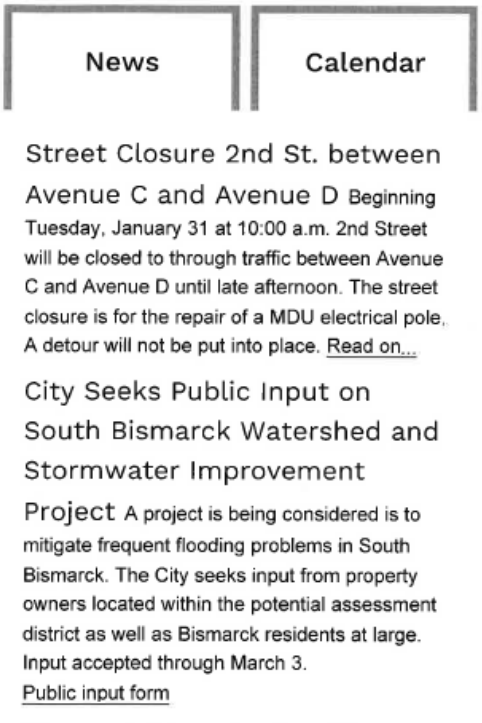
South Bismarck Watershed Stormwater Public Information Meeting Aug. 25

The City of Bismarck will hold a public informational meeting on Thursday, August 25, from 6:30-7:30 p.m., Bismarck Public Works Building, 601 South 26th Street, Bismarck, North Dakota.

At the informational meeting, the project team will provide information about how the stormwater system responds to stormwater events. In addition, an overview of the South Bismarck Watershed Model Update and Stormwater Improvement Report that is to be presented to the City Commission August 23 will be provided. The purpose of the meeting is to provide information and respond to questions from the public.

To view a map of the South Bismarck Watershed, view the link below.

South Bismarck Watershed Map



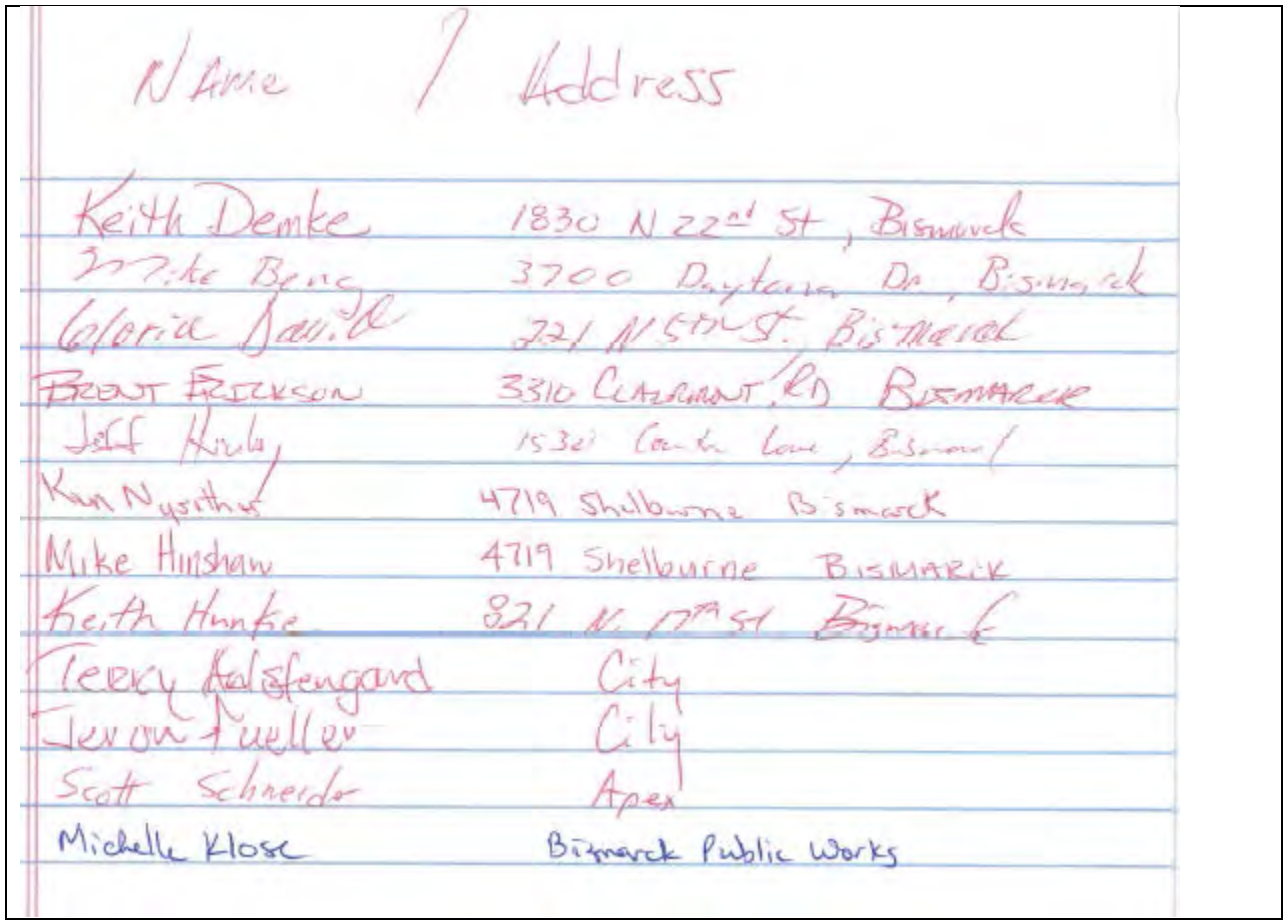
News | Calendar

Street Closure 2nd St. between Avenue C and Avenue D Beginning Tuesday, January 31 at 10:00 a.m. 2nd Street will be closed to through traffic between Avenue C and Avenue D until late afternoon. The street closure is for the repair of a MDU electrical pole. A detour will not be put into place. Read on...

City Seeks Public Input on South Bismarck Watershed and Stormwater Improvement Project A project is being considered is to mitigate frequent flooding problems in South Bismarck. The City seeks input from property owners located within the potential assessment district as well as Bismarck residents at large. Input accepted through March 3.
Public input form

South Bismarck Watershed
Storm water Public Meeting
Aug 25, 2016 6:30pm

Name	Address
Travis Johnson	Bismarck
Linda Oster	City of Bis. - Engineering
Nancy Guy	City Commission
Dale Johnson	Larson Engineering Inc,
Harley Swenson	8301 Hwy 1804 S Bis
JACK GABRIEL	502 River Rd Bis
Jim Johnson	524 Macon Dr
Stephanie Beierle	2507 E Ave D
Matthew Luger	725 E Water Ave
Gary Stadstad	512 Augsburg Ave
Shawn Oban	3815 Neptune Circle
David Sporyneczynaty K	1957 Mesquite Loop
Steve Jungwirth	3020 Roosevelt Dr.
MANBAR MANGARE	234 W. CENTURY AVE, BISMARCK
Jake Leimius	146 Delaware St. Bismarck,
Neal Leimius.	146 Delaware St.
GARY PUPPE	1111 N. FIRST ST BISMARCK
DB HICKS	1475 Brookside Lane
Bruce Hicks	" "
Dick Dever	1416 Eastwood ST.
Beverly Engr	501 Augsburg Ave - Bis
Mike Donahue 391-0772	2749 Smokey Lane - Bis
Dan Lind	139 New Jersey ST.
Dorothy Clark	103 Lorraine Dr.
Jim Farnsworth	1501 E Bismarck Expwy
Steve Schwab	1700 Houston Drive 58504
DENNIS REEP	BISMARCK



Name	Address
Keith Demke	1830 N 22nd St, Bismarck
Mike Beno	3700 Daytona Dr, Bismarck
Gloria Dassinger	221 N 5th St. Bismarck
Brent Erickson	3310 Claremont Rd Bismarck
Jeff Hicks	1532 Castle Lane, Bismarck
Kari Nyarthus	4719 Shelburne Bismarck
Mike Hinshaw	4719 Shelburne Bismarck
Keith Hunke	821 N 17th St Bismarck
Terry Holstengard	City
Jevon Mueller	City
Scott Schneider	Apex
Michelle Klose	Bismarck Public Works

Public Input and Awareness of Community Rating System participation and flood mitigation progress report.

As part of the city's participation in the Community Rating System program, Bismarck Emergency Management provides the city commission and the general public with an update regarding progress made relating to flood mitigation action items annually since becoming a Community Rating System community. As part of the presentation, Bismarck Emergency Management invites the public to review the mitigation plan document and provide input relating to the flood hazard or any hazard as desired at any time. The flood mitigation progress report was also shared via KFYR TV https://www.kfyrtv.com/content/news/Missoiuri-River-flood-mitigation-plan-567342691.html as well as KX News https://www.kxnet.com/news/top-stories/bismarck-releases-multi-hazard-plan-for-2020/

NEWS RELEASE

For Immediate Release:
January 27, 2020

For More Information, Media Contact:
Gary Stockert, Bismarck Emergency Manager
Phone: 701-222-6727
Email: gstockert@bismarcknd.gov

Bismarck publishes flood mitigation annual progress report

BISMARCK, N.D. – As a participating community in FEMA's Community Rating System (CRS) program, the City is required to develop and post a progress report relating to the flood mitigation action items as identified in the 2015 Bismarck Multi-Hazard Mitigation Plan. The progress report must be distributed to the City Commission and also be available to the public. The Flood Mitigation Progress Report and the Community Rating System (CRS) renewal certification will be addressed at the January 28, 2020 City Commission Meeting. A copy of the report entitled "Flood Mitigation Annual Progress Report" can be viewed or downloaded from the City website www.bismarcknd.gov/floodresources.

The Flood Mitigation Annual Progress Report constitutes the review of the plan by the Flood Hazard Mitigation Plan Committee since its adoption. The information in the progress report presents the progress made to-date on specific mitigation actions in the Flood Hazard Mitigation Plan.

The CRS program is a voluntary incentive program that recognizes and encourages a comprehensive approach to floodplain management and rewards communities that exceed minimum floodplain management requirements. The CRS program provides benefit to Bismarck by conducting activities to better manage risk in categories such as public information, mapping and regulations, flood damage reduction, warning and response, stormwater and drainage system maintenance.

Residents and business owners in the City of Bismarck and Extraterritorial Zone (ETA) may take advantage of a reduction in flood insurance premiums because of the City's active participation in the National Flood Insurance Program's (NFIP) Community Rating System. In addition to lower premiums, the CRS program helps to reduce the threat of damage due to flooding. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions that meet the goals of the CRS program. Property owners who hold flood insurance policies are encouraged to review the policy with their insurance agent to take advantage of any qualifying discounts.

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Acronyms – Appendix A

APHIS: Animal and Plant Health Inspection Service
APZ: Accident Potential Zone
BCA: Benefit Cost Analysis
BCR: Benefit Cost Ratio
BFE: Base Flood Elevation
BNSF: Burlington Northern Santa Fe railroad
BSC: Bismarck State College
CDBG: Community Development Block Grant
CDC: US Centers for Disease Control
CenCom: Central Dakota Communications Center
CERC: Community Emergency Response Committee (City of Bismarck)
CFS: Cubic Feet per Second
CPC: Climate Prediction Center
CPEC: Central Power Electric Cooperative, Inc. (formerly Capital Electric Cooperative)
COG: Continuum of Government
COOP: Continuity of Operations Plan
CRS: Community Rating System
DED: Dutch Elm Disease
DES: ND Department of Emergency Services
DFIRM: Digital Flood Insurance Rate Map
DHS: Department of Homeland Security
DMVW: Dakota Missouri Valley and Western Railroad
DOT: Department of Transportation
DR: Disaster
EAB: Emerald Ash Borer
EAP: Emergency Action Plan
EM: Emergency
EMP: Electro Magnetic Pulse
EOC: Emergency Operations Center
EOP: Emergency Operations Plan
EPA: Environmental Protection Agency
ETA: Extraterritorial Area boundary
FEMA: Federal Emergency Management Agency
FIRM: Flood Insurance Rate Map
FIS: Flood Insurance Study
FRA: Federal Railroad Administration
GIS: Geographic Information System
HazMat: Hazardous Materials
HAZUS-MH: Hazards United States Multi-Hazard

HI: Heat Index
HILF: High Impact, Low Frequency
HMGP: Hazard Mitigation Grant Program
HUD: Housing and Urban Development
HVAC: Heating, Ventilating, and Air Conditioning
IBC: International Building Code
ISO: Insurance Services Office
LEPC: Local Emergency Planning Committee
MDU: Montana Dakota Utilities
MHMP: Multi-Hazard Mitigation Plan
MOU: Memorandum of Understanding
mph: miles per hour
MPO: Metropolitan Planning Organization
MSL: Mean Sea Level
NCDC: National Climatic Data Center
ND: North Dakota
NDCC: North Dakota Century Code
NDDoH: North Dakota Department of Health
NDSU: North Dakota State University
NFIP: National Flood Insurance Program
NOAA: National Oceanic and Atmospheric Administration
NRCS: National Resources Conservation Service
NTSB: National Transportation & Safety Board
NWS: National Weather Service
PDM: Pre-Disaster Mitigation
PMP: Probable Maximum Precipitation
RWI: Recreational Water Illness
SCMI: Shortage or Outage of Critical Materials or Infrastructure (hazard name)
SLIC: State and Local Intelligence Center
STAPLEE: Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SWAT: Special Weapons and Tactics
SWC: State Water Commission
SWMP: Storm Water Master Plan
THIRA: Threat and Hazard Identification Risk Assessment
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USGS: United Stated Geological Survey
WAPA: Western Area Power Administration
WMD: Weapons of Mass Destruction
WRD: Water Resource District
WUI: Wildland Urban Interface

Generator Status – City Owned Facilities

City Building	EM Generator	EM Lights/ Egress	Dedicated lighting & Circuits	Specific Areas/Equipment	CR/ Command Center
Bismarck Event Center	X	X	X	Public Address System	
			Limited Arena Lighting	Sound	
			Limited Exhibit Hall Lighting		
			Miscellaneous Lighting	Two Elevators	
Belle Mehus	NONE				
(Power Inverter)		X			
City County	X	X		Entire Facility powered by back-up generator	
CenCom and Emergency Operations Center Facility (facility owned by DCN)	X	X	X	Back-up power for entire building, systems, and UPS.	X
Fire Station 1	X	X	X	Fire Chies Office	X
Entire facility is planned for back-up power for year 2021 per Bismarck Facilities Manager.					
			Bay Lighting	Fire Alarm System	
				OH Door & Operators	
				VIP Offices	
				IT Equipment	
				IT/ Phone System	
				Truck Bay	
Fire Station 2	X	X	Bay Lighting	OH Door & Operators	
				Truck Bay	

City Building	EM Generator	EM Lights/ Egress	Dedicated lighting & Circuits	Specific Areas/Equipment	CR/ Command Center
Fire Station 3	X	X	Bay Lighting	OH Door & Operators	
				Truck Bay	
Fire Station 4	X	X	Entire Facility	Entire Facility	
				Truck Bay	
Fire Station 5	X	X	Bay Lighting	OH Door Operators	
				Truck Bay	
Library	X	X	X	Transformers TE & TE2	
				Fire Alarm System	
				Phone System	
				Security Panel	
				Two Heaters (Garage)	
				Boiler #1 & oil pump	
				Elevator & sump	
				Two hot water pumps	
				Five sump pumps	
				Two sewage ejectors	
				IT equipment rooms (3)	
				Vern's office- Major Technology	
Police Headquarters	X	X	X	Adminstration Section	
				Records / Reception	
				Shift Commanders Office	
				Maintenance Office & Controls	
				Air Handlers	
				Boilers	
				Water circulation pumps	
				IT/ Phone systems	

City Building	EM Generator	EM Lights/ Egress	Dedicated lighting & Circuits	Specific Areas/Equipment	CR/ Command Center
Public Health	X	X	X	VIP offices	X
				Administration	
				Phone/IT room	
				Fire Alarm System	
				Vaccine Refrigerators	
				2 mini split units	
Public Works	X	X	X	Mechanical room lights	
				John's office	
				6 OH Doors & operators	
				HP 205, 203 A&B	
				fuel island pumps	
				card reader	
				Building Ext lights	
				Transformers TE1&2	